

ISCRAM 2019

16 TH INTERNATIONAL CONFERENCE ON INFORMATION SYSTEMS FOR CRISIS RESPONSE AND MANAGEMENT

ISCRAM 2019 PROGRAM

**16th International Conference on Information
Systems for Crisis Response and
Management**

Valencia (Spain), May 19-22



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Satellite events

Sunday, 19/May/2019

WORKSHOPS AND DOCTORAL COLLOQUIUM

9:00am - 11:00am	DC-1: ISCRAM 2019 Doctoral Colloquium (1) – Room 2.15
9:00am - 11:00am	ICMT-1: 2nd International Workshop on Intelligent Crisis Management Technologies for climate events -ICMT (1) – Room 2.9-2.10 Welcome – Introductions, by Anastasios Karakostas IREACT presentation and Demo, by Claudio Rossi Paper: A Filtering and Visualization Workbench for Messages Jan-Wilhelm Blume, Philipp Hertweck, Tobias Hellmund, Jürgen Moßgraber
9:00am - 11:00am	PCTLC1: Workshop on Physical and cyber threats: the new challenges for TLC Critical Infrastructures (1) – Room 2.11 - Welcome, by the Workshop co-chairs - The problem of the protection of Telecommunication Infrastructures at a glance, by A. Neri - Technologies for cyber threats: an overview of the issues for the critical infrastructures, by F. Pascucci
9:00am - 11:00am	PIPR: Workshop on Encouraging Productive Interaction between Practitioners and Researchers (1) – Room 2.7-2.8
11:00am - 11:30am	CB-S1: Coffee Break
11:30am - 1:30pm	DC-2: ISCRAM 2019 Doctoral Colloquium (2) – Room 2.15
11:30am - 1:30pm	ICMT-2: 2nd International Workshop on Intelligent Crisis Management Technologies for climate events -ICMT (2) – Room 2.9-2.10 FBBR: fire and rescue Service in Denmark PLV: disaster management in Valencia "An event-driven micro service architecture for building a decision support system" Authors: Philipp Hertweck, Tobias Hellmund, Jan-Wilhelm Blume, Jürgen Moßgraber, Anastasios Karakostas, Benjamin Mandler
11:30am - 1:30pm	PCTLC2: Workshop on Physical and cyber threats: the new challenges for TLC Critical Infrastructures (2) – Room 2.11 - Interactive groups working coordinated by experts in the field (drawn by the research and the industrial community): 1. Technologies for Physical threats; 2. Technologies for cyber threats; 3. Citizens in-the-loop: situation awareness and perception - Round table coordinated by a moderator with Q&A session - Concluding remarks
11:30am - 1:30pm	PIPR-2: Workshop on Encouraging Productive Interaction between Practitioners and Researchers (2) – Room 2.7-2.8
1:30pm - 2:30pm	LS: Lunch
2:30pm - 4:00pm	DC-3: ISCRAM 2019 Doctoral Colloquium (3) – Room 2.15
2:30pm - 4:00pm	ICMT-3: 2nd International Workshop on Intelligent Crisis Management Technologies for climate events -ICMT (3) – Room 2.9-2.10

	<p>beAWARE presentation and Demo Anastasios Karakostas</p>
2:30pm - 4:00pm	<p>SMA-1: Workshop on Incorporating social media analysts in emergency dispatch centers (1) – Room 2.7-2.8</p> <ul style="list-style-type: none"> – Introduction by co-chairs (objectives, agenda, final output) – Each attendant presents his/her background and interests for the topic – Organization of integrated small-groups <i>Introductory Presentation Round-table discussion Groups of 3-4(practitioners and researchers)Session 1– Topic(s) Discussions</i> – Re-assemble for Discussion <i>Small-group discussions, including “tagging” participants with index cards who want to contribute use cases, experiences, etc. Co-chairs lead summary discussions and assemble note cards from tagged attendees</i>
4:00pm - 4:30pm	<p>CB-S2: Coffee Break</p>
4:30pm - 6:00pm	<p>DC-4: ISCRAM 2019 Doctoral Colloquium (4) – Room 2.15</p>
4:30pm - 6:00pm	<p>ICMT-4: 2nd International Workshop on Intelligent Crisis Management Technologies for climate events -ICMT (4) – Room 2.9-2.10</p> <p>In IN-PREP presentation and Demo Evangelos Sdongos</p> <p>Outcomes and discussion</p>
4:30pm - 6:00pm	<p>SMA-2: Workshop on Incorporating social media analysts in emergency dispatch centers (2) – Room 2.7-2.8</p> <p>Topic(s) Discussions</p> <ul style="list-style-type: none"> – Re-assemble for Discussion <i>Small-group discussions, including “tagging” participants who want to contribute use cases, experiences, etc. Co-chairs lead summary discussions and assemble note cards from tagged attendees</i> Closing session - Co-chairs and attendants work together to prepare collaborative drafting of the main lines and conclusions of the white paper and its dissemination. Future collaborations will be addressed.
7:00pm - 9:00pm	<p>WB: Welcoming beers at the Restaurant Contrapunto Les Arts.</p>

Conference schedule at a glance

Monday, 20/May/2019

9:00am - 10:30am	M1: OPENING + KEYNOTE 1 – Room “Salón de Actos” Keynote Talk 1: Transplantation: the Spanish Model in a world of challenges by Marcos Bruna, Md, PhD Session Chair: José J. González
10:30am - 11:00am	CB-M1: Coffee Break
11:00am - 12:45pm	M23: Protecting Critical Infrastructures in Crisis Situations - Room:2.13 Session Chair: Stefan Rass
11:00am - 1:30pm	M21: Social Media in Crises and Conflicts (1) - Room: 2.7-2.8 Session Chair: Amanda Lee Hughes
11:00am - 1:30pm	M22: Analytical Modelling and Simulation (1) - Room: 2.9-2.10 Session Chair: Christopher William Zobel
11:00am - 1:30pm	M24: Planning, Foresight and Risk Analysis (1) - Room: 2.11 Session Chair: Víctor Amadeo Bañuls Silvera
11:00am - 1:30pm	M25: Community Engagement & Healthcare Systems - Room: 2.12 Session Chair: Zeno Franco
12:45pm - 1:30pm	M41: Privacy Risk Management in Critical Infrastructures - Room: 2.13 Session Chair: Javier Parra-Arnau
1:30pm - 2:45pm	LM: Lunch
2:45pm - 3:30pm	M53: Planning, Foresight and Risk Analysis (2) - Room: 2.11 Session Chair: Víctor Amadeo Bañuls Silvera
2:45pm - 4:15pm	M52: Analytical Modelling and Simulation (2) - Room: 2.9-2.10 Session Chair: Christopher William Zobel
2:45pm - 4:15pm	M55: Geospatial Technologies and Geographic Information Science for Crisis Management (1) - Room: 2.13 Session Chair: Carolin Klonner
2:45pm - 5:00pm	M51: Social Media in Crises and Conflicts (2) - Room: 2.7-2.8 Session Chair: Muhammad Imran
2:45pm - 5:45pm	M54: Tool Talks - Room: 2.12 Session Chairs: Bas Lijnse & Jürgen Moßgraber
3:30pm - 4:15pm	M61: Intelligent and Semantic Web Systems (1) - Room: 2.11 Session Chair: Julie Dugdale
3:30pm - 4:15pm	M62: Logistics and Supply Chain Management in Crisis Response - Room: 2.13 Session Chair: Bernd Hellingrath
4:15pm - 5:45pm	P&D: Poster & demo session – Room “Sala VIP” Session Chairs: Josune Hernantes & Leire Labaka
6:00pm - 10:00pm	PW: Paella Workshop at the Castle of Benissanó

Tuesday, 21/May/2019

8:00am - 10:30am	UME: visit to the UME headquarters
10:30am - 11:00am	CB-T1: Coffee Break
11:00am - 12:15pm	T1: Professionals Day - KEYNOTE 2 – Room “Salón de Actos” Keynote Talk 2: Addressing Complexities of Disaster Social Media Analysis by Steve Peterson, CEM@ Session Chair: Andrea Tapia
12:15pm - 1:45pm	T2: Professionals Day - Panel: “Research meets practice” – Room “Salón de Actos” Two practitioners, Jennifer Chan (Northwestern University, USA) and Steve Peterson (Emergency Management Specialist, Division of Emergency Management, National Institutes of Health, Bethesda, MD, USA), and two researchers, Caroline Rizza (Associate Professor in Information and Communication Sciences, Economic and Social Sciences Department of Télécom Paristech, Paris, France) and Marcos Borges (Professor at the Federal University of Rio de Janeiro, Department of Computer Sciences, Rio de Janeiro, Brazil) brainstorm needs, challenges and opportunities for practice-oriented research. The panel will be facilitated by Valérie November, Director of Research, Technical Laboratory, Territories and Society, Ecole des Ponts, University Paris, France.
1:45pm - 3:00pm	LT: Lunch
2:15pm - 3:00pm	WIS: Women in ISCRAM – Room: 2.7-2.8 Session Chair: Fiona Jennet McNeill This year at the WISCRAM event we are planning to talk about how we can develop a stronger, more active ISCRAM community that is diverse along multiple dimensions. It will therefore not be a women-only event: we invite everyone to attend. An important outcome of the session will be concrete plans of action. We will be setting up a Community Working Group to focus on these issues: both how we support the community engagement we see in the conference to continue year round, and how we encourage new people from diverse backgrounds into our community. We will be looking for volunteers to join the working group and suggestions about what the group should be doing. We hope to see you there!
3:00pm - 3:45pm	T42: Analytical Modelling and Simulation (3) - Room: 2.9-2.10 Session Chair: Christopher William Zobel
3:00pm - 3:45pm	T44: Geospatial Technologies and Geographic Information Science for Crisis Management (2) - Room: 2.13 Session Chair: Joao Porto de Albuquerque
3:00pm - 4:30pm	T41: Social Media in Crises and Conflicts (3) - Room: 2.7-2.8 Session Chair: Christian Reuter
3:00pm - 4:30pm	T43: Intelligent and Semantic Web Systems (2) - Room: 2.12 Session Chairs: Fiona Jennet McNeill & Hemant Purohit
3:00pm - 4:30pm	T45: Planning, Foresight and Risk Analysis (3) - Room: 2.11 Session Chair: Victor Amadeo Bañuls Silvera
3:45pm - 4:30pm	T51: Knowledge, Semantics and AI for RISK and CRISIS Management (1) - Room: 2.9-2.10 Session Chair: Antonio De Nicola
4:30pm - 5:00pm	CB-T2: Coffee break
5:00pm - 6:15pm	ISCRAM: ISCRAM Assembly – Room “Salón de Actos”
7:30pm - 11:00pm	GALA: Gala Dinner at the Veles e Vents building, at the Marina Real

Wednesday, 22/May/2019

9:00am - 10:30am	W1: KEYNOTE 3 – Room “Salón de Actos” Keynote talk 3: Making IT Personal: Radically Reflexive Resilience by Prof. Dr. Monika Buscher Session Chair: Julie Dugdale
10:30am - 11:00am	CB-W1: Coffee break
11:00am - 11:45am	W22: Universal Design of ICT in Emergency Management - Room: 2.9-2.10 Session Chairs: Terje Gjørseter and Jaziar Radianti
11:00am - 2:00pm	W21: Social Media in Crises and Conflicts (4) - Room: 2.7-2.8 Session Chair: Muhammad Imran
11:00am - 2:00pm	W23: Command & Control Studies - Room: 2.11 Session Chairs: Peter Berggren & Björn Johan Erik Johansson
11:00am - 2:00pm	W24: Open Track - Room: 2.12 Session Chairs: Hossein Baharmand & José J. González
11:45am - 1:15pm	W31: Ethical, Legal, and Social Issues - Room: 2.13 Session Chairs: Katrina Petersen & Caroline Rizza
11:45am - 2:00pm	W32: Knowledge, Semantics and AI for RISK and CRISIS Management (2) - Room: 2.9-2.10 Session Chairs: Hedi Karray & Nada Matta
2:00pm - 3:15pm	LW: Lunch

Presentations by session

M23: Protecting Critical Infrastructures in Crisis Situations

Time: Monday, 20/May/2019: 11:00am - 12:45pm Room:2.13
Session Chair: Stefan Rass

ID: 197 / M23: 1

T14 - Protecting Critical Infrastructures in Crisis Situations

Keywords: Cascading failures, industrial control systems, critical infrastructures, hybrid situational awareness

Wipe Paper: 11:00-11:18

Cascading Threats in Critical Infrastructures with Control Systems

Sandra König, Stefan Schauer

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Increasing interconnection of critical infrastructures as well as the ongoing digitalization yields an increased risk of failure of a critical infrastructure (CI). This has two main sources: first, threats occur due to the interconnection and second, failure of a single component may affect large parts of an infrastructure due to cascading effects. One way to support functionality of a CI is the use of Industrial Control Systems (ICS) that allow monitoring remote sites and controlling processes. However, this is an additional source for threats as recent cyber-attacks have shown. Further, the additional information for such cyber systems is often not efficiently combined with existing information on the physical infrastructure. We here propose a method to combine these two sources of information in order to estimate the impact of a security incident on CIs, taking into account cascading effects of threats. Implementation of the model allows simulation of the dynamics inside a C from which an estimation of consequences of an incident may be deduced. Visualization of the results provides an overview on the situation of the entire CI at a certain time. The cascading effects may be observed through a sequence of successive representations at fixed time intervals.

ID: 144 / M23: 2

T14 - Protecting Critical Infrastructures in Crisis Situations

Keywords: Critical Infrastructure Protection, Interdependency, Resilience, Vulnerability, Cascading Effects, Emergency Management, Participatory Approach

Core Paper: 11:18-11:43

Enhanced Crisis-Preparation of Critical Infrastructures through a Participatory Qualitative-Quantitative Interdependency Analysis Approach

Axel Dierich¹, Katerina Tzavella², Neysa Jacqueline Setiadi², Alexander Fekete², Florian Neisser²

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Critical Infrastructure (CI) failures are aggravated by cascading effects due to interdependencies between different infrastructure systems and with emergency management. Findings of the German, BMBF-funded research project "CIRMin" highlight needs for concrete assessments of such interdependencies. Driven by challenges of limited data and knowledge accessibility, the developed approach integrates qualitative information from expert interviews and discussions with quantitative, place-based analyses in three selected German cities and an adjacent county.

This paper particularly discusses how the mixed methods approach has been operationalized. Based on anonymized findings, it provides a comprehensive guidance to interdependency analysis, from survey and categorization of system elements and interrelations, their possible mutual impacts, to zooming into selected dependencies through GIS mapping. This facilitates reliably assessing the need for maintenance of critical functionalities in crisis situations, available resources, auxiliary powers, and optimization of response time.

ID: 178 / M23: 3

T14 - Protecting Critical Infrastructures in Crisis Situations

Keywords: Resilience, critical infrastructure, optimization

Wipe Paper: 11:43-12:01

Choosing Ways to Increase Resilience in Critical Infrastructures

Sandra König

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Resilience is a term that is difficult to specify as it is often used vaguely and inconsistently. A general definition seems hard to find but a formalization of the term can at least be found in the context of critical infrastructures. Based on this measure we investigate how resilience in critical infrastructures can be increased and propose a method that consists of three steps: identification of threats and countermeasures, estimation of resilience of the critical infrastructure for each of these cases, and finally choosing optimal ways of protection. The optimal choice is based on sound mathematical concepts and an implementation of the method used is publicly available. Further, the analysis provides information on which threat scenarios reduce the resilience the most. The approach is illustrated with a small example that also demonstrates the challenges of the analysis.

ID: 128 / M23: 4

T14 - Protecting Critical Infrastructures in Crisis Situations

Keywords: critical infrastructure resilience, tolerance triangles, questionnaire, IMPROVER

Core Paper: 12:01-12:26

Evaluating Critical Infrastructure Resilience via Tolerance Triangles: Hungarian Highway pilot case study

Laura Petersen^{1,2}, Eva Horvath³, Johan Sjöström⁴

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While accepted as part of critical infrastructure (CI) resilience, no consensus exists on how to measure the exact minimum level of service or the rapidity of rapidly restoring services. The H2020 European project IMPROVER (Improved risk evaluation and implementation of resilience concepts to critical infrastructure) suggests to use the public's declared tolerance levels for both minimum level of service and rapidity of service restoration as criteria with which to evaluate if the resilience of a given CI is resilient enough. This paper demonstrates the development of a questionnaire-based methodology to determine public tolerance levels. It then tests this methodology via a pilot case study at IMPROVER's Hungarian Highway Living Lab. The paper demonstrates that 1) the questionnaire-based methodology permits one to evaluate public perception in such a way as to compare it to technical resilience analyses and 2) public tolerance levels are a reasonable choice for a criteria for resilience evaluation.

ID: 258 / M23: 5

T14 - Protecting Critical Infrastructures in Crisis Situations

Keywords: Virtual reality, training, coordination

Wipe Paper: 12:26-12:44

On the usage of Virtual Reality for Crisis Management exercises in Critical Industrial Sites

Aurélie Congès¹, Frédérick Bénaben¹, Olivier Pierre², Francis Savic³, Olivier Chabiron², Matthieu Lauras¹

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EGCERSIS is a starting research program aiming at defining a virtual collaborative training space for crisis management. It should provide the users (first and second aid, firefighters, etc.) with a way to virtually perform operational and strategic tasks of crisis management in digital twins of critical infrastructures. The training system is structured according to four main components: (i) protocol and tools for digital twins generation, (ii) scenario editor dedicated to defining crisis use-cases within the modeled digital twins, (iii) integration with the technological crisis management platform (RIO-Suite), and (iv) monitoring component in charge of the continuous edition of dashboards (real-time and afterward). The main expected benefit of the EGCERSIS program is to create a breakthrough in the way training and exercises are performed in critical sites.

M21: Social Media in Crises and Conflicts (1)

Time: Monday, 20/May/2019: 11:00am - 1:30pm **Room: 2.7-2.8**

Session Chair: Amanda Lee Hughes

ID: 127 / M21: 1

T8- Social Media in Crises and Conflicts

Keywords: Emergency Management, Crisis Informatics, Real-time, Twitter, Categorization

Core Paper: 11:00-11:25

TREC Incident Streams: Finding Actionable Information on Social Media

Richard McCreadie¹, Cody Buntain², Ian Soboroff³

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The Text Retrieval Conference (TREC) Incident Streams track is a new initiative that aims to mature social media-based emergency response technology. This initiative advances the state of the art in this area through an evaluation challenge, which attracts researchers and developers from across the globe. The 2018 edition of the track provides a standardized evaluation methodology, an ontology of emergency-relevant social media information types, proposes a scale for information criticality, and releases a dataset containing fifteen test events and approximately 20,000 labelled tweets. Analysis of this dataset reveals a significant amount of actionable information on social media during emergencies (>10%). While this data is valuable for emergency response efforts, analysis of the 39 state-of-the-art systems demonstrate a performance gap in identifying this data. We therefore find the current state-of-the-art is insufficient for emergency responders' requirements, particularly for rare actionable information for which there is little prior training data available.

ID: 109 / M21: 2

T8- Social Media in Crises and Conflicts

Keywords: image classification, disaster damage, domain adaptation, domain adversarial neural networks.

Core Paper: 11:25-11:50

Identifying Disaster Damage Images Using a Domain Adaptation Approach

Xukun Li¹, Doina Caragea¹, Cornelia Caragea², Muhammad Imran³, Ferda Ofli³

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Approaches for effectively filtering useful situational awareness information posted by eyewitnesses of disasters, in real time, are greatly needed. While many studies have focused on filtering textual information, the research on filtering disaster images is more limited. In particular, there are no studies on the applicability of domain adaptation to filter images from an emergent target disaster, when no labeled data is available for the target disaster. To fill in this gap, we propose to apply a domain adaptation approach, called domain adversarial neural networks (DANN), to the task of identifying images that show damage. The DANN approach has VGG-19 as its backbone, and uses the adversarial training to find a transformation that makes the source and target data indistinguishable. Experimental results on several pairs of disasters suggest that the DANN model generally gives similar or better results as compared to the VGG-19 model fine-tuned on the source labeled data.

ID: 152 / M21: 3

T8- Social Media in Crises and Conflicts

Keywords: Social media, humanitarian data processing, text classification, application programming interfaces, data processing services

Core Paper: 11:50- 12:15

CrisisDPS: Crisis Data Processing Services

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Over the last few years, extensive research has been conducted to develop technologies to support humanitarian aid tasks. However, many technologies are still limited as they require both manual and automatic approaches, and more importantly, are not ready to be integrated into the disaster response workflows. To tackle this limitation, we develop automatic data processing services that are freely and publicly available, and made to be simple, efficient, and accessible to non-experts. Our services take textual messages (e.g., tweets, Facebook posts, SMS) as input to determine (i) which disaster type the message belongs to, (ii) whether it is informative or not, and (iii) what type of humanitarian information it conveys. We built our services upon machine learning classifiers that are obtained from large-scale comparative experiments utilizing both classical and deep learning algorithms. Our services outperform state-of-the-art publicly available tools in terms of classification accuracy.

ID: 121 / M21: 4

T8- Social Media in Crises and Conflicts

Keywords: Disaster, Pattern, User Classification, Mood Detection, Twitter

Wipe Paper: 12:15-12:33

Understanding patterns and mood changes through tweets about disasters

Liuling Li, Edward A. Fox

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We analyzed a sample of large tweet collections gathered since 2011, to expand understanding about tweeting patterns and emotional responses of different types of tweeters regarding disasters. We selected three examples for each of four disaster types: *school shooting*, *bombing*, *earthquake*, and *hurricane*. For each collection, we deployed our novel model TwiRole for user classification, and an existing deep learning model for mood detection. We found differences in the daily tweet count patterns, between the different types of events. Likewise, there were different average scores and patterns of moods (fear, sadness, surprise), both between types of events, and between events of the same type. Further, regarding surprise and fear, there were differences among roles of tweeters. These results suggest the value of further exploration as well as hypothesis testing with our hundreds of event and trend related tweet collections, considering indications in those that reflect emotional responses to disasters.

ID: 142 / M21: 5

T8- Social Media in Crises and Conflicts

Keywords: rapid mapping, floods, information extraction, filtering, crowdsourcing

Wipe Paper: 12:33-12:51

Filtering images extracted from social media in the response phase of emergency events

Sara Barozzi¹, Jose Luis Fernandez Marquez², Amudha Ravi Shankar², Barbara Pernici¹

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The use of social media to support emergency operators in the first response phases can improve awareness on ongoing emergency events. Social media contain both textual and visual information, in the form of pictures and videos. The problem in using social media posts as a source of information during emergency it is difficult to select the relevant information among a very large amount of not useful information.

In particular, we focus on the extraction images relevant to the event for rapid mapping purposes.

A set of possible filters is proposed and analyzed in the paper, with the goal of selecting images from posts, evaluating how precision and recall are impacted in two different case studies. Filtering techniques have the goal of proving participants in crowdsourcing activations and emergency operators with better quality posts and reduced volumes.

ID: 160 / M21: 6

T8- Social Media in Crises and Conflicts

Keywords: Twitter, Simulation, Crisis Response, Social Media

Wipe Paper: 12:51-13:09

Simulating real-time Twitter data from historical datasets

Shane Errol Halse¹, Rob Grace¹, Jess Kropczynski², Andrea Tapia¹

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In this paper, we will discuss a system design for simulating social media data based on historical datasets. While many datasets containing data collected from social media during various crisis have become publically available, a lack of tools or systems can present this data on the same timeline as it was originally displayed. Through the design and use of the tool discussed in this paper, we show how historical datasets can be used for algorithm testing such as those used in machine learning to improve the quality of the data. In addition, the use of simulated data can also show benefits in training scenarios, which has benefit of allowing participants to see real, non-fabricated social media messages on the same timeline, as they would be posted. Lastly, we will discuss the positive reception and future improvements suggested by 911 Public Service Answering Point (PSAP) professionals.

ID: 169 / M21: 7

T8- Social Media in Crises and Conflicts

Keywords: Social media, emergency management, crisis informatics, software requirements, Delphi method

Wipe Paper: 13:09-13:27

Requirements for Software to Support the use of Social Media in Emergency Management: A Delphi Study

Starr Roxanne Hiltz¹, Amanda Hughes², Muhammad Imran³, Linda Plotnick¹, Robert Power⁴, Murray Turoff¹

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Social Media contain a wealth of information that could improve the situational awareness of Emergency Managers during a crisis, but many barriers stand in the way. These include information overload, making it impossible to deal with the flood of raw posts, and lack of trust in unverified crowdsourced data. The purpose of this project is to build a communications bridge between emergency responders and technologists who can provide the advances needed to realize social media's full potential. We are employing a Delphi study survey design, which is a technique for exploring and developing consensus among a group of experts around a particular topic. Participants include emergency managers and technologists with experience in software to support the use of social media in crisis response, from many countries. The topics of the study are described and preliminary, partial results presented for Round 1 of the study, based on 33 responses.

M22: Analytical Modelling and Simulation (1)

Time: Monday, 20/May/2019: 11:00am - 1:30pm Room: 2.9-2.10
Session Chair: Christopher William Zobel

ID: 137 / M22: 1

T1- Analytical Modeling and Simulation

Keywords: Simulation Platform, Unmanned Aerial Vehicles, Delay Tolerant Networks, Emergency Ad Hoc Networks

Core Paper: 11:00 -11:25

Simulation Platform for Unmanned Aerial Systems in Emergency Ad Hoc Networks

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Natural disasters regularly impede communication infrastructure, leaving civilians without reliable means of communication. In such cases, ad hoc networks enable basic communication inside the affected areas. However, low human mobility and group formation limit their performance, as messages are confined to distinct communication islands. Autonomous Unmanned Aerial Vehicles can help in spreading messages across multiple such islands, as proposed in the literature. Evaluating the resulting Unmanned Aerial System (UAS) under real-world conditions requires significant resources, e.g., field tests and prototypes. For a systematic assessment of a UAS and its support strategies under controlled conditions, simulations are the preferred method. To this end, we propose the first simulation platform that combines ad hoc communication on the ground and the corresponding human mobility models with an extensible model for a networked UAS and their respective support strategies. We implement and evaluate two representative strategies, showcasing the capabilities of the proposed platform.

ID: 122 / M22: 2

T1- Analytical Modeling and Simulation

Keywords: large earthquake, hydrant, water outage, fire-spread, firefighter.

Core Paper: 11:25 -11:50

Simulation Analysis of Fire Hydrant Usability Levels after Large Earthquake

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Since large earthquakes can disrupt water supply networks, it is essential to gain an understanding of the expected usability of fire hydrants in post-quake firefighting activities. In this study, data about water supply networks was collected and a water outage simulation model was constructed in order to predict the likelihood that individual fire hydrants would become unusable in the wake of a large earthquake. The water outage simulation model was integrated with a previously developed urban zone damage simulation and a fire department activity simulation in order to carry out a simulation-based analysis of the 23 wards of Tokyo, after which a quantitative analysis of the relationship between use of fire hydrants and the number of buildings lost to fire was performed. This analysis revealed the benefits of hardening water lines against earthquakes, fire hydrant usage variations depending on locality, and the benefits of using water pressure sensors to identify usable fire hydrants.

ID: 191 / M22: 3

T1- Analytical Modeling and Simulation

Keywords: Earthquake shelter location-allocation, evacuation time minimization, objective, MPSO

Wipe Paper: 11:50 -12:08

Location-allocation model for earthquake shelter solved using MPSO algorithm

Xiujuan Zhao¹, Jianguo Chen¹, Peng Du², Wei Xu³, Ran Liu², Hongyong Yuan¹

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Constructing shelters in suitable quantities, with adequate capacities and at the right locations is essential for evacuees under earthquake disasters. As one of the disaster management methods, constructing shelters can help to significantly reduce disruption and devastation to affected population. Mathematical models have been used to solve this problem allied with a heuristic optimization algorithm. The optimization of evacuation efficiency, as one of the most important objectives, has many expressive forms, such as minimizing evacuation distance and evacuation time. This paper proposes a new model that aims to minimize evacuation time with a new calculation method and to maximize total evacuees' comfort level. The modified particle swarm optimization (MPSO) algorithm is employed to solve the model and the result is compared with a model that calculated evacuation time differently and a model without distance constraint, respectively.

ID: 145 / M22: 4

T1- Analytical Modeling and Simulation

Keywords: Evacuation, Agent-based modelling, Crisis event, GAMA platform

Core Paper: 12:08 -13:05

ESCAPE: Exploring by Simulation Cities Awareness on Population Evacuation

Eric Daudé¹, Kevin Chapuis², Clément Caron¹, Alexis Drogoul², Benoit Gaudou^{2,5}, Sebastien Rey-Coyrehourq¹, Arnaud Saval³, Patrick Taillandier⁴, Pierrick Tranouez³, Jean-Daniel Zucker²

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Horizontal evacuation of populations in urban areas is an important prevention measure against a natural or technological risk. However, casualties during massive displacement in a context of stress and in a potentially degraded environment may be high. The development of organizational plans is therefore fundamental to avoid death caused by bad evacuation training. As those plans can be hardly evaluated on the ground before crisis, there is a need for realistic models in order to evaluate them using simulations. In this paper, we present the ESCAPE software framework that aims at supporting the development of such models. Using the GAMA open-source platform as a core component, it provides an agent-based simulation tool to study evacuation of a city at fine temporal and geographical scales. Two applications are presented: the city of Rouen (France) in the context of a technological hazard and a district of Hanoi (Vietnam) in a flood context.

ID: 217 / M22: 5

T1- Analytical Modeling and Simulation

Keywords: Crowd response, simulation, emergency, herd effect.

Wipe Paper: 13:05-13:23

Simulation of Crowd Response During Emergency Considering People's Rational and Irrational Thinking

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Human beings have been facing numerous emergencies which could threaten their property or even their lives in all ages. In order to learn how people respond to the emergencies like earthquakes and fire disasters, a two-stage simulation considering people's rational and irrational thinking was conducted. Results show that people's irrational thinking, like the herd effect, could exaggerate people's behavior of conformity, and it changes the spatial features that stronger herd effect leads to higher cohesion level. It is also worth mentioning that crowd response under condition of smaller population is harder to predict because of its instability, and the response of the very first part of people who make decisions could make great changes to the whole crowd's response. These results could give some enlightenment on the evacuation instruction during emergencies and future research works.

ID: 140 / M22: 6

T1- Analytical Modeling and Simulation

Keywords: Cyber resilience, System dynamics, Critical infrastructure protection (CIP)

Core Paper: 13:23-13:48

The Dynamics of Cyber Resilience Management

Juan Francisco Carías¹, Leire Labaka¹, Jose Maria Sarriegi¹, Andrea Tapia², Josune Hernantes¹

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With the latent problem of security breaches, denial of service attacks, other types of cybercrime, and cyber incidents in general, the correct management of cyber resilience in critical infrastructures has become a high priority. However, the very nature of cyber resilience, requires managing variables whose effects are hard to predict, and that could potentially be expensive. This makes the management of cyber resilience in critical infrastructures a substantially hard task.

To address the unpredictability of the variables involved in managing cyber resilience, we have developed a system dynamics model that represents the theoretical behaviors of variables involved in the management of cyber resilience. With this model, we have simulated different scenarios that show how the dynamics of different variables act, and to show how the system would react to different inputs

M24: Planning, Foresight and Risk Analysis (1)

Time: Monday, 20/May/2019: 11:00am - 1:30pm Room: 2.11
Session Chair: Victor Amadeo Bañuls Silvera

ID: 138 / M24: 1

T7- Planning, Foresight and Risk Analysis

Keywords: Interdisciplinary approach, case study, evacuation, tsunami, recommendations disaster risk management

Core Paper:11:00-11:25

Combining a social science approach and GIS-based simulation to analyse evacuation in natural disasters: A case study in the Chilean community of Talcahuano

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In rapid-onset disasters the time needed for evacuation is crucial. Aside from the behaviour of the population, the road network plays a fundamental role. It serves as a medium to reach a safe area. This study analyses the entire evacuation process, from decision-making up to the arrival at an evacuation zone by combining standardised questionnaires and GIS-based simulation. Based on a case study in the Chilean community of Talcahuano, an event-based past scenario and a hypothetical future scenario is investigated, integrating the affected population in the research process. The main problem identified in past evacuations has been time delay due to congestions, which also is evident in the results of the hypothetical future scenario. A result which supports evacuation by foot. This paper argues that a combination of scientific methods is essential for analysing evacuation and to reduce the risk due to time delay, critical route and transport medium choice.

ID: 146 / M24: 2

T7- Planning, Foresight and Risk Analysis

Keywords: Agent-based Simulation, Spontaneous Volunteers, Spontaneous Volunteer Coordination Scenario Definition Language (SVCDSL), System Entity Structure (SES), Disaster Scenario

Core Paper:11:25-11:50

Simulating Spontaneous Volunteers: A System Entity Structure for Defining Disaster Scenarios

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Fast and easy communication, e.g. via Twitter or Facebook, encourages self-coordination between spontaneous volunteers in disasters. Unfortunately, this is more and more challenging official disaster management. The need for the directed coordination of spontaneous volunteers triggered researchers to develop effective coordination approaches. However, evaluating and comparing such approaches as well as their exercising are lacking a standardized way to describe repeatable disaster scenarios, e.g. for simulations. Therefore, we present a novel System Entity Structure (SES) for describing disaster scenarios considering the disaster environment, communication infrastructure, disaster management, and population of spontaneous volunteers. The SES is discussed as a promising scheme for including spontaneous volunteers in disaster scenarios on a general level. Its applicability is demonstrated by a Pruned Entity Structure derived from a real disaster scenario. Based on the results, we give an outlook on our subsequent research, the XML-based Spontaneous Volunteer Coordination Scenario Definition Language (SVCSDL).

ID: 189 / M24: 3

T7- Planning, Foresight and Risk Analysis

Keywords: Telecommunications, AcciMap, accident analysis, incident analysis

Wipe Paper: 11:50 -12:08

Applying Generic AcciMap to a DDOS Attack on a Western-European Telecom Operator

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After a large incident on a telecommunications network, the operator typically executes an incident analysis to prevent future incidents. Research suggests that these analyses are done ad hoc, without a structured approach. In this paper, we conduct an investigation of a large incident according to the AcciMap method. We find that this method can be applied to telecommunications networks with a few small changes; we find that such a structured approach yields many more actionable recommendations than a more focused approach and we find that both the onset of an incident and the resolution phase merit their own analysis. We also find that such an analysis costs a lot of effort and we propose a more efficient approach to using this method. An unexpected outcome was that AcciMap may also be very useful for analyzing crisis organizations.

ID: 190 / M24: 4

T7- Planning, Foresight and Risk Analysis

Keywords: Medical Resource Assignment, Disaster Medical Relief, Injury-Driven Ontology Model.

Wipe Paper: 12:08-12:26

Describing and Forecasting the Medical Resources assignments for International Disaster Medical relief Forces Using an Injury-Driven Ontology Model

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Available medical resources are the basis of efficient disaster medical relief. The medical resources assignments for international disaster medical relief forces are usually fixed. However, the injury condition distribution in different disaster differs and the demand for the medical resources differ. So the assignments of medical relief forces should be more flexible and based on the injury treatment process. We analyze the component parts and rules of disaster medical relief, defining the related concepts and rules. Then, we construct the describing rules of injury-treatment-medical-technique-resource assignment process. Based on these, we establish the ontologies of disaster medical relief system and the injury-driven medical resources assignment ontology model (MRAOM). We used the model to describe the medical relief situation after earthquake to demonstrate the model could describe complicated situation. We also used the model to describe and forecast the medical resource assignment of treating batch wounded to demonstrate the model's validity.

ID: 256 / M24: 5

T7- Planning, Foresight and Risk Analysis

Keywords: Crowdsourcing, First Responders, Human Centered Design, Service Design, Emergency management.

Wipe Paper: 12:26-12:44

A Crowdsourcing App supporting the First Responders in Disaster Risk Reduction

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Disaster Risk Reduction is a complex field in which a huge amount of data is collected and processed every day in order to plan and run preparedness and response actions, which are required to get ready and to effectively respond to natural disasters when they strike. This paper, which targets a wide audience, focuses on the design of a mobile application that aims to integrate the crowdsourcing paradigm in current Disaster Risk Reduction processes. The design process is integrated in the User Centred Approach, which we apply through a co-design methodology involving end-users, iterative prototyping and development phases, and five in-field evaluations of the implemented solution. We describe both the design activities and the results obtained from end-users' feedbacks focusing on the perspective of first responders.

ID: 243 / M24: 6

T7- Planning, Foresight and Risk Analysis

Keywords: Pictogram-based process visualisation, risk management, risk identification, emergency response, CBRN

Wipe Paper: 12:44-13:02

Information collection using process visualisation in the risk management concept for emergency response

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Security-critical processes of emergency response are part of a complex system of people, organisation and technology. They are often characterised by their own dynamics, interconnectedness and information deficits. In addition, a wide variety of stakeholders, some from different organisations, work together, each specialising in a specific area. In order to capture this (process-) knowledge in risk management, information from the experts is necessary. However, experts are difficult to access, often separated locally, cost-intensive and usually have little time (discussion-) capacity. A pictogram-based process visualisation was developed within the risk management concept. The method could be validated within a European project in an expert workshop. This was done using the example of a CBRN mass casualty incident. By using the methods presented, very good qualitative and quantitative results can be achieved from the perspectives of various organisations and their experts. The limited resource "expert" is used optimally.

ID: 211 / M24: 7

T7- Planning, Foresight and Risk Analysis

Keywords: Capability Model, Training, Emergency Management, Stakeholders, QuEP

Wipe Paper:13:02-13:20

Towards a Capability Model for Emergency Training Improvement

Patricia Quiroz-Palma^{1,2}, Ma Carmen Penadés¹, Ana-Gabriela Núñez¹

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Giving adequate attention to training personnel within an organization to perform an activity of any kind determines its success or failure. Training in emergency management is a key point and the participants must have adequate preparation for each activity they carry out. The different activities in each emergency management phase generate the appropriate training according to the role performed by stakeholders. The training is provided through techniques and IT support tools that consolidate the knowledge imparted by the trainer. This paper describes the initial steps in creating a capability model to support the training of stakeholders and ensure the effectiveness of the response teams, as well as the appropriate actions of workers and citizens in an emergency. Knowledge is consolidated through training, evaluation and feedback from practice. The proposed model is being integrated into the QuEP framework to guide organizations in assessing and improving the management of their emergency plans.

M25: Community Engagement & Healthcare Systems

Time: Monday, 20/May/2019: 11:00am - 1:30pm **Room: 2.12**

Session Chair: Zeno Franco

ID: 130 / M25: 1

T11- Community Engagement & Healthcare Systems

Keywords: Information and communication technology, sociotechnical systems, crisis and disaster management, community interaction

Core Paper: 11:00-11:25

Taxonomy of Community Interaction in Crises and Disasters

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Taxonomies are integral to systems engineering, as they structure our knowledge of a field and so provide the foundation for technological development. We contribute such taxonomies for the field of Community Interaction and Engagement in Crisis and Disaster Management, which represents the interface between members of the public who commit to relief efforts and established organisations that have a pre-defined role in crisis management. These actors are unified in their purpose to help those in need, but also set apart by their organisational structures and modes of operation. We classify the actors of Community Interaction and Engagement, as well as the interactions between them. Our contribution outlines areas where the application of Information and Communication Technology can offer benefits to Community Interaction and Engagement.

ID: 234 / M25: 2

T11- Community Engagement & Healthcare Systems

Keywords: Citizens, Volunteers, Taxonomy, Social Media, Citizen Integration

Wipe Paper:11:25-11:50

Taxonomy of post-impact volunteerism types to improve citizen integration into crisis response

Robin Batard^{1,2}, Caroline Rizza¹, Aurélie Montarnal², Frédérick Bénaben², Christophe Prieur¹

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Information and Communication Technologies (ICT), and particularly Social Media, drastically changed communication channels and organization during a crisis response. In this context, new forms of citizen initiatives appear, contributing to situational awareness, providing new profiles of stakeholders and broadening the scope of volunteerism in disaster situations. Thus, given the increasing need to understand and take citizen initiatives into account, this article provides a taxonomy of volunteerism types in crisis contexts. Mapped on two main dimensions: the *status* (who they are) and the *focus* (what they are doing), multiple types of volunteers are presented on this taxonomy. Then, the article deals with possible use of this taxonomy towards integration of citizen initiatives into the crisis response.

ID: 216 / M25: 3

T11- Community Engagement & Healthcare Systems

Keywords: Information Systems, Community Engagement, Participatory Systems, Systems Design, Inclusive Systems

Wipe Paper:11:50-12:15

Designing Disaster Information Management Systems 2.0: Connecting communities and responders

Kenny Meesters, Vittorio Nespeca, Tina Comes

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Information and supporting information systems is a key element in an effective emergency response. From creating situational awareness to informed decision making, information enables responders to optimize their decisions and operations. Today, with the increased availability of information technology around the globe, a new active player in the field of information management is emerging as communities are becoming increasingly active in the field of information gathering, analyzing and sharing.

However, communities may have specific requirements and approaches to using information systems in crisis situations. Moreover, connecting information systems between communities and responder pose specific challenges due to the different information needs, capacities and incentives to use them. In this paper we build on the DERMIS premises and explore through a case study if and how these principles apply to inclusive information systems. We present the initial findings of this work of designing information systems involving both communities and formal responders.

ID: 222 / M25: 4

T11- Community Engagement & Healthcare Systems

Keywords: Reciprocity, Resilience, Disaster risk analysis, Community engagement, Organizational effectiveness, Data integration

Wipe Paper:12:15-12:40

The reciprocity of data integration in disaster risk analysis

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Humanitarian organizations are increasingly challenged by the amount of data available to drive their decisions. Useful data can come from many sources, exists in different formats, and merging it into a basis for analysis and planning often exceeds organizations' capacities and resources. At the same time, affected communities' participation in decision making processes is often hindered by a lack of information and data literacy capacities within the communities. We describe a participatory disaster risk analysis project in the central Philippines where the community and a humanitarian NGO worked towards a joint understanding of disaster risks and coping capacities through data integration and IT-supported analysis. We present findings from workshops, group discussions and semi-structured interviews, showing the reciprocal effects of the collaborative work. While the community valued the systematically gathered and structured evidence that supported their own risk perceptions and advocacy efforts, the humanitarian NGO revisited established work practices on data collection for analysis and planning.

ID: 136 / M25: 5

T11- Community Engagement & Healthcare Systems

Keywords: Voluntary emergency response, ICT, smartphone application, end users, co-production.

Core Paper: 12:40-13:05

Identifying functions for smartphone based applications in volunteer emergency response

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Emergency response organisations struggle with resource constraints and therefore faces challenges in providing high-quality public services. Utilising voluntary first responders is one way to address these challenges. There are different types of volunteers who can help at an emergency site, e.g. citizen volunteers or voluntary professionals from other occupations. To successfully engage with and utilise these new resources, adequate information and communication technology (ICT) is necessary. In this meta-study, combining and further exploring two previous studies, the aim is to identify, analyse and evaluate the suitable functions for a smartphone application that can be used to dispatch and support volunteers. The results show that the functions can be divided into essential ones that are necessary for the response to work at all, and others that might contribute to a more effective response. The study also shows that the same application can be used for different volunteer groups

ID: 195 / M25: 6

T11- Community Engagement & Healthcare Systems

Keywords: information management, health information, knowledge bases, curation

Wipe Paper: 13:05-13:23

Trends in Humanitarian Health Information during 2010 Haiti Earthquake: Motivation for Curating Domain Knowledge Base

Jennifer Lisa Chan¹, Gabriel Nam², Allison G. Marshall³, Hemant Purohit⁴

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Health response plays a major role during disasters and information management plays a crucial role in situational awareness to adapt to evolving needs. Health organizations exchange information often through narrative-based documents called situation reports. Although situation reports are widely shared, they are an increasingly challenging information source for which to infer knowledge for situational awareness. This paper analyzed health information from traditional health reports using mixed methods during the aftermath of the 2010 Haiti Earthquake, and provides insights into the patterns of what's being said, how it's being said and trends over time. Opportunities lie ahead to analyze narrative documents at scale by combining human knowledge from qualitative coding with machine intelligence. In addition, developing unifying health domain ontologies representing diverse humanitarian health concepts will advance computational technique to improve the efficiency and accuracy of retrieving knowledge for improved situational awareness and potential decision making during humanitarian health response.

ID: 214 / M25: 7

T11- Community Engagement & Healthcare Systems

Keywords: crisis, mental health, visualization, veterans, clinical decision

Wipe Paper: 13:23-13:41

Visualizing Early Warning Signs of Behavioral Crisis in Military Veterans: Empowering Peer Decision Support

Olawunmi George¹, Rizwana Rizia¹, MD Fitrat Hossain¹, Nadiyah Johnson¹, Carla Echeveste², Jose Lizarraga Mazaba², Katinka Hooyer², Zeno Franco², Mark Flower³, Sheikh Iqbal Ahamed¹, Praveen Madiraju¹, Lisa Rein²

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Several attempts have been made at creating mobile solutions for patients with mental disorders. A preemptive approach would definitely outdo a reactive one. This project seeks to ensure better crisis detection, by assigning patients (veterans) to caregivers (mentors). This is called the mentor-mentee approach. Enhanced with the use of mobile technology, veterans can stay connected in their daily lives to mentors, who have gone through the same traumatic experiences and have overcome them. A mobile application for communication between veterans and their mentors has been developed, which helps mentors get constant feedback from their mentees about their state of well-being. However, being able to make good deductions from the data given as feedback is of great importance. Under-representing or over-representing the data could be dangerously misleading. This paper presents the design process in this project and the key things to note when designing a data visualization for timely crisis detection and decision-making.

ID: 203 / M25: 8

T11- Community Engagement & Healthcare Systems

Keywords: Community resilience, customer perspective, payment system, crisis management

Wipe Paper: 13:41-13:59

Community resilience towards disruptions in the payment system

Peter Berggren¹, Molly Lundberg¹, Joeri van Laere², Björn J E Johansson¹

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This paper presents a study where nine Swedish citizens were interviewed about their concerns and expectations, from a customer perspective, in relation to a 10 day disruption in the payment system. The purpose of the study was to understand the customer's perspective in order to provide input to the development of a simulation environment. This simulation environment aims at allowing different stakeholders to experience how a disruption in the payment system affects the local community and thereby create understanding of how resilience is built and affected. The research questions were: What do customers expect to get access to? When? What are customers prepared for? How does this differ among different customer groups? The results indicate some understanding of how such a crisis affects the local community and what the informants expect to happen. The respondents represented a diversity of socio-economic backgrounds from rural and urban parts of the municipality.

M41: Privacy Risk Management in Critical Infrastructures

Time: Monday, 20/May/2019: 12:45pm - 1:30pm Room: 2.13
Session Chair: Javier Parra-Arnau

ID: 106 / M41: 1

T13 - Privacy Risk Management in Critical Infrastructures

Keywords: Social Media, Privacy, Security, Crisis Management, Surveillance

Core Paper: 12:45-13:10

Renouncing Privacy in Crisis Management? People's View on Social Media Monitoring and Surveillance

Larissa Aldehoff, Meri Dankenbring, Christian Reuter

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Social media is used during crises and disasters by state authorities and citizens to communicate and provide, gain and analyze information. Monitoring of platforms in such cases is both a well-established practice and a research area. The question, whether people are willing to renounce privacy in social media during critical incidents, or even allow surveillance in order to contribute to public security, remains unanswered. Our survey of 1,024 German inhabitants is the first empirical study on people's views on social media monitoring and surveillance in crisis management. We find the willingness to share data during an imminent threat depends mostly on the type of data: a majority (63% and 67%, respectively) would give access to addresses and telephone numbers, whereas the willingness to share content of chats or telephone calls is significantly lower (27%). Our analysis reveals diverging opinions among participants and some effects of sociodemographic variables on the acceptance of invasions into privacy.

ID: 199 / M41: 2

T13 - Privacy Risk Management in Critical Infrastructures

Keywords: privacy, critical infrastructures, data anonymization, CIPSEC, security logs

Wipe Paper: 13:10-13:28

Anonymizing Cybersecurity Data in Critical Infrastructures: The CIPSEC Approach

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Cybersecurity logs are permanently generated by network devices to describe security incidents. With modern computing technology, such logs can be exploited to counter threats in real time or before they gain a foothold. To improve these capabilities, logs are usually shared with external entities. However, since cybersecurity logs might contain sensitive data, serious privacy concerns arise, even more when critical infrastructures (CI), handling strategic data, are involved.

We propose a tool to protect privacy by anonymizing sensitive data included in cybersecurity logs. We implement anonymization mechanisms grouped through the definition of a privacy policy. We adapt said approach to the context of the EU project CIPSEC that builds a unified security framework to orchestrate security products, thus offering better protection to a group of CIs. Since this framework collects and processes security-related data from multiple devices of CIs, our work is devoted to protecting privacy by integrating our anonymization approach.

M53: Planning, Foresight and Risk Analysis (2)

Time: Monday, 20/May/2019: 2:45pm - 3:30pm Room: 2.11
Session Chair: Victor Amadeo Bañuls Silvera

ID: 207 / M53: 1

T7- Planning, Foresight and Risk Analysis

Keywords: Emergency Plans Management, Total Quality Management, Maturity Levels, Techniques, Certification

Wipe Paper: 2:45-3:03

Towards an organization certified in emergency plans management

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QuEP is a framework that guides organizations in assessing and improving their emergency plan management by following a set of principles, practices, and techniques at the different maturity levels established in the QuEP model. Its main objective is to be applied to real cases to discover the state of an organization's emergency plan management and recommend techniques for improvement. In this paper, we describe the first application of QuEP as a prior step to its implementation and possible use in official certifications for emergency plans with a guarantee of quality. So, we have applied a real case in a UPV building towards the certification of the emergency plan management.

ID: 204 / M53: 2
T7- Planning, Foresight and Risk Analysis

Keywords: Delphi, Public Administration, Intentional Risks, Homeland Security, Resilience.

Wipe Paper:3:03-3:21

A Delphi approach for the establishment of the fundamental principles of an Organizational Security System in Public Administration

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The aim of this work is defining fundamental principles of an Internal Security System in the presence of intentional risks in Public Administration. Despite the large number of regulations and relevance of this topic, there is not any study which defines in a comprehensive manner the requirements that a security system must have in the presence of intentional risks in Public Administration. The results of this work are intended to be a reference for the Public Administration, for the prevention and reaction to damage to people, property, and operation, intentionally caused by external agents, personnel themselves or users. These principles have been applied and validated through a Delphi process in the Administration of the Regional Government of Andalusia in which more than 40 security-related managers have participated.

M52: Analytical Modelling and Simulation (2)

Time: Monday, 20/May/2019: 2:45pm - 4:15pm **Room: 2.9-2.10**
Session Chair: Christopher William Zobel

ID: 113 / M52: 1

T1- Analytical Modeling and Simulation

Keywords: Expert assessment, Desktop exercise, Tabletop exercise, Modeling and simulation, Dynamic complexity

Core Paper: 2:45-3:10

Reliability of expert estimates of cascading failures in Critical Infrastructure

Ahmed Abdeltawab Abdelgawad, Jose J. Gonzalez

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Owing to the complexity of Critical Infrastructures and the richness of issues to analyze, numerous approaches are used to model the behavior of CIs. Organizations having homeland security as mission often conduct desktop-based simulations using judgmental assessment of CI interdependencies and cascading failures. Expert estimates concern direct effects between the originally disrupted CI sector and other sectors. To better understand the magnitude of aggregate cascading effects, we developed a system dynamics model that uses expert estimates of cascading failures to compare the aggregate effect of cascading failures with the primary direct cascading failures. We find that the aggregate effect of compounded cascading failures becomes significantly greater than the primary cascading failures the longer the duration of the original disruption becomes. Our conceptually simple system dynamics model could be used to improve desktop-based exercises, since it illustrates consequences that go beyond judgmental assessment.

ID: 184 / M52: 2

T1- Analytical Modeling and Simulation

Keywords: SMEs; agent-based modelling and simulation; flooding; short-term recovery; manufacturing and retail.

Wipe Paper:3:10-3:28

Assessing Flood Recovery of Small Businesses using Agent-Based Modelling and Simulation

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In developed countries, small and medium-sized enterprises (SMEs) represent the majority of all businesses, e.g. 99.9% in the UK. Given this significant proportion, any disruption to the operation of SMEs will have a negative impact on a nation's economy. In the context of flooding, this paper reports on the use of agent-based modelling and simulation (ABMS) to assess SMEs immediate response and short-term recovery. In particular, it focuses on the interactions between manufacturing SMEs and mutual aid partners, and retail SMEs and companies specializing in refurbishing premises. Results show that a manufacturing SME with a mutual aid partner can reduce loss in production by approximately 6% over a 7 working day period. In relation to retail SMEs, those with employees able to be allocated to refurbish its premises recovered faster than SMEs employing a refurbishment company, potentially one day earlier.

ID: 139 / M52: 3

T1- Analytical Modeling and Simulation

Keywords: Crisis Management, Decision-Making, Visual Analytics, Computational Model.

Core Paper:3:28-3:53

Understanding the Main Themes Towards a Visual Analytics Based Model for Crisis Management Decision-Making

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We designed a survey protocol to understand which themes influence visualizations to support Crisis Management (CM). In previous work, we carried out systematic mapping studies, analysis of official documents, ethnographic studies, questionnaires during the large events held in Brazil in recent years. In this work, we interviewed eight CM specialists. We analyzed this data qualitatively with the coding technique. Then we evaluated the coding results with the focus group technique. With the results, we identified the relationships between the visual needs and other main themes of influence for CM. This thematic synthesis enabled us to build a draft model based on Visual Analytics. We hope that, after future cycles of validations and improvements, the agencies that manage crises might use this model as a reference in their activities of knowledge production and decision-making.

ID: 210 / M52: 4

T1- Analytical Modeling and Simulation

Keywords: Emergency response, Knowledge-intensive business, Business Process Model and Notation, Case Management Model and Notation, Decision Model and Notation

Wipe Paper:3:53-4:11

Improving Emergency Response through Business Process, Case Management, and Decision Models

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The emergency procedures contain a set of actions responsible for providing the necessary corrective measures to address an emergency. The relevance of contextual knowledge during emergency responses is of utmost importance since many decisions are made from the information gathered in real time that sometimes conflicts with the formal knowledge specified in the emergency plan. Consequently, tools that support the emergency plan mentioned must be sensitive to context and allow decision making at the time an emergency takes place. We demonstrate how Case Management Modeling Notation (CMMN) along with Decision Model and Notation (DMN) are very suitable approaches to obtain a flexible model adapted to the context-driven response processes.

M55: Geospatial Technologies and Geographic Information Science for Crisis Management (1)

Time: Monday, 20/May/2019: 2:45pm - 4:15pm **Room: 2.13**

Session Chair: Carolin Klonner

ID: 134 / M55: 1

T6- Geospatial Technologies and Geographic Information Science for Crisis Management (GIS)

Keywords: lifestyle patterns, mobility patterns, semantic annotations, semantic mobility

Wipe Paper: 2:45-3:03

Semantic Understanding of Human Mobility Lifestyle to support Crisis Management

Humasak Tommy Argo Simanjuntak, Fabio Ciravegna

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In this paper, we propose a method for understanding the semantics of mobility (mainly related to lifestyle) patterns based on stay point detection from tracking data. The method identifies the context (trip purpose and visited point of interest) of tracking data by using large-scale data collection infrastructure. We evaluate our method with a tracking dataset in Birmingham (European project SETA) generated by 534 users from September 2017 to September 2018. To this end, we compare insights from the tracking data with check-in mobility in social media. The results show that both data capture rich human lifestyle features related to the visited point of interest. Our study provides solid evidence that lifestyle patterns from tracking and social media data can indeed be useful for understanding and gauging the level of disruption after a crisis, as it is possible to check the deviation of habits from normal conditions and post-crisis.

ID: 220 / M55: 2

T6- Geospatial Technologies and Geographic Information Science for Crisis Management (GIS)

Keywords: Agent-based modelling, evacuation simulation, multi-event scenario, NetLogo, OpenStreetMap

Wipe Paper: 3:03-3:21

Evaluating the effects of consecutive hurricane hits on evacuation patterns in Dominica

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The Caribbean island of Dominica is at constant risk of being hit by tropical storms during the hurricane season. Therefore, Dominica and areas in similar situations need to raise their resilience to natural hazards. The potential consequences of climate change intensify this risk. After a hurricane hit, repair of damage to buildings and infrastructure can take several months. As hurricane frequency is increasing and time between hurricanes fluctuates, modeling sequences of hurricane events can help to determine different evacuation strategies. This paper introduces an agent-based model, simulating two hurricane events in one season. The prototype simulates the movement of evacuees over a road network and damage to buildings and infrastructure. Initial results show marked differences between road movements of evacuees during a second evacuation. Although shifts in the average shelter occupation are small (up to 2%) for our case study, this can indicate that adjustments to shelter capacities are necessary.

ID: 148 / M55: 3

T6- Geospatial Technologies and Geographic Information Science for Crisis Management (GIS)

Keywords: Susceptibility mapping, disaster prevention, landslides, drones

Wipe Paper: 3:21-3:39

Identifying potential landslide location using Unmanned Aerial Vehicles (UAVs)

Jorge Vargas-Florez¹, Grovher Palomino², Andres Flores¹, Gloria Valdivia², Carlos Saito¹, Daniel Arteaga², Mario Balcazar¹, Miguel Fernandez¹, José Olliden², Daniel Díaz²

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The impact of landslides is determined by the previous state of vulnerability and susceptibility present in a community. Vulnerability is known by measuring the factors present in the exposure to the existing threats in the territory. Susceptibility is closer to behavioral, social, political, industrial and geographical issues. Knowledge of geography allows us to characterize and measure some of these factors. For example, in landslides called huacos in Peru, these are related to the existence of a slope and soil type of the hills favorable to the loosening of land masses, as well as the increase in rainfall and the presence of streams. The use of UAVs (Unmanned Aerial Vehicles, commonly called drones) for the identification of susceptibility zones is presented in this paper. The result is positive for using the georeferenced data to identify potential landslide flow using as unique criterion surface slopes.

ID: 131 / M55: 4

T6- Geospatial Technologies and Geographic Information Science for Crisis Management (GIS)

Keywords: geovisualization, multiplexing tools, crisis management.

Core Paper: 3:39-4:04

Exploring multiplexing tools for co-visualization in crisis units

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Natural hazards can generate damages in large inhabited areas in a very short time period. Crisis managers must plan interventions very quickly to facilitate the arrival of the first emergency. In a crisis unit, experts visualize heterogeneous visual representations of spatio-temporal information, in order to facilitate decision making, based on various types of screens, i.e. laptops, tablets, or wall screens. Visualizing all this information at the same time on the same interface would lead to cognitive overload. In this paper, we assume that it could be of interest to provide innovative co-visualization models and tools, to bring hazard, geospatial and climate information together, in a shared interface. We propose to explore spatial and temporal multiplexing tools within a dedicated geovisualization environment, in order to help expert decision making. The proposition is implemented with the case study of a tsunami event in the Caribbean sea.

M51: Social Media in Crises and Conflicts (2)

Time: Monday, 20/May/2019: 2:45pm - 5:00pm Room: 2.7-2.8
Session Chair: Muhammad Imran

ID: 104 / M51: 1

T8- Social Media in Crises and Conflicts

Keywords: Emergencies; social media; Twitter; Facebook; representative study

Core Paper: 2:45-3:10

Social Media Use in Emergencies of Citizens in the United Kingdom

Thomas Spielhofer², Anna Sophie Hahne², Christian Reuter¹, Marc-André Kaufhold¹, Stefka Schmid¹

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People use social media in various ways including looking for or sharing information during crises or emergencies (e.g. floods, storms, terrorist attacks). Few studies have focused on European citizens' perceptions, and just one has deployed a representative sample to examine this. This article presents the results of one of the first representative studies on this topic conducted in the United Kingdom. The study shows that around a third (34%) have used social media during an emergency and that such use is more widespread among younger people. In contrast, the main reasons for not using social media in an emergency include technological concerns and that the trustworthiness of social media content is doubtful. However, there is a growing trend towards increased use. The article deduces and explores implications of these findings, including problems potentially arising with more citizens sharing information on social media during emergencies and expecting a response.

ID: 111 / M51: 2

T8- Social Media in Crises and Conflicts

Keywords: Social Media, Disaster Risk Management, Flood Risk

Core Paper: 3:10-3:35

Integrating Social Media into a Pan-European Flood Awareness System: A Multilingual Approach

Valerio Lorini^{1,2}, Carlos Castillo², Francesco Dottori¹, Milan Kalas³, Domenico Nappo¹, Peter Salamon¹

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This paper describes a prototype system that integrates social media analysis into the European Flood Awareness System (EFAS). This integration allows the collection of social media data to be automatically triggered by flood risk warnings determined by a hydro-meteorological model. Then, we adopt a multi-lingual approach to find flood-related messages by employing two state-of-the-art methodologies: language-agnostic word embeddings and language-aligned word embeddings. Both approaches can be used to bootstrap a classifier of social media messages for a new language with little or no labeled data. Finally, we describe a method for selecting relevant and representative messages and displaying them back in the interface of EFAS.

ID: 173 / M51: 3

T8- Social Media in Crises and Conflicts

Keywords: Filtering, Convolutional Neural Networks, Natural Disasters, Twitter, Model Transferability

Wipe Paper: 3:35-3:53

Robust filtering of crisis-related tweets

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Social media enables fast information exchange and status reporting during crises. Filtering is usually required to identify the small fraction of social media stream data related to events. Since deep learning has recently shown to be a reliable approach for filtering and analyzing Twitter messages, a Convolutional Neural Network is examined for filtering crisis-related tweets in this work. The goal is to understand how to obtain accurate and robust filtering models and how model accuracies tend to behave in case of new events. In contrast to other works, the application to real data streams is also investigated. Motivated by the observation that machine learning model accuracies highly depend on the used data, a new comprehensive and balanced compilation of existing data sets is proposed. Experimental results with this data set provide valuable insights. Preliminary results from filtering a data stream recorded during hurricane Florence in September 2018 confirm our results.

ID: 221 / M51: 4

T8- Social Media in Crises and Conflicts

Keywords: Social media, disaster management, damage prediction

Wipe Paper:3:53-4:11

Predicting Hurricane Damage Using Social Media Posts Coupled with Physical and Socio-Economic Variables

Guoqin Ma, Chittayong Surakitbanharn

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During a natural disaster or emergency event, individual social media posts or hot spots may not necessarily correlate to the most devastated areas. To better understand the correlation between social media and physical damage, we compare Tweets, data about the physical environment, and socio-economic factors with insurance claim information (as a proxy for physical damage) from 2017 Hurricane Irma in the state of Florida. We use machine learning to identify relevant Tweets, sensitivity analyses to identify socio-economic factors, and statistical regression to determine the predictive capability of insurance claims as a proxy for damage. We find that Tweets alone result in a poorly fitted regression model of insurance claims, but the inclusion of physical features (e.g., power outages, wind level) and socio-economic factors (e.g., population density, education, Internet access) improves the model's fit. Such models contribute to the knowledge base that may allow social media to predict damage in real-time.

ID: 176 / M51: 5

T8- Social Media in Crises and Conflicts

Keywords: crisis mapping, crisis informatics, GIS, social media

Wipe Paper:4:11-4:29

Facebook Disaster Maps: Aggregate Insights for Crisis Response & Recovery

Paige Maas, Shankar Iyer, Andreas Gros, Wonhee Park, Laura McGorman, Chaya Nayak, P. Alex Dow

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After a natural disaster or other crisis, humanitarian organizations need to know where affected people are located and what resources they need. While this information is difficult to capture quickly through conventional methods, aggregate usage patterns of social media apps like Facebook can help fill these information gaps.

In this paper, we describe the data and methodology that power Facebook Disaster Maps. These maps utilize information about Facebook usage in areas impacted by natural hazards, producing insights into how the population is affected by and responding to the hazard. The maps include insights into evacuations, cell tower connectivity, access to electricity, and long-term displacement.

In addition to descriptions and examples of each map type, we describe the source data used to generate the maps, and efforts taken to ensure the security and privacy of Facebook users. We also describe limitations of the current methodologies and opportunities for improvement.

ID: 119 / M51: 6

T8- Social Media in Crises and Conflicts

Keywords: Counter Narratives, Online Campaign, Social Media, Terrorism, Radicalisation

Wipe Paper:4:29-4:47

Counter Narratives in Social Media: An Empirical Study on Combat and Prevention of Terrorism

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social media is used for recruitment and radicalization of susceptible target groups. Counter narratives are trying to disclose the illusion created by radical and extremist groups through a purposive and educational counter statement, and to initiate a rethinking in the affected individuals via thought-provoking impulses and advice. This study investigates counter narrative campaigns in their fight and prevention against terrorism with regard to content and success criteria based on posts in social media. Posts with strong emotions and a personal reference to affected individuals achieved the highest impact and most reactions from the target group. Furthermore, our results illustrate that counter narratives can be an efficient method to fight terrorism and to prevent target groups from a potential radicalization, while the different dynamics and aims of counter narratives and social media interfere with each other.

ID: 236 / M51: 7

T8- Social Media in Crises and Conflicts

Keywords: Crowd-sourcing, Social Media, Digital Volunteer, Spatial Data Quality, User Design

Wipe Paper: 4:47-5:05

Evaluation of Digital Volunteers using a Design Approach: Motivations and Contributions in Disaster Response

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With the growth of social media and crowdsourcing in disaster response, further research is needed on the motivations and contributions of digital volunteers. This study applies a user-centered design approach to understanding how we might make better tools to support digital volunteers. This user-centered design approach involves stated preference elicitation methods through an online survey to understand what digital volunteers want in such tools. Through choice-based conjoint analysis, we contribute to mixed-methods research to gain additional insight into motivations and user preferences for a set of design features that might be incorporated into an online tool specifically for digital volunteers. Initial results show preferences for measures of success that were not monetary, which aligned with directly stated motivations for volunteering. Our findings corroborate with previous research in that feedback to volunteers is very important, as well as being able to measure the impact of their work.

M54: Tool Talks

Time: Monday, 20/May/2019: 2:45pm - 5:45pm **Room: 2.12**

Session Chair: Bas Lijnse

Session Chair: Jürgen Moßgraber

ID: 117 / M54: 1

T12- Tool Talks

Keywords: SensorThings API, FROST, Time series data, sensor data management, data storage

Core Paper: 2:45-3:00

Management of Sensor Data with Open Standards

Philipp Hertweck, Tobias Hellmund, Hylke van der Schaaf, Jürgen Moßgraber, Jan-Wilhelm Blume

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In every emergency, getting up-to-date information about the current situation is crucial to orchestrate an efficient response. Since the Internet of Things (IoT) is rapidly growing with an estimated number of 30 billion sensor in 2020, it offers excellent potential to collect information and to improve situational awareness. Yet, the IoT brings several challenges: through a splintered sensor and sensor manufacturer landscape, data comes in various structures and formats, through incompatible protocols and without clear semantics. Solving these challenges requires as mandatory premise a singular instance, from where uniform data can be queried through a well-defined interface. The Open Geospatial Consortium (OGC) has recognized this demand and developed the SensorThings-API standard, an open and unified way to interconnect devices throughout the IoT, which is implemented in the Fraunhofer OpenSource SensorThings-Server (FROST-Server). It is only consequential to transfer these solutions into the First-Responder community.

ID: 163 / M54: 2

T12- Tool Talks

Keywords: Training System, Disaster Management, Active Learning, Humanitarian Technology, Social Media Mining

Core Paper: 3:00-3:15

EMAssistant: A Learning Analytics System for Social and Web Data Filtering to Assist Trainees and Volunteers of Emergency Services

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An increasing number of Machine Learning based systems are being designed to filter and visualize the relevant information from social media and web streams for disaster management. Given the dynamic disaster events, the notion of relevant information evolves, and thus, the active learning techniques are often considered to keep updating the predictive models for the relevant information filtering. However, the active relevant feedback provided by the human annotators to update the models are not validated. As a result, they can introduce unconscious biases in the learning process of humans and can result in an inaccurate or inefficient predictive system. Therefore, this paper describes the design and implementation of an open-source technology-based learning analytics system 'EMAssistant' for the emergency volunteers or practitioners - referred as the trainee, to enhance their experiential learning cycle with the cause-effect reasoning on providing relevant feedback to the machine learning model. This continuous integration between the cause (providing feedback) and the effect (observing predictions from the updated model) in a visual form will likely to improve the understanding of the trainees to provide more accurate feedback. We propose to present the system design as well as provide hands-on exercises for the conference session.

ID: 129 / M54: 3

T12- Tool Talks

Keywords: Evaluation Framework, Software Testing, Software Usability, Software Usefulness, Humanitarian Disaster
WiPe Paper: 3:15-3:30

Evaluation Framework for the iTRACK Integrated System

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Evaluation and testing are major steps in the development of any information system, particularly if it is to be used in high-risk contexts such as conflicts. While thus far there are various approaches for testing against technology requirements; usability or usefulness, there is a lack of a comprehensive evaluation framework that combines the three elements. The lack of such a framework and commonly agreed standards constitutes a barrier for innovation, and at the same time imposes risks to responders if the technology is introduced without proper testing. This paper aims to close this gap. Based on a reviewing of evaluation methods and measurement metrics, we design a comprehensive evaluation framework including common code quality testing metrics, usability testing methods, subjective usefulness questionnaires, and performance indicators. We demonstrate our approach by using the example of an integrated system for the safety and security of humanitarian missions, and we highlight how our approach allows measuring the system's quality and usefulness.

ID: --- / M54: 4

T12- Tool Talks

Keywords: Smoke diver training, multimodal data, data visualisations

WiPe Paper: 3:30-3:45

Supporting firefighter training through visualising indoor positioning, motion and time use data

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Providing feedback to smoke divers following their training exercises is constrained by limitations on the opportunities for observation by instructors, as the buildings are filled with smoke. Yet, sensors that can be used to track and provide data on various aspects of the smoke divers training are becoming available. This paper describes a study of how to support firefighters and their instructors with visualisations of their training performance. The study has involved the development of a training support tool, FireTracker, that visualises data from firefighters smoke diving activity, and an evaluation of FireTracker in use. FireTracker uses data from sensors such as Bluetooth Beacons and gyroscopes to detect and visualize the smoke diver's movement and work patterns during smoke diving exercises. We found that there is a training need for these visualisations, but clear limitations on the positioning data that currently can be provided.

ID: 135 / M54: 5

T12- Tool Talks

Keywords: Maps, Web-Based Systems, Tools, Open Data, OpenStreetMap

Core Paper: 3:45-4:00

Robust Private Web Maps with Open Tools and Open Data

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Crisis management information often has a geospatial dimension that allows it to be visualized on a map. As more and more systems are developed as web-based applications, maps have also become a common sight in such applications. The de-facto solution to add maps to web-based applications is to integrate a third-party service. For web-based crisis management information systems, this approach has two disadvantages. First, the third-party service must be available and reachable. Second, by using third-party services you implicitly share what you are viewing, with the risk of unintentionally exposing sensitive location information. In this Tool Talks paper, we show how to create a robust and private alternative for web-based maps using open source tools and open data.

The track will be completed with three rounds of lab sessions, during each round there may be multiple lab sessions simultaneously. For some lab sessions there is a maximum number of participants. During the break, lab sessions will be assigned to one or more rounds based on interest and capacity.

M61: Intelligent and Semantic Web Systems (1)

Time: Monday, 20/May/2019: 3:30pm - 4:15pm Room: 2.11
Session Chair: Julie Dugdale

ID: 186 / M61: 1

T5- Intelligent and Semantic Web Systems

Keywords: Multi-agent systems, cognitive agents, GIS, communication, bushfires

Wipe Paper: 3:30-3:48

Multi-agent geospatial simulation of human interactions and behaviour in bushfires

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Understanding human behaviour and interactions in risk situations may help to improve crisis management strategies in order to avoid the worst scenarios. In this paper we present a geospatial agent-based model and simulation of human behaviour in bushfires. We have modelled the social interactions between different actors involved in bushfires such as firefighter, police, emergency centre managers and civilians. We use the Belief, Desire and Intention (BDI) architecture to model realistic human behaviour, and the FIPA-ACL standard to model the communications. We use geospatial data to represent the environment in a realistic way. We show how the model has been implemented and how we have unified the communications model and the BDI architecture. Finally, we compare the processing time of two implementations of our model representing a 2D simple and a 3D GIS environment.

ID: 181 / M61: 2

T5- Intelligent and Semantic Web Systems

Keywords: Flash floods, crisis communication, trust, agent-based modelling and simulation, serious game

Wipe Paper: 3:48-4:06

Vigi Flood: a serious game for understanding the challenges of crisis communication

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Emergency managers receive risk communication training about the importance of being 'first, right and credible', which is not easy. For instance, in October 2018, the Aude department in the South-West of France was hit by intense rain. Flash floods were hard to forecast and only the 'orange' level of vigilance could be raised initially, but the population dismissed this very usual warning in that season. The 'red' level was then raised too late, leading to high criticism. The main problem here is the loss of trust induced by too many 'false alarms'. In this paper we propose a serious game called VigiFlood for raising awareness in the population about the difficulty of crisis communication and their own responsibility for reacting to the alerts. The implemented game still has limited functionality but already shows interesting results in helping the user to visualise and understand the trust dynamics.

M62: Logistics and Supply Chain Management in Crisis Response

Time: Monday, 20/May/2019: 3:20pm – 3:45pm Room: 2.13
Session Chair: Bernd Hellingrath

ID: 201 / M62: 2

T4- Logistics and Supply-Chain Management in Crisis Response

Keywords: Crisis Logistics, EMS Logistics, Social Media, Decision-Making

Wipe Paper: 3:20-3:45

Towards Social Media Decision Support for Joined EMS and Crisis Logistics

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In this paper, we investigate how social media can be utilised to support the integration of emergency medical services (EMS) and crisis management activities. We explore the literature both on social media in Crisis management and on EMS logistics to elaborate on their potential to support EMS logistics planning based on the experiences from crisis management. We then discuss how social media data can be used for tactical and strategic decision-making using location data to improve demand forecasting and planning for both routine emergencies and crises.

T42: Analytical Modelling and Simulation (3)

Time: Tuesday, 21/May/2019: 3:00pm - 3:45pm Room: 2.9-2.10
Session Chair: Christopher William Zobel

ID: 240 / T42: 1

T1- Analytical Modeling and Simulation

Keywords: Risk, Severity, Natural hazard, Analytic methods

Wipe Paper: 3:00-3:18

A New Data-Driven Approach to Measuring Hurricane Risk

Duygu Pamukçu¹, Christopher William Zobel¹, Andrew Arnette²

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Improving disaster operations requires understanding and managing risk. This paper proposes a new data-driven approach for measuring the risk associated with a natural hazard, in support of developing more effective approaches for managing disaster operations. The paper focuses, in particular, on the issue of defining the inherent severity of a hazard event, independent of its impacts on human society, and concentrates on hurricanes as a specific type of natural hazard. After proposing a preliminary severity measure in the context of a hurricane, the paper discusses the issues associated with collecting empirical data to support its implementation. The approach is then illustrated by comparing the relative risk associated with two different locations in the state of North Carolina subject to the impacts of Hurricane Florence in 2018.

ID: 218 / T42: 2

T1- Analytical Modeling and Simulation

Keywords: MCIs, Optimization-based approach, Co-ordination, Emergency response.

Wipe Paper: 3:18-3:36

A Preliminary Optimisation-based Approach to Coordinate the Response of Ambulances in Mass Casualty Incidents

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Mass Casualty Incidents (MCIs) may occur with no notice and require a rapid response to manage the casualties and arrange their transportation to hospitals. MCIs may result in different numbers of casualties and fatalities. Further, response time can play a crucial role in reducing fatalities and protecting lives. This paper reports on a preliminary optimisation-based approach, termed MCIER, which has been developed to co-ordinate the response of ambulances to multiple MCIs. In this approach, a realistic representation of the road network is modelled for the geographical area of interest. Also, a Neighbourhood Search Algorithm has been developed in order to find the optimum solution to the problem under consideration. A hypothetical case study of a MCI in Newcastle-upon-Tyne has been considered to investigate the effect on response time of the time of day, and day of week, on which the incident occurs.

T44: Geospatial Technologies and Geographic Information Science for Crisis Management (2)

Time: Tuesday, 21/May/2019: 3:00pm - 3:45pm Room: 2.13
Session Chair: Joao Porto de Albuquerque

ID: 141 / T44: 1

T6- Geospatial Technologies and Geographic Information Science for Crisis Management (GIS)

Keywords: Alert, Smartphone application, Major risks

Wipe Paper: 3:00-3:18

Sorting the good from the bad smartphone application to alert residents in case of disasters - Experiments in France

Esteban Bopp¹, Johnny Douvinet¹, Damien Serre²

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The number of smartphone applications to alert and inform the population in a risk situation in France is too large and these solutions are still unknown by the population. This study proposes an evaluation protocol based on various indicators, which take into account the capacity of the applications to send a targeted alert, their attractiveness, the ability of individuals to emit information and number of hazards considered. The results obtained on 50 applications deployed in

France show that very few of them meet the objectives of the alert, in the sense defined by civil security, because of a single-risk approach, a unique sense of communication, and the low acceptance of these solutions by citizens.

ID: 244 / T44: 2

T6- Geospatial Technologies and Geographic Information Science for Crisis Management (GIS)

Keywords: volunteered geographic information (VGI), Instagram, social media, fires, disasters, disaster management
Wipe Paper: 3:18-3:36

Instagrammers report about the deadly wildfires of East Attica, 2018, Greece: An introductory analytic assessment for disaster management purposes

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This article contributes to identifying Instagram's capabilities when utilized as a source of Volunteered Geographic Information (VGI) for disaster management (DM) purposes. The geographic focus of the research is in the Mediterranean area. As case study, the fire event of East Attica 2018, Greece, was chosen. This major fire occurred on the 23rd of July 2018 and caused the death of 100 people, the injury of additional 164 while the total burnt area was about 1275,9ha. It is the deadliest in modern Greece's history and the second deadliest at a global level, within the 21st century. About 15000 related photos along with the corresponding captions and timestamps were crawled. An initial sample of about 1100, was analyzed, using a certain methodology, divided in certain steps, the most important of which include the classification of the information, geo-referencing and the creation of graphs and maps that visualize the processed data.

T41: Social Media in Crises and Conflicts (3)

Time: Tuesday, 21/May/2019: 3:00pm - 4:30pm **Room: 2.7-2.8**

Session Chair: Christian Reuter

ID: 118 / T41: 1

T8- Social Media in Crises and Conflicts

Keywords: Rumours, large-scale data, event summarisation, sub-event detection, social media analysis
Core Paper:3:00-3:25

Rumour Detection on Social Media for Crisis Management

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We address the problem of making sense of rumour evolution during crises and emergencies. We study how understanding and capturing emerging rumours can benefit decision makers during such event. To this end, we propose a two-step framework for detecting rumours during crises. In the first step, we introduce an algorithm to identify noteworthy sub-events in real time. In the second step, we introduce a graph-based text ranking method for summarising newsworthy sub-events while events unfold. We use temporal and content-based features to achieve the effective and real-time response and management of crises situations. These features can improve efficiency in the detection of key rumours in the context of a real-world application. The effectiveness of our method is evaluated over large-scale Twitter data related to real-world crises. The results show that our framework can efficiently and effectively capture key rumours circulated during natural and man-made disasters.

ID: 120 / T41: 2

T8- Social Media in Crises and Conflicts

Keywords: Uses and gratifications theory; information sources; Internet; social media; structural equation modelling
Core Paper:3:25-3:50

Information Uses and Gratifications Related to Crisis: Student Perceptions since the Egyptian Uprising

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People use diverse sources of information, e.g., newspapers, TV, Internet news, social media, and face-to-face conversations, to make sense of crises. We apply uses and gratifications theory (UGT) and structural equation modeling to illustrate how using internet-based information sources since the political uprisings in Egypt influence perceptions of information satisfaction. Consistent with expectations we find that content and process gratifications constructs combine to explain information satisfaction, while social gratifications do not significantly influence satisfaction in the context of a crisis. This suggests that UGT is useful for evaluating the use of information technology in a context where information is limited in quantity and reliability.

ID: 179 / T41: 3

T8- Social Media in Crises and Conflicts

Keywords: social media, Twitter, missing and found people, California wildfires, disaster response

Wipe Paper:3:50-4:08

#CampFireMissing: An Analysis of Tweets About Missing and Found People From California Wildfires

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Several research studies have shown the importance of social media data for humanitarian aid. Among others, the issue of missing and lost people during disasters and emergencies is crucial for disaster managers. This work analyzes Twitter data from a recent wildfire event to determine its usefulness for the mitigation of the missing and found people issue. Data analysis performed using various filtering techniques, and trend analysis revealed that Twitter contains important information potentially useful for emergency managers and volunteers to tackle this issue. Many tweets were found containing full names, partial names, location information, and other vital clues which could be useful for finding missing people.

ID: 192 / T41: 4

T8- Social Media in Crises and Conflicts

Keywords: Disasters, social media, hurricanes, data, framework, public safety

Wipe Paper:4:08-4:26

When Official Systems Overload: A Framework for Finding Social Media Calls for Help during Evacuations

Steve Peterson¹, Keri Stephens², Hemant Purohit³, Amanda Hughes⁴

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During disasters it is not uncommon for official systems to encounter disruptions or overload due to call volume. As observed in the two past U.S. hurricane seasons, citizens are increasingly turning to social media as a consequence of their inability to reach 9-1-1 or as a preferential means of communications. Relying on past research examining social media use in disasters, combined with practical knowledge of disaster response experiences, this paper develops a knowledge-driven framework containing parameters useful in identifying patterns of shared social media information when citizens need help. This effort explores the feasibility of determining differences, similarities, common themes, and time-specific discoveries of social media calls for help associated with hurricane evacuations. At a future date, validation of this framework will be demonstrated using datasets from multiple disasters. The results will lead to recommendations on how the framework can be modified to make it applicable as a generic disaster-type characterization tool.

T43: Intelligent and Semantic Web Systems (2)

Time: Tuesday, 21/May/2019: 3:00pm - 4:30pm **Room: 2.12**

Session Chair: Fiona Jennet McNeill

Session Chair: Hemant Purohit

ID: 171 / T43: 1

T5- Intelligent and Semantic Web Systems

Keywords: Emergency hub, personalization, cloud, NG112, AI.

Wipe Paper:3:00-3:18

How to build an innovative C2 system supporting individual-centric emergency needs ?

Guillaume Lambert¹, Bruno Fontaine², Michel Monneret¹, Mourad Madani¹

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The paper describes the need for, and work in progress to provide the French population with a modern emergency communication infrastructure that uses open source components to deliver real time communications from smart phones as well as traditional routes.

The article puts forward the vision of the NexSIS 18-112 project aimed at designing and implementing the next generation AI enhanced emergency services response platform for France. The vision and ambition of the NexSIS 18-112 system is to rewrite the command and control system from scratch at a national level, providing it with state of the art functionalities.

Anticipating the future deployment of 5G networks, the work described in the article explains how to ensure the transition of the legacy emergency operation systems to an operational IP-based model, capable of offering voice, video, Instant Messaging, and Real Time Text (RTT) services to emergency services' operators.

ID: 155 / T43: 2

T5- Intelligent and Semantic Web Systems

Keywords: Knowledge sharing, intuitive teams, collaborative intuitions

Wipe Paper:3:18-3:36

Sharing Gut Feelings to Support Collaborative Decision Making

Frância Weidt Neiva¹, Marcos Roberto da Silva Borges²

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Expertise-based intuition plays a key role in decision making, especially in complex environments as those involved with crisis and emergency domains where decisions often need to be made on the basis of dynamic, incomplete, and/ or contradictory information. In such environments, a deliberative analysis is often impossible or inefficient. Using teams to make collaborative decisions in complex environments can bring benefits to organizations, but the complexity of supporting this scenario also increases. The present work proposes a solution based on graphs to support the sharing of the intuition in teams aiming at an accelerated expertise. The development of the proposal is part of a methodological context of design science research. In this paper we report the execution of one of the expected cycles that explores the use of generated artifacts in practice that then produced insights for the proposed computational support.

ID: 215 / T43: 3

T5- Intelligent and Semantic Web Systems

Keywords: Evacuation of Public Buildings, Data Fusion, Data Aggregation, Crowd Simulation, Social Simulation

Wipe Paper:3:36-3:54

Data Acquisition for ad-hoc Evacuation Simulations of Public Buildings

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Crowd simulation is suitable to evaluate evacuation strategies but its validity strongly depends on the quality of input data. The acquisition of adequate input data is particularly challenging when simulating the evacuation of public buildings such as universities. As they are publicly accessible, the exact number of persons on site is unknown. Yet, to investigate specific emergency situations by means of simulation, e.g. amok or fire, information is required about distribution and amount of people within the building at a specific point of time. Due to data privacy, public buildings do not implement access control. However, data artifacts are available in various information systems, e.g., wifi data, room administration. Our hypothesis is, that acquisition and fusion of such data artifacts is sufficient to enable data-based ad-hoc simulation of evacuation scenarios as decision support for the operations management. Finally, we introduce a procedure for the situation-dependent collection fusion of simulation input data.

ID: 227 / T43: 4

T5- Intelligent and Semantic Web Systems

Keywords: provenance, data matching, data integration, semantic web systems, decision support

Wipe Paper:3:54-4:12

Communication in Emergency Management through Data Integration and Trust: an introduction to the CEM-DIT system

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This paper discusses the development of the CEM-DIT (Communication in Emergency Management through Data Integration and Trust) system, which allows decision makers in crises to send out automated data requests to multiple heterogeneous and potentially unknown sources and interactively determine how reliable, relevant and trustworthy the responses are. We describe the underlying technology, which is based partially on data integration and matching, and partly on utilisation of provenance data. We describe our cooperation with the \ac{UO}, which allows us to develop the system in collaboration with developers of the kind of crisis-relevant data which the system is designed for. The system is currently in development, and we describe which parts are fully implemented and which are currently being developed.

ID: 252 / T43: 5

T5- Intelligent and Semantic Web Systems

Keywords: Emergency Evacuation, IoT, Software Architecture, Network Optimization, Queuing Network.

Wipe Paper:4:12-4:30

Real-time Emergency Response through Performant IoT Architectures

Claudio Arbib¹, Davide Arcelli¹, Julie Dugdale², Mahyar Tourchi Moghaddam¹, Henry Muccini¹

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This paper describes the design of an IoT system for building evacuation. There are two main design decisions for such systems: i) specifying the platform on which the IoT intelligent components should be located; and ii) establishing the level of collaboration among the components.

For safety-critical systems, such as evacuation, real-time performance and evacuation time are critical. The approach aims to minimize computational and evacuation delays and uses Queuing Network (QN) models. The approach was tested, by computer simulation, on a real exhibition venue in anonymous that has 34 sets of IoT sensors and actuators. Experiments were performed that tested the effect of segmenting the physical space into different sized virtual cubes. Experiments were also conducted concerning the distribution of the software architecture. The results show that using centralized architectural pattern with a segmentation of the space into large cubes is the only feasible solution.

T45: Planning, Foresight and Risk Analysis (3)

Time: Tuesday, 21/May/2019: 3:00pm - 4:30pm **Room: 2.11**

Session Chair: Victor Amadeo Bañuls Silvera

ID: 229 / T45: 1

T7- Planning, Foresight and Risk Analysis

Keywords: Disaster, emergency management, wicked problem, Delphi, personalized emergency system

Wipe Paper:3:00-3:18

From Hindsight to Foresight: using collaborative methodologies to tackle the wicked problems and improve the Emergency System

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The main goal of this WiPe is to analyze a wicked problem of disaster management, to offer an external evaluation on how the emergency system works and to plan a foresight exercise. The first part of the paper is rather a hindsight analysis regarding disaster management of "Colectiv 2015", the worst manmade disasters in the recent Romanian history. After four years of investigations and reports "Colectiv 2015" is still a wicked problem that needs external evaluation. The next part of the paper is a two-tier research: an intermediary analysis of the wicked problem (using Barry Turner's framework) and the design of a foresight exercise. In the Conclusions of WiPe we propose a design of research meant to: 1) better understand the causes and shortcomings of disaster management and failure of foresight and 2) help the Emergency System in Romania build a disaster resilience mechanism.

ID: 213 / T45: 2

T7- Planning, Foresight and Risk Analysis

Keywords: Crisis management, traces, response plan, clustering, process mining.

Wipe Paper:3:18-3:36

Towards an Automatic Assistance in Crisis Resolution with Process Mining

Hoang Nam Ho², Mourad Rabah¹, Ronan Champagnat¹, Frédéric Bertrand¹

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To deal with a crisis situation, experts must undertake a chain of activities, called process, to minimize crisis consequences. To assist the expert in making decision in crisis resolutions, authors propose a method aiming at discovering crisis response processes. This method is based on a two-step strategy: the first step classifies the system's traces, representing stakeholders' past actions, into different sets, where each one represents a set of response processes according to a specific context; the second step uses process mining algorithm to discover the corresponding response plan process model based on the obtained chain of activities for each previously classified context. These response plans will be a referenced aid for experts while making crisis resolution, according to each context. The proposed approach is illustrated on the traces issued from the crisis caused by the 2010 Xynthia storm in France.

ID: 133 / T45: 3

T7- Planning, Foresight and Risk Analysis

Keywords: Community resilience; human-centered design; interface design; simulation modeling; recovery planning

Core Paper: 3:36-4:01

Challenges in Community Resilience Planning and Opportunities with Simulation Modeling

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The importance of community resilience has become increasingly recognized in emergency management and community well-being after disasters. With this regard, three seismic resilience planning initiatives were conducted in the US in last ten years to assess and present current state and propose desired level of community resilience. Experts who participated these planning initiatives faced to some challenges that can be addressed for further planning initiatives. We interviewed with the participants to learn the planning process and figure out characteristics and challenges involved with this process. Conducting qualitative content analysis of the transcribed interviews, we provide these challenges.

Additionally, we discuss the advantages of using simulation modeling to facilitate this collaborative planning. We argue that while simulation modeling has the capability to overcome many of observed challenges, it is required to be designed deliberately to be best usable for experts. We refer it as Human-Centered Simulation Modeling.

T51: Knowledge, Semantics and AI for RISK and CRISIS Management (1)

Time: Tuesday, 21/May/2019: 3:45pm - 4:30pm **Room: 2.9-2.10**

Session Chair: Antonio De Nicola

ID: 149 / T51: 1

T10- Knowledge, Semantics and AI for RISK and CRISIS management

Keywords: Semantic interoperability, early warning system, internet-of-things, SEMIoTICS, IoT platform

Core Paper:4:01-4:26

SEMIoTICS: Semantic Model-Driven Development for IoT Interoperability of Emergency Services

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Modern early warning systems (EWSs) use Internet-of-Things (IoT) technologies to realize real-time data acquisition, risk detection and message brokering between data sources and warnings' destinations. Interoperability is crucial for effective EWSs, enabling the integration of components and the interworking with other EWSs. IoT technologies potentially improve the EWS efficiency and effectiveness, but this potential can only be exploited if interoperability challenges are properly addressed. The three main challenges for interoperability are: (1) achieving semantic integration of a variety of data sources and different representations; (2) supporting time- and safety-critical applications with performance and scalability; and (3) providing data analysis for effective responses with personalized information requirements. In this paper, we describe the "SEmantic Model-driven development for IoT Interoperability of emergenCy serviceS" (SEMIoTICS) framework, which supports the development of semantic interoperable IoT EWSs. The framework has been validated with a pilot performed with accident use cases at the port of Valencia. The validation results show that it fulfils the requirements that we derived from the challenges above.

ID: 193 / T51: 2

T10- Knowledge, Semantics and AI for RISK and CRISIS management

Keywords: Crisis management team, intelligent autonomous system, coalition formation, shared mental model

Wipe Paper:4:26-4:43

A Unified Approach Integrating Human Shared Mental Models with Intelligent Autonomous Team Formation for Crisis Management

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ABSTRACT

Autonomous systems are being exceedingly used to assist humans in various crisis responses scenarios such as earthquakes and nuclear disasters. Because they operate in highly unstructured and uncertain environments, failures are an inherent part of such autonomous systems, and, techniques for making these systems robust to failures arising from computer hardware, software or communication malfunctions are already integrated into their design. However, an important aspect while designing such systems is often times overlooked: how to better coordinate and communicate across distributed, possibly diverse human teams who are working in cooperation with autonomous systems into the design of the autonomous system itself. Unfortunately, this results in limited adoption of autonomous systems in real-life crisis scenarios. In this working paper, we describe ongoing work that attempts to address this deficit by integrating research on shared mental models between humans with techniques for autonomous agent team formation in the context of search and rescue scenarios.

W22: Universal Design of ICT in Emergency Management

Time: Wednesday, 22/May/2019: 11:00am - 11:45am Room: 2.9-2.10

Session Chair: Terje Gjørseter

Session Chair: Jaziar Radianti

ID: 177 / W22: 1

T9- Universal Design of ICT in Emergency Management

Keywords: Broadcasting, Artificial Voice, Emergency Information, Community Construction, Universal Design

Wipe Paper: 11:00-11:18

Life-Area Broadcasting System (LABS) for Usual and Emergency Cases by Using Easy Contents Management System and New Speaker Devices

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The "community" has played an important role in enhancing the regional disaster management capabilities in Japan. This paper proposes a Life-Area Broadcasting System (LABS) for usual and emergency cases. In order to realize very simple and easy management of LABS, we developed the Easy Contents Management System. By this system, people can obtain life-area information related to their life support, small events and accident news occurring at their living area not only in emergency cases but also in usual cases by voice and images. Further, we developed some new Speaker Devices for unfamiliar users of ICT devices such as elderly users. Those users can receive the service of LABS as like as a television or a radio broadcast terminal anytime and every day. In this paper, we describe the concept of LABS and introduces the developed new systems and devices.

ID: 188 / W22: 2

T9- Universal Design of ICT in Emergency Management

Keywords: Situational Disabilities, Situational Awareness, Universal Design of ICT for Emergency Management

Wipe Paper: 11:18-11:36

Understanding Situational Disabilities and Situational Awareness in Disasters

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In this paper, a scenario-based approach augmented with personas typically used in universal design and interactive design domains is used to illustrate the occurrence of situational disabilities in emergency situations, and to show how environmental factors can trigger these situational disabilities. With the help of personas representing selected archetypical characteristics and roles, the scenarios are further examined to show how these situational disabilities can affect the situational awareness of different stakeholders, not only in the command and control centers, but also first responders in the field as well as affected members of the public. This approach provides a better understanding of the importance of universal design of ICT for Emergency Management, not only for people with disabilities and the elderly, but for anyone.

W21: Social Media in Crises and Conflicts (4)

Time: Wednesday, 22/May/2019: 11:00am - 2:00pm Room: 2.7-2.8

Session Chair: Muhammad Imran

ID: 251 / W21: 1

T8- Social Media in Crises and Conflicts

Keywords: social search, real-time adaptive search, event tracking, crisis communication

Wipe Paper: 11:00-11:18

Real-time Adaptive Crawler for Tracking Unfolding Events on Twitter

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When a major event such as a crisis situation occurs, people post messages on social media sites such as Twitter, in order to exchange information or to share emotions. These posts can provide useful information to raise situation awareness and support decision making. In this paper, we propose a novel method for social media crawling, which exploits a Bayesian inference framework to keep track of keyword changes over time and uses a counter-stream for keeping the inclusion of noise and irrelevant information under control. In addition, we contribute to another still under-developed area for adaptive crawling, namely systematic evaluation of recall. We come up with a framework to evaluate real-time adaptive social search algorithms in a reproducible manner, which relies on a semi-automated approach for ground-truth construction. We show that our method outperforms previous methods for very large scale events.

ID: 150 / W21: 2

T8- Social Media in Crises and Conflicts

Keywords: Social Media, Topic modeling, Socio-economic recovery, Used-car demand, Housing demand.

Core Paper:11:18-11:43

Detecting Disaster Recovery Activities via Social Media Communication Topics

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Enhancing situational awareness by mining social media has been widely studied, but little work has been done focusing on recovery phases. To provide evidence to support the possibility of harnessing social media as a sensor of recovery activities, we examine the correlations between topic frequencies on Twitter and people's socio-economic recovery activities as reflected in the excess demand for used cars and housing, after the Great East Japan Earthquake and Tsunami of 2011. Our research suggests that people in the disaster-stricken area communicated more about recovery and disaster damages when they needed to purchase used cars, while the non-local population communicated more about going to and supporting the disaster-stricken area. On the other hand, regarding the excess demand for housing, when the local population of the disaster-stricken area started to resettle, they communicated their opinions more than in other periods about disaster-related situations.

ID: 159 / W21: 3

T8- Social Media in Crises and Conflicts

Keywords: sensemaking, emergency dispatch, social media, role play

Core Paper:11:43-12:08

Integrating Social Media in Emergency Dispatch via Distributed Sensemaking

Rob Grace¹, Shane Halse¹, Jess Kropczynski², Andrea Tapia¹, Fred Fonseca¹

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Emergency dispatchers typically answer 911 calls and relay information to first responders; however, new workflows arise when social media analysts are included in emergency dispatch work. In this study we examine emergency dispatch workflows as distributed sensemaking processes performed among 911 call takers, dispatchers, and social media analysts during simulated emergency dispatch operations. In active shooter and water rescue scenarios, emergency dispatch teams including call takers, dispatchers, and social media analysts make sense of unfolding events by analyzing, aggregating, and synthesizing information provided by 911 callers and social media users during each scenario. Findings from the simulations inform design requirements for social media analysis tools that can help analysts detect, seek, and analyze information posted on social media during a crisis, and protocols for coordinating analysts' sensemaking activities with those of 911 call takers and dispatchers in reconfigured emergency dispatch workflows.

ID: 180 / T41: 4

T8- Social Media in Crises and Conflicts

Keywords: Social Media, Crisis Informatics, Twitter, Information Extraction.

Wipe Paper:12:08-12:26

Comparison of Social Media in English and Russian During Emergencies and Mass Convergence Events

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Twitter is used for spreading information during crisis events. In this paper, we first retrieve event-related information posted in English and Russian during six disasters and sports events that received wide media coverage in both languages, using an adaptive information filtering method for automating the collection of about 100 000 messages. We then compare the contents of these messages in terms of 17 informational and linguistic features using a difference in differences approach. Our results suggest that posts in each language are focused on different types of information. For instance, almost 50% of the popular people mentioned in these messages appear exclusively in either the English messages or the Russian messages, but not both. Our results also suggest differences in the adoption of platform mechanics during crises between Russian-speaking and English-speaking users. This has important implications for data collection during crises, which is almost always focused on a single language.

ID: 161 / W21: 5

T8- Social Media in Crises and Conflicts

Keywords: Word Embedding, Deep Learning, Machine Learning, Sympathy Tweets Detection

Wipe Paper:12:26-12:44

Sympathy Detection in Disaster Twitter Data

Yingjie Li¹, Seoyeon Park¹, Cornelia Caragea¹, Doina Caragea², Andrea Tapia³

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Sympathy is an expression of one's compassion or sorrow for a difficult situation that another person is facing. Providing sympathy to people affected by a disaster can help change people's emotional states from negative to positive emotions, and hence, help them feel better. Moreover, detecting sympathy contents in Twitter can potentially be used for finding candidate donors since the emotion "sympathy" is closely related to people who may be willing to donate. Thus, in this paper, as a starting point, we focus on detecting sympathy-related tweets. We address this task using Convolutional Neural Networks (CNNs) with refined word embeddings. We also report experimental results showing that the CNNs with the refined word embeddings outperform not only Long Short Term Memory Networks, but also traditional machine learning techniques, such as Naive Bayes, Support Vector Machines and AdaBoost with conventional feature sets as bags of words.

ID: 212 / W21: 6

T8- Social Media in Crises and Conflicts

Keywords: usability inquiry, mobile application, disasters, alerts, public perspective

Wipe Paper:12:44-13:02

Enhancing the usability of a disaster app: exploring the perspective of the public as users

Marion Lara Tan¹, Raj Prasanna¹, Kristin Stock¹, Emma Hudson-Doyle¹, Graham Leonard², David Johnston¹

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Limited research has studied how citizens' perspective as end-users can contribute to improving the usability of disaster apps. This study addresses the gap by introducing a conceptual disaster app and exploring how users can provide valuable insights in enhancing usability.

New Zealand has multiple public alerting authorities that have various technological options in delivering information to the population's mobile devices; including social media platforms as well as the Emergency Mobile Alert system. However, during critical events, the multiplicity of information may become overwhelming. A disaster app, conceptualised in the New Zealand context, aims to aggregate, organise, and deliver information from official sources to the public. After the initial conceptual design, a usability inquiry was administered by interviewing members of the public. Partial results of the inquiry show that the public's perspective has value; in the process of understanding the new user's viewpoint, usability highlights and issues are identified.

ID: 175 / W21: 7

T8- Social Media in Crises and Conflicts

Keywords: Social media, Twitter, Relevance, Keywords, Hashtags, Few-shot models, One-class classification

Wipe Paper: 13:02-13:20

Detecting event-related tweets by example using few-shot models

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Social media sources can be helpful in crisis situations, but discovering relevant messages is not trivial. Methods have so far focused on universal detection models for all kinds of crises or for certain crisis types (e.g. floods). Event-specific models could implement a more focused search area, but collecting data and training new models for a crisis that is already in progress is costly and may take too much time for a prompt response.

As a compromise, collecting a small amount of example messages manually is feasible. Few-shot models can generalize to unseen classes with such a small handful of examples, and do not need to be trained anew for each event. We show how these models can be used to detect crisis-relevant tweets during new events with just 10 to 100 examples and counterexamples. We also propose a new type of few-shot model that does not require counterexamples.

ID: 231 / W21: 8

T8- Social Media in Crises and Conflicts

Keywords: Spontaneous volunteers, chatbot, social media, system architecture

Wipe Paper: 13:20-13:38

Towards Automated Individual Communication for Coordination of Spontaneous Volunteers

Sophie Gerstmann, Hans Betke, Stefan Sackmann

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In recent years spontaneous volunteers often turned out to be a critical factor to overcome disaster situations and avoid further damages to life and assets. These Volunteers coordinate their activities using social media and mobile devices but are not integrated in usual command and control structures of disaster responders. The lack of professional disaster response knowledge leads to a waste of potential workforce or even dangerous situations for the volunteers. In this paper a novel approach for a centralized coordination of spontaneous volunteers through disaster response professionals while using popular communication channels esp. messaging services (e.g. Facebook Messenger, WhatsApp) is presented. The architecture of a volunteer coordination system and focusing on automated multi-channel communication is shown and the possibilities of a universal chatbot for individual assignment and scheduling of volunteers are discussed. The paper also provides first insights in a demonstrator system as a practical solution.

ID: 247 / W21: 9

T8- Social Media in Crises and Conflicts

Keywords: Dispatch, Public Safety Answering Point (PSAP), Social Media, Qualitative Coding.

Wipe Paper: 13:38-13:56

Refining a Coding Scheme to Identify Actionable Information on Social Media

Jess Kropczynski¹, Rob Grace², Shane Halse², Doina Caragea³, Cornelia Caragea⁴, Andrea Tapia²

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This paper describes the use of a previously established qualitative coding scheme developed through a design workshop with public safety professionals, and applied the schema to social media data collecting during crises. The intention of applying this scheme to existing crisis datasets was to acquire training data for machine learning. Applying the coding scheme to social media data revealed that additional subcategories of the coding scheme are necessary to satisfy information requirements necessary to dispatch first responders to an incident. The coding scheme was refined and adapted into a set of instructions for qualitative coders on Amazon Mechanical Turk. The contribution of this work is a coding scheme that is more directly related to the information needs of public safety professionals. Implications of early results using the refined coding scheme are discussed in terms of proposed automated methods to identify actionable information for dispatch of first responders during emergency incidents.

W23: Command & Control Studies

Time: Wednesday, 22/May/2019: 11:00am - 2:00pm **Room: 2.11**

Session Chair: Peter Berggren

Session Chair: Björn Johan Erik Johansson

ID: 103 / W23: 1

T2- Command and control studies

Keywords: Information Sharing; Disaster Response; Qualitative Analysis; Collaboration; Coordination

Core Paper: 11:00-11:25

Cause and Effect: A Qualitative Analysis of Obstacles to Information Sharing During a Regional Disaster Exercise

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After large-scale disasters, diverse partner agencies rely heavily on an information-sharing environment that supports collaborative work. In the U.S., this occurs under the Incident Command System (ICS), a structured organizational framework for coordinated action. We explore obstacles to information sharing and coordination observed at a county-level Emergency Operations Center (EOC) operating under ICS during the response phase of a large-scale regional disaster exercise. Textual observations collected in situ are analyzed for both the effect/manifestation and cause/source of barriers to information sharing. Two-thirds of barriers that manifest as computational issues are not caused by technology breakdowns, and a third caused by unclear processes manifest as computational issues. Overall, obstacles to collaborative work that appear to be related to computational issues are generally attributable to non-technical causes. This indicates that resources directed at improving collaborative management of disasters by enhancing technological capabilities are likely to be misdirected.

ID: 196 / W23: 2

T2- Command and control studies

Keywords: Full-scale drill, elicitation methods, situational awareness, common operational picture, information needs.

Wipe Paper:11:25-11:43

Analysis of Common Operational Picture and Situational Awareness during Multiple Emergency Response Scenarios

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Disaster response operations require communication and coordination between agencies that seldom occurs in their everyday working life. Further, in such hybrid environments, it is necessary to establish a common operational picture for the responders involved to support collaborative decision-making. The emergency responders must gain situational awareness, and this can further affect the quality of how they deal with the situation. Training in emergency situations is shown to be effective for learning. In order to understand the complexity of working in unpredictable environments, an analysis of an audio-log from a large-scale drill was conducted. Moreover, this paper provides a definition of several categories for identifying the processes for establishing situational awareness and common operational picture among emergency responders. The analyzing process revealed how the actors communicate and exposed an overall communication pattern.

ID: 230 / W23: 3

T2- Command and control studies

Keywords: Urban search and rescue, unmanned aerial vehicle, command and control structures, tabletop exercise, emergency management

Wipe Paper:11:43-12:01

Testing the implementation of a flying localization system into emergency response using a tabletop exercise

Sebastian Schmitz, Konrad Barth, Tim Brüstle, Tobias Gleibs, Ompe Aimé Mudimu

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To optimize the search for trapped victims after building collapses, the authors participated in the development of a localization system based on an unmanned aerial vehicle. The objective of this study is to evaluate an approach to implement this system into the command and control structures during the emergency response after a building collapse. For this purpose, a tabletop exercise, based on a gas explosion scenario in an apartment building, was carried out with emergency response managers of the fire department and the German federal agency of technical relief. Observers have documented the exercise. Additionally, audio and video recordings were used. Thus, statements could be made about the implementation approach and the tabletop exercise method. Based on the results, the implementation approach can be considered appropriate. In addition, knowledge was gained about the appropriateness of tabletop exercises for the purpose of scientific evaluation.

ID: 116 / W23: 4

T2- Command and control studies

Keywords: Inter-organizational learning, knowledge sharing, exercise reports, double loop learning

Core Paper:12:01-12:26

Supporting Inter-Organizational Learning – A Review of Post-Exercise Knowledge Sharing

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Inter-organisational learning from exercises and response operations is crucial for improving overall response capacity for coping with cross-domain crisis events. In order to compile and disseminate experiences and acquired knowledge in the form of lessons learned, post-exercise reports are written. This paper presents a review of 17 Swedish post-exercise reports. The review was conducted with the aim to investigate whether such reports contained enough information to support inter-organisational learning, i.e. if learning goals were stated, how the event was described, method for evaluation, conclusions, and whether recommendations for change were sufficient for supporting inter-organisational learning. It was found that most reports did not support organisational development and lacked recommendations that were useful outside the own organisation or the context of the specific exercise scrutinised. The results indicate the need for an exercise evaluation framework for inter-organisational exercises.

ID: 202 / W23: 5

T2- Command and control studies

Keywords: Learning, exercise, crisis management

Wipe Paper:12:26-12:44

Who Learns from Crisis Management Exercises: An Explorative Study

Mari Olsén, Niklas Hallberg, Kristoffer Darin Mattsson

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Exercises are stated to be an important means to learn how to handle crises. However, it has been discussed who should participate and what can be learnt from them. Several roles are involved in the planning, execution and evaluation of exercises, such as participants, observers, facilitators and evaluators. This paper presents an empirical study of the differences in learning experiences between participants and observers. The study was based on interviews with participants and observers involved in a series of exercises at municipality level. The result shows that the participants' learning relates to individual experiences and how well they felt they performed the task. Meanwhile, the observers' learning experiences concerned organisational issues. The findings suggest that to achieve variation in learning experiences, which is important for inventing new solutions, crisis management organisations need to allow their personnel to try different roles in the exercises to increase the learning outcome.

ID: 223 / W23: 6

T2- Command and control studies

Keywords: Inter-organizational, exercise, learning, crisis management, collaboration

Wipe Paper: 12:44-13:02

Do's and Don'ts in Inter-Organizational Crisis Management Exercises

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It is commonly assumed that conducting exercises will contribute to better crisis management. However, the exact mechanisms of cause and effect are hard to isolate empirically. The objective of this paper is to compile and analyze the recommendations in the literature on inter-organizational exercises and learning. While not claiming to meet the strict scientific demand of empirical validation and general applicability, the compilation may nevertheless provide some guidance from research to practitioners. Forty-four papers about learning in inter-organizational exercises were analyzed. Out of the analyzed papers, 28 discussed obstacles or success factors. However, the recommendations applicable in one setting are not automatically valid in others, and some are even contradictory. The recommendations have therefore been categorized according to two criteria; when in the exercise cycle and for whom they apply. Several recommendations concern individual learning, but maximizing individual learning can sometimes hamper learning on the organizational level

ID: 219 / W23: 7

T2- Command and control studies

Keywords: Exercise design, morphological analysis, crisis management

Wipe Paper:v13:02-13:20

Design to Fit – Morphological Analysis as a Tool for Exercise Design

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Exercises are considered as vital to develop and sustain crisis management capabilities. An exercise may have a role both as a provider of knowledge about the crisis management system, and its performance, and as a driver of change through training of individuals, groups and organizations. However, the relationship between the design and characteristics of a specific exercise, and the usability of its results in the development of the crisis management system is not well-understood. The objective of this paper is to explore if a morphological field can be used to investigate this relationship. Such a field was designed and evaluated. Even though this field was relatively simple, it was concluded that it provides results that deepen the understanding of how different types of exercises can contribute to the development of the crisis management system.

ID: 126 / W23: 8

T2- Command and control studies

Keywords: Crisis and disaster management, spontaneous volunteers, command and control, volunteer management
Core Paper: 13:20-13:45

Opportunistic Affiliation in Spontaneous Volunteer Management

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Spontaneous volunteers influence crisis and disaster relief efforts as both an effective aid and a stressing factor for emergency organisations. Managing the negative impacts of spontaneous volunteering has thus become part of command and control deliberations. In this paper, we take a closer look at integrating spontaneous volunteers into the formal response system to mitigate negative impacts. Working with participants from formal response organisations, we gathered qualitative data regarding the management of spontaneous volunteers during the European migration crisis in 2015. Through thematic analysis, we extracted topics to systematically describe the interaction between emergency organisations and spontaneous volunteers. As implication thereof, we propose how computer supported systems can be applied to better manage spontaneous volunteers. In our discussion, we focus on the registration process and *ad hoc* verification of spontaneous volunteers to better integrate them in the formal response process.

ID: 206 / W23: 9

T2- Command and control studies

Keywords: Simulation games, training, Systemic Resilience Model, team resilience, assessment
Wipe Paper: 13:45-14:03

Evaluating the observation protocol of the Team Resilience Assessment Method for Simulation (TRAMS)

Amanda Jaber¹, Björn Johan Erik Johansson¹, Linnea Bergsten¹, Joeri Laere van², Peter Berggren¹

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This work in progress paper presents an initial evaluation of the observation protocol of the Team Resilience Assessment Method for Simulation (TRAMS) conducted in a crisis response simulation project. TRAMS is designed to assess the resilience of crisis response teams. The TRAMS observation protocol uses six core resilience functions from the Systemic Resilience Model as its theoretical foundation. Three independent observers used the protocol during a pilot study and six actual simulation games. Strategies relating to three out of six core resilience functions could be identified. The observations made were distributed similarly among the observers, indicating that the components of the TRAMS protocol are stable enough to continue developing the protocol. This study describes changes made to the protocol since the original design, and describes how the strategies relating to the six core resilience functions can be identified in the simulation games.

W24: Open Track

Time: Wednesday, 22/May/2019: 11:00am - 2:00pm **Room: 2.12**

Session Chair: Hossein Baharmand

Session Chair: Jose J. Gonzalez

ID: 156 / W24: 1

T15- Open Track

Keywords: Fire service, case study, sociotechnical analysis, work analysis, information systems
Core Paper: 11:00-11:25

First In, Left Out : Current Technological Limitations from the Perspective of Fire Engine Companies

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The cognitive demands and skills required of a fire engine company when assessing the scene of an incident and the systems they use to manage this information and deploy aid are a matter of life or death. We conducted a case study with an entire fire battalion in Florida (35 firefighters at varying levels of command) to assess their routine technology needs. Using a cognitive work analysis approach, we found that the firefighters in our study relied on mission critical systems that often failed, as well as disparate secondary systems that lacked integration. Capability gaps and inaccessible data also increased the likelihood of errors, creating frustration in the systems that both helped and hindered these firefighters in their daily job tasks. We describe what firefighters need from technology in its present state and we outline usability issues for technology designers and practitioners to leverage in the design of future systems.

ID: 157 / W24: 2
T15- Open Track

Keywords: Exercise management, Mixed reality, Simulation, Deliberate practice, ADL, MSaaS, C2Sim, ExConSim, ExManSim

Wipe Paper: 11:25-11:43

Structured crisis training with mixed reality simulations

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We argue that current technology for crisis training does not explicitly cater well enough for managing training objectives and skill building metrics throughout the lifespan of training. We suggest how successful crisis training may be enabled by interoperating next-generation exercise management tools with mixed-reality simulations. We propose an architecture consisting of (1) a front-end in which training objectives, essential skills, corresponding events and metrics can be declared, (2) a back-end consisting of simulations that implement the events and metrics and (3) a middleware which transfers information between the front-end and back-end to enable semi-automatic composition of the simulations and performance analysis. The purpose of this architecture is to facilitate learning through the principles of deliberate practice. We indicate where emerging technologies are necessary to achieve this.

ID: 107 / W24: 3
T15- Open Track

Keywords: Acceptance of ICT, Methodology, User Centered Design, UCD

Wipe Paper: 11:43-12:01

Design and development methods for improving acceptance of IT among emergency responders

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Various sources report a low adoption of IT-based tools in emergency response, especially in the front lines, as well as a negative attitude of responders to such tools. The responders' needs, simply put, are not met by the IT-based tools offered to them. Observing this situation through a user-centered design lens, we note that such problems typically stem from insufficient or erroneous context analysis. The problems become even more pronounced when considering that emergency response represents a complex, adaptive socio-technical system. We also note that research papers from the emergency management domain rarely discuss the appropriate methodology to use for designing ER systems, thus leaving designers at a loss for proven, solid methods of analysis and development in this domain. To fill that void, the present paper discusses a minimal set of techniques that, both in our experience and according to state of the art practice, can guide developers towards positively-accepted IT systems for emergency response. The paper is directed towards system designers and developers of ER systems, as well as researchers who are trying to find new ways of improving ER.

ID: 165 / W24: 4
T15- Open Track

Keywords: Data management, challenges, trends, firefighting

Wipe Paper: 12:01-12:19

Challenges and Trends of Data Management for Firefighting in Germany and the Netherlands

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For successful firefighting, information is key. In this work, a general overview of the current challenges and trends of data management for firefighting in Germany and the Netherlands are examined. This was accomplished by conducting a literature review to find out the current state-of-the-art in research. The results of the literature review are then compared with expert sentiments and gaps between research and practice are revealed. Through the review, six challenge categories are identified: cartographic data harmonization, IS standardization, information gathering from unstructured data, canonical bodies of knowledge, and data-driven firefighting support. The challenges and trends are discussed in the context of Germany and the Netherlands and significant differences are presented. Lastly, the gaps between research and practice are thoroughly analyzed and potentials for future work revealed.

ID: 123 / W24: 5
T15- Open Track

Keywords: Vanuatu, mobile network data, humanitarian, disaster impact, tropical cyclones.

Core Paper: 12:19-12:44

Understanding Aggregate Human Behaviour Changes in Response to a Natural Disaster in Vanuatu via Mobile Network Data Analysis

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This paper presents a use case of mobile network data as a new source of insight for humanitarian action. Based on analysis covering the Republic of Vanuatu, we identify aggregate behavioral patterns indicating short term and medium term behavior changes as a result of a tropical cyclone, which could contribute to our understanding of the resilience of communities to natural hazards. We also find interesting behavioral insights on how the human movement network is impacted by a cyclone. Due to the detail and tractability of the data set, insights on preparation, displacement, damage and resilience could enable more agile and adaptive responses by public institutions and other actors to humanitarian emergencies. Considering the array of natural hazards that the South Pacific region faces on an annual basis, this use case contributes more evidence in favor of using anonymized mobile network data to inform humanitarian action.

ID: 260 / W24: 6
T15- Open Track

Keywords: Common operational picture, situational awareness, collaboration support, geographic information systems, terminology harmonisation

Wipe Paper: 12:44-13:02

Sharing Incident and Threat Information for Common Situational Understanding

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This paper presents the INSITU research project initiated to provide a systematic approach for effective sharing, integration and use of information from different sources, to establish a common operational picture (COP) and shared situational understanding among multiple actors in emergency response. The solution developed will provide an interactive map display, integrating harmonisation of terminology and collaboration support for information sharing and synthesis. The enhanced COP will also support evaluation and learning from exercises and incidents. The project involves close collaboration with emergency management stakeholders in Norway, for requirements analysis, participatory design, and validation of project deliverables. The research will improve information sharing and decision support in emergency operations centres, which will contribute to improve societal resilience through more effective response capability.

ID: 259 / W24: 7
T15- Open Track

Keywords: Citizens, Volunteers, Integration, IT Solution

Wipe Paper: 13:02- 13:20

Integrating citizen initiatives in a technological platform for collaborative crisis management

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Although they can make a significant contribution to crisis response and management, citizens tend to be underestimated and under-integrated by official crisis responders. There is a necessity to take citizen contribution into crisis management tools, both for the information they can provide (*information-focused volunteers*) and the actions they can carry out (*action-focused volunteers*). Therefore, professionals need to be aware of the diverse ways citizens can help them to manage a critical situation: obviously by improving the situational awareness, but also by spontaneously performing tasks to meet specific needs on the ground.

After presenting the RIO-Suite software, a crisis management tool based on collaboration of stakeholders, this paper suggests ideas about how to make the most of action-focused volunteers to improve the orchestration of the crisis response. Given a volunteer action, four possible decision types are identified: Ignore, Stop, Consider and Support, and their consequences on 1) the crisis response and 2) the collaboration process are presented.

ID: 166 / W24: 8
T15- Open Track

Keywords: Virtual teams, crisis, sensemaking theory, swift trust, team performance.

Wipe Paper: 13:20-13:38

The Influence of Swift Trust on Virtual Team's Sensemaking in Crisis: A Research Model

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Virtual teams are an important form of collaboration, especially in the context of transboundary organizational crises. Achieving team effectiveness through good sensemaking is key to virtual teams' success in responding to crisis. However, there is still a lack of understanding about the relationship of this sensemaking in a virtual team during crisis to the virtual team's development of swift trust. Adapting from a model of sensemaking, in this paper, we propose a research model to describe the relationships among swift trust, sensemaking and team performance in the context of virtual teams during crisis.

ID: 182 / W24: 9
T15- Open Track

Keywords: Deep Web, Dark Web, Surface Web, Black Markets, Crisis Response, Crisis Management

Wipe Paper: 13:38-2:03

Dark Web, Black Markets: The Utility of Dark in Disaster Recovery Research

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The Dark Web is a critically unexplored area of the Internet in the crisis research literature. Lack of knowledge about the space, how to access it, how to safely and efficiently navigate this environment, and prevailing myths about the dangers of being on Dark Web likely lead to this deficiency of research. This work examines this area of the Internet for utility and insight relevant to crisis managers. A pilot study on Puerto Rico in the months following Hurricane Maria reveals links between public understanding of crisis response and the development of black markets, which reflects on of long-term recovery and reconstruction. As more people adopt this hidden part of the Internet, researchers and managers must do more to pay attention to activities that occur in this space.

W31: Ethical, Legal, and Social Issues

Time: Wednesday, 22/May/2019: 11:45am - 1:15pm **Room: 2.13**

Session Chair: Katrina Petersen

Session Chair: Caroline Rizza

ID: 245 / W31: 1

T3- Ethical, Legal and Social Issues

Keywords: Chinese social media, fact contestation, transparency, authenticity, trust

Wipe Paper: 11:45-12:03

On Liquid Ground: Contesting the facts around Shouguang Flood on Weibo

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As one of the most well-known social media platforms in China, Weibo provides an online public sphere. During the 2018 Shouguang flood, many people who were affected converged on the platform. Very quickly, competing accounts of the situation emerged, some provided by government and some by individual Weibo users. The government – the highest emergency management authority – was accused of using censorship and other measures to suppress the coverage of the disaster. Based on an analysis of 34 qualitative interviews with Weibo users, of which nine directly address the Shouguang floods, this paper examines how diverse actors contested the facts during the disaster. This provides insights into a universal challenge in risk communication. We identify time, time-space compression, and scales of risk responsibility as critical points of friction, and explore opportunities of designing for contestation in crisis information systems as a way of promoting living with risk more circumspectly.

ID: 209 / W31: 2

T3- Ethical, Legal and Social Issues

Keywords: Earthquake, Risk reduction, Disaster app, Safety tips, ELSI.

Wipe Paper: 12:03-12:21

Efficiently allocating safety tips after an earthquake – lessons learned from the smartphone application LastQuake

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In a context of information overload, actors in disaster management are facing challenges to efficiently allocate critical information during a crisis. Based on the empirical experience of EMSC (Euro-Mediterranean Seismic Centre) with its application LastQuake, this paper explores ways to provide safety information in a timely manner, to the people who actually need it. First we introduce the method used to design and implement universally understandable visual safety tips, taking Ethical, Legal and Social Issues (ELSI) into consideration. Then results on the effective use of the feature are presented. Findings demonstrate the importance of designing universal tools to limit the use of personal data as well as the necessity of developing a multichannel approach for efficient crisis information allocation.

ID: 233 / W31: 3

T3- Ethical, Legal and Social Issues

Keywords: Social Media, crisis management exercise, firefighters, methodology

Wipe Paper: 12:21-12:39

What can we learn from a crisis management exercise? Trusting social media in a french firefighters' department

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This paper sets out the methodology and the temporary results of an ongoing research project on the use of social media in crisis management (in France). It discusses the benefits and limits to use an emergency crisis exercise for research purposes. It describes an observation protocol and a coding method that could be replicate to survey further exercises. Some possible processing of the observation data is exposed, and further visualizations of the data are still in progress. One of the first analytical results tackles the way Var's firefighters consider social media information. For now, social media seem to be regarded as questionable because they do not easily fit into the organizational routine. At the same time, the awareness of the need to use social media is quite strong. On the analytical level, the paper tries to use sociological concepts to describe and explain some results.

ID: 248 / W31: 4

T3- Ethical, Legal and Social Issues

Keywords: Ethics, Transboundary, Responsibility, Collaboration, Information Technology

Wipe Paper: 12:39-12:57

Managing Risk Across Borders: ethical implications of engaging information technology for transboundary disaster collaboration

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Disaster management is increasingly becoming a project in managing diversity, from cross-organisational collaboration to inclusivity of voices. This is particularly prevalent when dealing with transboundary risks. New information technologies support these transboundary interactions by compiling diverse information and sources to build collaborative insight beyond what any individual organisation can know. This paper explores the ethical concerns that planners and responders face as they work with these collaborative information technologies to engage with data from other organisations, based in different data frameworks, socio-political priorities, goals, and cultures of risk. It draws on the ethical impact assessment of a cross-border collaborative crisis planning platform currently under development in the H2020 project IN-PREP to examine ethical tensions around equity, inclusion, diversity, solidarity, accountability and transparency. It discusses the consequences of such design foci for an agency's ability to notice ethical risks that emerge from working in diversity.

W32: Knowledge, Semantics and AI for RISK and CRISIS Management (2)

Time: Wednesday, 22/May/2019: 11:45am - 2:00pm Room: 2.9-2.10

Session Chair: Hedi Karray

Session Chair: Nada Matta

ID: 114 / W32: 1

T10- Knowledge, Semantics and AI for RISK and CRISIS management

Keywords: Application ontology, Common situation representation, Rescue of people, Situation awareness

Wipe Paper: 11:45-12:03

Situation Representation and Awareness for Rescue Operations

Samer CHEHADE^{1,2}, Nada MATTA¹, Jean-Baptiste POTHIN², Remi COGRANNE¹

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During rescue operations, being aware of the situation is very critical for rescuers and decision-makers to reduce the impacts. This work aims to support situation awareness amongst actors participating in rescue operations by adopting an ontology-based approach. An application ontology is proposed based on existing related ontologies and operational expertise collection. It will help to ensure common situation representation and understanding between different actors. After that, a knowledge-based system will be developed and integrated in actors' environment to support decision-making. Our preliminary results are shown in this paper.

ID: 147 / W32: 2

T10- Knowledge, Semantics and AI for RISK and CRISIS management

Keywords: Risk assessment, geographic information system, conceptual modeling, ontology, computational creativity

Core Paper: 12:03-12:28

An Automatic Approach to Qualitative Risk Assessment in Metropolitan Areas

Denis Barcaroli¹, Alex Coletti², Antonio De Nicola¹, Antonio Di Pietro¹, Luigi La Porta¹, Maurizio Pollino¹, Vittorio Rosato¹, Giordano Vicoli¹, Maria Luisa Villani¹, Enrico Zavagnini¹

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Risk assessment aims at improving prevention and preparedness phases of the crisis management lifecycle. Qualitative risk assessment of a system is important for risks identification and analysis by the various stakeholders and often requires multi-disciplinary knowledge. We present an automatic approach to qualitative risk assessment in metropolitan areas using semantic techniques. In particular, users are provided with a computational support to identify and prioritize by relevance risks of city services, through generation of semantic descriptions of risk situations. This approach is enabled by a software system consisting of: TERMINUS, a domain ontology representing city knowledge; WS-CREAM, a web service implementing risk identification and ranking functions; and CIPCast, a GIS-based Decision Support System with functions of risk forecast due to natural hazards. Finally we present the results of a preliminary validation of the generated risks concerning some points of interest in two different areas of the city of Rome.

ID: 226 / W32: 3

T10- Knowledge, Semantics and AI for RISK and CRISIS management

Keywords: Semantic interoperability, modular ontology, upper-level ontology, mid-level ontology, disaster response

Wipe Paper: 12:28- 12:46

A Modular Ontology for Semantically Enhanced Interoperability in Operational Disaster Response

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Up to now, the world has witnessed how inadequate communication capabilities can adversely affect disaster response efforts. There are various Emergency Responders (ERs) that potentially must work together towards a successful resolution of the disaster. However, the different terminologies and technical vocabularies that are being exchanged between the ERs may lead to a misunderstanding and lack of semantic integrity. Yet, understanding the semantics of the exchanged data is one of the major challenges. The purpose of this work is to define the complex knowledge of the ERs by proposing a common and modular ontology shared by all the stakeholders to come up with a common shared vocabulary in order to ensure semantic interoperability between ERs. In this paper, we present the proposed ontology and we discuss how it was developed using Basic Formal Ontology as an upper-level ontology and Common Core Ontology as a mid-level ontology to define each module.

ID: 115 / W32: 4

T10- Knowledge, Semantics and AI for RISK and CRISIS management

Keywords: machine learning, video data, filtering, crisis management, user-evaluation

Wipe Paper: 12:46-13:04

Video Summarization And Video Highlight Selection Tools To Facilitate Fire Incident Management

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This paper reports on the added value of combining different types of sensor data and geographic information for fire incident management. A survey was launched within the Belgian fire community to explore the need of added value and the use of new types of sensor data during a fire incident. This evaluation revealed that people are visually-oriented and that video footages and images are of great value to gain insights in a particular problem. However, due to the limited available time (i.e., fast decisions need to be taken) and the large amount of cameras it is not feasible to analyze all video footages sequentially. To solve this problem we propose a video summarization mechanism and a video highlight selection tool based on the automatic generated image and video tags.

ID: 187 / W32: 5

T10- Knowledge, Semantics and AI for RISK and CRISIS management

Keywords: casualty, information extraction, news articles, casualty data visualization

Wipe Paper: 13:04-13:22

Casualty Information Extraction and Analysis from News

Basanta Chaulagain, Aman Shakya, Bhuwan Bhatt, Dip Kiran Pradhan Newar, Sanjeeb; Prasad Panday, Rom Kant Pandey

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During unforeseen situations of crisis such as disasters and accidents we usually have to rely on local news reports for the latest updates on casualties. The information in such feeds is in unstructured text format, however, structured data is required for analysis and visualization. This paper presents a system for automatic **extraction and visualization of casualty information** from news articles. A prototype online system has been implemented and tested with local news feed of road accidents. The system extracts information regarding number of deaths, injuries, date, location, and vehicles involved using techniques like Named Entity Recognition, Semantic Role Labelling and Regular expressions. The extracted entities were manually annotated and compared with the results obtained from the system. Initial results are promising with good accuracy overall. Moreover, the system maintains an online database of casualties and provides information visualization and filtering interfaces for analysis.

ID: 108 / W32: 6

T10- Knowledge, Semantics and AI for RISK and CRISIS management

Keywords: Crisis, Fuzzy Theory, Ontology, Stress.

Wipe Paper: 13:22 – 13:40

Generating Crisis Situation by Using Ontology and Fuzzy Theory

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A crisis is a complex situation, difficult to manage by the actors. Some of them are under stress as it is difficult to deal with problems when consequences cannot be predict. The human conditions (concerning familial and life) and, the influence of the environment related to politics, economic, and media push the actors to lose control of the crisis situation. The question we face in this paper is: "is it possible to use the fuzzy theory for predicting the stress impact in crisis?" Our main hypothesis to represent experience feedback in a situation prediction in order to show negative consequences and correctness actions is taken account. Fuzzy theory concept is used in prediction in order to generate several situations.

Poster & Demo Session

Poster and Demo Session

Time: Monday, 20/May/2019: 4:15pm - 5:45pm Room: Sala VIP, ground floor

Session Chair: Josune Hernantes

Session Chair: Laire Labaka

INDleKNOW: Traditional Ecological Knowledge, Economic Sustainable Development and Disaster Resilience

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This poster illustrates the development of a new research network-INDleKNOW, which links researchers and practitioners of Disaster and Risk Management (DRM) and Economic Sustainable Development (ESD) in Southeast Asia Countries (SEA). We are investigating how Traditional Ecological Knowledge (TEK) can be mobilised in practice-policy intervention that aligns DRM and Tourism to support ESD. This is a work in progress, and the poster traces the explorative and conceptual stage of the research. We used a creative knowledge exchange methodology generating rich 'network capital', enabling access to stories, usually discarded, that evidence the potential of TEK to harmonise a much needed integration of DRM and tourism.

The Search for Embeddedness: Leveraging Scientific Modeling in Disaster Response

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Numerous studies concerning the response to extreme events demonstrate serious management, coordination, and problem-solving issues that diminished the ability to minimize human suffering. A plethora of scientific modeling technologies exist that can aid in both the panning and response to disasters. In fact, the availability of scientific models is accelerating – but the ability to adopt this technology has had a much slower growth pattern. This research focuses on determining methods for appropriating, integrating and using scientific modeling technologies to improve disaster response efforts in the area of mas care. This work will build on previous research concerning the modeling of technology embeddedness.

LETSCROWD: Dynamic Risk Assessment for Mass Gatherings

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Risks for crowd in mass gathering events are so called “High Impact Low Probability” risks (e.g. terrorism, lone wolfs, domestic extremisms) and therefore managing them accordingly, i.e. without a sufficient statistics, means to “*seek a method that leads us to make the least egregious errors in decision-making across the range of possible scenarios that might develop in the future*” (Willis, et al., 2005). Thus, the LETSCROWD project proposes an innovative Dynamic Risk Assessment (DRA) methodology for Law Enforcement Agencies (LEAs) to assess risks for the crowd on the basis of dynamically collected information to minimise decision-making errors across the possible scenarios that might develop in the critical time frame from the event planning to the event execution.

Comparative Study of Feature Representations for Disaster Tweet Classification

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Twitter is a popular social media platform where users publicly broadcast short messages on a myriad of topics. In recent years, it has enjoyed an increased usage around disaster events due to availability of information in near real time. Additionally, enhanced information representations to facilitate the classification of social media in terms of relevancy and type of information is currently a highly active research area. In this work, we consider the usefulness and reliability of a range of representation models in the analysis of disaster related social media.

Collaboration in Emergency Response Drills: an Experience with Firefighters

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Emergency response drills, conducted mostly by means of simulations, are strategies used by various complex social-technical systems in order to prepare organizations and people to deal with foreseen or unforeseen risk situations. Collaborative work is part of these practitioners' work, which requires communication, cooperation, coordination, and awareness from them so they can properly do their job. Such collaborative work may be supported/aided by technological artifacts that ensure, for instance, a shorter response time, improved information sharing, and a better understanding of the local situation. Previous research in several types of firefighters' training and observations of teams in Command and Control Centers indicated the need of training approaches better suited to the reality of these practitioners, as well as better ways to analyze training results, enable an effective organizational learning. Immersed in this context, the purpose of this study was an analysis of an emergency response simulation exercise carried out by firefighters, to identify aspects of collaborative work to identify issues on the practitioners' communication, coordination, cooperation, and awareness.

Evaluating the Performance of Deep Learning Methods for Hurricane-Related Image Classification

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Global social media use during natural disasters has been well documented. In the U.S., public social media platforms are often a primary venue for those affected by disasters. Some disaster victims believe first responders will see their public posts and that the 9-1-1 telephone system becomes overloaded during crises. Moreover, some feel that the accuracy and utility of information on social media is likely higher than traditional media sources. However, sifting through content during a disaster is often difficult due to the high volume of 'non-relevant' content. In addition, text is studied more than images posted on Twitter, leaving a potential gap in understanding disaster experiences. Images posted on social media during disasters have a high level of complexity. Our study calls to action that social media images posted during disasters should be studied using machine learning.

Multi-agent planning and execution with risk analysis and multi-criteria optimization: the case of rescue plans to environmental and humanitarian crisis

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A disaster seriously disrupts the functioning of a society and generates human, material and economic losses. Unfortunately, some are weakly predictable such as the terrorist. But even the predictable ones, like the cyclones whose intensity remains difficult to assess are not always easy to forecast in terms of damage. Over the past 10 years, disasters have killed more than 700,000 people worldwide, 1.4 million injured and total economic losses of more than 1,100 billion euros. Due to the sudden occurrence of disasters, the reaction must be quick and efficient as much as possible in order to minimize the human loss by providing help and rescue to the injured people. The main objective is to assist and take them as fast as possible to the nearest treatment center that can treat their cases. The presented work concerns the definition of a new decentralized model combining proactive-reactive approaches and Multi-agent systems (M.A.S) for solving the planning problem of a terrorist attack scenario. It is dedicated to present a PhD research work involving both The Production Engineering Laboratory in France and the research laboratory of the Lebanese-French University of Tripoli in Lebanon.

CroMa – Crowd Management in Transportation Infrastructures

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The high and continuously rising number of passengers using public transportation in Germany is leading to an expansion of the services offered by public transport operators. The existing transportation infrastructures, especially the railway stations, can only partly cope with this rapid growth in passenger volume. Overcrowding on platforms and access routes is already occurring, especially in the event of operational disruptions by natural disasters or major public events. This crowding may lead to passenger injuries or to a standstill of operations for safety reasons. The collaborative research project "Crowd-Management in Transportation Infrastructures – CroMa" aims at improving the robustness, safety and performance of railway stations during peak loads. For this purpose, improved building regulations, suitable crowd management as well as guidelines for risk management, resilience and inter-organizational information management will be developed.

Towards Bridging the Gap between Demand and Supply in Humanitarian Geodata Use

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In humanitarian practice, high-quality and context-specific geodata is crucial to come to informed decisions and to efficiently coordinate and conduct humanitarian activities. While humanitarian actors also make use of internal resources to collect various kinds of geodata, they mostly rely on external geodata providers. This is mainly due to a lack of own resources, appropriate expertise, and the complexity of humanitarian contexts. However, both research and practice show an imbalance between the geodata provided and humanitarian actors' needs and requirements, which leads to less efficient use of geodata in humanitarian activities. The main aim of the work is to close this gap through a methodological approach that enables structured communication of these needs and requirements of humanitarian actors - to enable better understanding and in consequence, to facilitate geodata creation and sharing with a better fit for humanitarian purposes.

Adapting General-Purpose Recognition for Disaster Images Identification

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There is tremendous progress in recent object recognition task due to the availability of extensive data set like ImageNet and PlaceCNN, and the upsurge of interest in Convolutional Neural Networks that leads to many proprietary publicly available or commercial API that can be used to gain some insight about object or scene of an image. However, most of the time, even the networks do a good job and has very high performance in doing its task, most of the time it was not helpful in the cross-domain setting where the target label is somewhat different. Crisis responder required a specific kind of category to reach each goal. We propose to find a better way to re-duce this gap where in this domain there are also several labeled datasets with the specific category which also available in a different kind of volume usually in smaller datasets. Our goal is to train network that can classify disaster-related images to a useful category for disaster response situation and to draw a conclusion whether extracted feature from a trained network can have benefit to increase the performance of classification.

Serious gaming for training non-technical skills in crisis management and emergency response

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A series of R&D initiatives carried out within an interdisciplinary (cognitive sciences, ergonomics, software engineering) and international (Canada and Sweden) partnership that is comprised of universities (U Laval, Linkoping U) and college (Campus Notre-Dame-De-Foy, Canada) researchers, developers and engineers from the industry (OVA, Thales) and subject-matter experts from emergency response teams (Quebec security department) is presented. The aim of our R&D program is to develop and validate innovative adaptive systems and tools for the training of non-technical (cognitive) skills in crisis management and emergency response. We present two on-going projects related to the training of interoperability in joint operations as well as other key cognitive skills: A first project is focused on the use of serious gaming and the other project with the use of VR within collaborative environments. In both cases the scenarios are designed to require teamwork, coordination of decisions and actions, communication and collaborative sensemaking and also provide a set of behavioral indicators and biometrics in order to monitor skill acquisition and the cognitive-affective state of the trainees.

tion and the cognitive-affective state of the trainees.

A comparison of two methodologies to assess shallow landslide risk

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Landslides are natural processes that can be hazardous events when they threaten human lives and assets, and their incidence can be increased by improper land use, such as irregular urbanization and the construction of dams and roads without good engineering planning. Landslide disasters and catastrophes are not new, and the loss of human life to them is common in developing countries. Moreover, mapping these risk areas are critical for managing and mitigating the risk. Municipalities can use the mappings to monitor the risk areas and to allocate resources or prioritize to relocate residents living in high and very high risk levels sectors.

The Brazilian government through its Ministry of Cities and the Institute for Technological Research (Instituto de Pesquisas Tecnológicas – IPT) developed a landslide risk mapping methodology that we are calling the Brazilian Government Methodology (BGM) to map landslides and river-bank erosion risk. The purpose of this study is to discuss and compare the performance of two methodologies that quantifies the BGM and automatically classify the risk level of shallow landslide prone-areas. The first methodology is based on the Analytical Hierarchical Process (AHP) and it is heuristic/expert based. The second is statistically-based and uses Ordinal Logistic Regression (OLR).

Analysis of Japanese Tweets about 2018 Typhoon Jebi by Creating Co-occurrence Networks

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Prompt and accurate collection/distribution of information is important to minimize damage due to a large-scale disaster. The utilization of social media, particularly Twitter, during a disaster has attracted worldwide attention (Imran et al., 2015). The number of tweets increases explosively during a large-scale disaster. For example, on the day of the Great East Japan Earthquake, approximately 33 million tweets were posted. In the 10 minutes after the Northern Osaka Earthquake hit Japan on June 2, 2018, more than 270,000 tweets that contained the word “地震” (earthquake, in Japanese) were posted (Yamada et al., 2018). Therefore, to effectively utilize Twitter during a disaster, it is important to analyze the characteristics of tweets. In this study, we analyze Japanese tweets posted when 2018 Typhoon Jebi, one of the strongest typhoons that landed in Japan in the past, was approaching and striking Japan. Specifically, we create co-occurrence networks to visualize what kind of tweets have been posted a lot. We also develop an application that displays the position of the typhoon, precipitation, and the co-occurrence network simultaneously.

Standardization for an enhanced crisis management

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The poster "Standardization for an enhanced Crisis Management" is describing the standardization activities within the research project DRIVER+ (Driving Innovation in Crisis Management for European Resilience). The integration of standardization in research and innovation projects is increasing and a well-established path and approved methodology that supports the integration of standardization in the projects is needed. This will address the need of the projects to exploit and disseminate the project findings with a suitable tool. DIN as standardization body is part of this project in which more than 30 partners work jointly to demonstrate and test crisis management solutions. Therefore the poster provides information on the project itself, the standardization methodology used within the frame of the project, the proposals for new standards as well as the possibility to join the standardization activities, the project related crisis management network CMINE and the future usage of the standardization work conducted in the project.

Constructing Trust in Disaster Communications

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The Great East Japan Earthquake on March 11th, 2011 caused severe damage to the northern coast of the main island in Japan. Since then we have been working to help out the affected area in terms of IT support such as internetworking and providing PCs. Through our support activities we came across an interesting issue concerning collaboration with people from heterogeneous backgrounds. Those people who worked on the disaster response came from different backgrounds and most of them were doing quite different tasks from what they usually did before the disaster. Disagreements and distrust happened quite easily. We call this problem disaster communications in this paper. We found that trust plays an important role in such communications, as well as how possibly we could construct trust based on the Salient Value Similarity (SVS) Model. In this paper, we report our experiences during our support activities and our findings in terms of trust.

Gathering Local Knowledge for Disaster Risk Reduction: The Use of Sketch Maps in Group Discussions

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Participatory approaches can be applied to investigate the geospatial knowledge and risk perception of citizens in disaster-affected regions. Knowledge gained this way can improve, for example, the precision of official risk maps for specific locations. A dialogue between researchers, citizens, and centers of expertise can be established, which enables exchange around recommendations for measures of disaster risk reduction on a local level. The presented approach is based on previous studies about the use of sketch maps for disaster risk reduction. These previous studies and related methods are further developed so that they can be used for group discussions. In this way, citizens can be involved in the whole disaster reduction process, which can help to motivate them to take own mitigation measures. Our approach offers automatic georeferencing and color detection. This enables a fast processing of the data and efficient use for disaster management. Moreover, the approach is paper-based in order to include marginalized groups, which do not have knowledge of specific technologies or access to the internet.

Towards a comprehensive architecture to extract situational models from Twitter data

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Crisis situations require specific information to organize and respond to the events. The need of information is important and emergency management cells aim at gathering them as much as possible to build a common operational picture (COP) of the field. Also, citizens are using more and more social media to share what is happening around them during exceptional events. Social media, such as Twitter, Facebook or Instagram therefore participate in the exchange of information related to the crisis. Consequently, it is important to be able to take advantage of this by integrating citizens' social media data into the decision-making process.

Up to this day, many tools exist in the literature. However, information systems integrating social media data into the COP are rarely used in the facts because they are still resource-consuming. This leads to a paradoxical situation where decision-makers are looking for information to organize their resources while victims and witnesses' willing to share information is not taken into account by rescue organizations. In this context, some possible necessary improvements are identified. Among them, "*how the added-value information extracted thanks to such social media-oriented system should be integrated in the decision-making process?*" echoes to this context. Consequently, how to fully integrate the information provided by social media data, in times of crisis, to improve the common understanding and thus the collaborative response of the responders.

A Filtering and Visualization Workbench for Messages in Crisis Management

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For emergency management agencies, information retrieval is of particular importance since it is crucial for decision-making and the gain of situational awareness during a crisis. Many different data sources are available for the usage in the context of crisis management like for example weather forecasts, sensor data, historical context information or social media messages. By including all these different information sources vast amounts of data can be generated in short times. If not handled appropriately this can lead to informational overflow for human analysts. To prevent this an automated analysis, efficient visualization and appropriate filtering methods for the multi-modal data are required. A combined visualization of the different data sources will also help in this regard. It will improve the ability of analysts to get a better overview of the current situation as well as their ability to validate and verify single events.

This work presents an approach to the realization of a visualization tool that tries to accomplish both: the ability to include many different data sources as well as being configurable to each single data source to prevent a loss of information. The presented approach was developed in the frame of the beAWARE project, which aims for the creation of a holistic approach, that supports decision makers through all phases of a natural disaster related crisis, i.e. preparedness, response and recovery.

Distributed Learning Automata-based Intelligence for Propagation-based Fake News Detection on Social Media During Crisis

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One of the recently revealed approaches to social media fake news detection is the propagation-based approach. The assumption is that information trustworthiness evidence could be unveiled by investigating different opinions and contradictions. In propagation-based methods, credibility networks are built to employ optimization techniques over different pieces of news giving the underlying point of view. Mining different viewpoints and reactions to news are referred to as stance detection tasks. However, stance detection models are not either robust enough nor generalized on different datasets, since they are highly dependent on the specific training data feature space. That introduces the first challenge to propagation-based fake news detection. Another challenging and maybe avoided issue is the problem of biased opinions or accounts.

However, it is a bit naive hypothesis since biased and misleading viewpoints would be the majority in many cases. The aim of our study is to develop a robust propagation-based fake news detection model that remains accurate regardless of the above-mentioned challenges. For that, we will simulate different use cases with biased and misleading stances.

Analysis of Tweets with Rescue Request Hashtags in The 2018 Japan Floods

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Large-scale natural disasters are a frequent occurrence in Japan. During and after the disasters, numerous messages (i.e., tweets) related to the disaster are posted on Twitter. At the times of recent disasters, such as the 2017 Northern Kyushu Floods in Japan and the 2018 Japan Floods (the July 2018 Heavy Rain Disaster in Japan), victims who needed to be rescued used the hashtag #救助 (meaning #Rescue) in the tweets they posted to request a rescue. Usually, if a victim needs to be rescued, an emergency phone call with a rescue request can be made (to the numbers 110 or 119 in Japanese phone networks). In the 2018 Japan Floods, a record-breaking heavy rain poured down in western Japan in July 2018, killing 222 people and causing severe damage. Media reports have noted that the fire department could not receive and respond to all of the rescue request calls because of their vast number. However, many victims did post tweets requesting a rescue on Twitter as an alternative to making emergency calls. Because only a few studies have investigated the effectiveness of such hashtags, an investigation into the circumstances of the posted tweets with rescue request hashtags needs to be conducted to enable better rescue and supporting activities. In this study, we collect and analyze tweets with rescue request hashtags that were posted during the 2018 Japan Floods.

Social Media in Disaster Management: Exploring the Information Exchange Behavior in the Underserved Communities

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The purpose of this paper is to examine the role of social media in the underserved communities to manage disasters. We draw on the *Uses and Gratification Theory*, *Situational Theory of Problem Solving*, and the research on *Communication Behavior* to develop a comprehensive model that will help identify people's behavior in the underserved communities when faced with an imminent disaster and their choice of social media for communication purpose during disaster. Our conceptual model and the propositions are given below. This paper is still work in progress. In the methodology section, we provide the method used to develop the conceptual model and the propositions. In the results section, we provide our conceptual model and the propositions. This paper finally concludes by proposing the further work that needs to be undertaken for completing this project.

AIOSAT - Autonomous Indoor & Outdoor Safety Tracking System

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The Europe population experiences yearly about 2 million to 2.5 million fires with 20 to 25 thousand deaths and 250 to 500 thousand reported injuries. Moreover, EUFireAcademy states European countries suffered 558 fatalities per million inhabitants due to fire hazards during the year 2010.

Even though satellite-based positioning technology allows rescue workers to already operate efficiently, GPS availability, reliability, and accuracy are often poor during fire operations, for example due to thick smoke, dense forests, rough terrain and inside buildings. In this context, the objective of AIOSAT (Autonomous Indoor & Outdoor Safety Tracking System) is to progress beyond the state of the art by defining the AIOSAT concept that aims to overcome aforementioned limitations of GNSS usage in rescue interventions. For this purpose, GNSS positions are enhanced with EGNOS and fused with position information inferred from IMU and RF.

Towards proactive agility of crisis response.

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The goal of this work is to introduce a framework to support decision-making during the crisis response step of the crisis lifecycle. Indeed, crisis situations are unstable phenomena by nature and by the effects of the crisis response itself. So, the crisis response is challenged over time: new objectives, new risks, lack of resources, evolving weather conditions, etc. Reacting once events happened to adapt the response is not sufficient enough to provide the agility required by the decision-makers.

Based on the projected effects of the chosen crisis response on a real-time model and several anticipated models of the situation, the proposed framework aims to achieve the last step of the situation awareness approach: the projection of the current situation in the near future. This can enable a proactive on-the-fly agility of the crisis response. A use case based on the Loire river flood is developed to illustrate the presented framework.

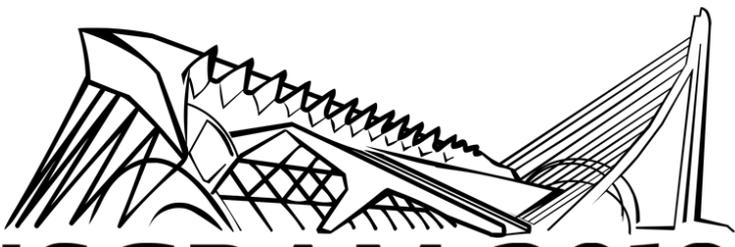
Geographic and Content-based Prioritization of Tweets During Weather-Related Disaster Events for Emergency Management

Marcela Suárez, Keith C. Clarke

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Content shared on Twitter usually represents timely, updated, and sometimes on-site reports. Because of this, and the speed and ease with which information is shared through this micro-blogging platform, forecasters and emergency managers have tried to leverage tweets as an on-the-ground reference for both confirming the occurrence of weather-related disaster events and for tracking their local impacts and damage. However, since Twitter data is massive, semantically varied, noisy and spatio-temporally uncertain (Steiger et al. 2015), little of this information is made useful and when it is, it usually requires exhaustive manual filtering – searching individually for tweets related to a specific event. This raises the questions of how can we both identify and prioritize tweets on weather-related disaster events based on their reliability in a timeframe that is useful for emergency response, and ultimately, which factors define their reliability.

This study presents an approach for prioritizing tweets so that they can be used by emergency managers and decision makers to assess local effects and damage caused by weather-related disaster events. Using Hurricane Harvey as a case study, we demonstrate how authoritative data, such as on-the-ground reports provided by weather spotters trained by National Weather Service (NWS), as well as the National Flood Hazard¹ information and damage maps created by the Federal Emergency Management Agency (FEMA) can be used to prioritize tweets based on their geographical location, and so allow them to assist in weather impact assessments.



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