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Introduction to the DIRECT minitrack (Disaster Information, Technology, and Resilience) in the Digital Government track

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After a year 2021 placed under the sign of the global pandemic, it is not surprising to find nearly a third of the articles selected for the DIRECT minitrack addressing the subject of COVID-19 (30%). Overall, almost half of the articles in this edition of the DIRECT minitrack deal with communication between and among citizens (46%), two articles deal with the notion of evacuation (15%), and almost a quarter deal directly with resilience (23%). Finally, there are a few original topics that are not often covered in the minitrack DIRECT, such as cybersecurity or traffic management.

The global feeling is that the next editions should probably slowly slide from instantaneous and short terms events mainly articles (e.g., earthquake) to long terms and continuous crisis articles (e.g. global warming and refugees),

The DIRECT minitrack of the eGov track of HICSS 55 presents thirteen great papers addressing these issues but also these perspectives. The following presents each of these articles.

1. Using a Public Safety Radio Network for Information Negotiation between the Three-Tiered Command and Control Structure

Kristine Steen-Tveit

Multi-organizational emergency operations require effective information sharing. Existing information management tools supporting a common operational picture mainly convey factual information. However, a growing body of literature recognizes the importance of sharing interpretations and implications among the involved stakeholders for building a common situational understanding. This study aims to identify information that must be negotiated across the strategic, tactical, and operational command and control structures (C2S) for developing common situational understanding. Based on 33 interviews and a survey of emergency management stakeholders,

information elements on the semantic and pragmatic levels are identified. Further, the results suggest how to use a secure radio network for facilitating information sharing so that the involved organizations can monitor and negotiate important information. These insights provide important lessons for improving information sharing in the emergency management domain.

2. IWARN: A people-centered approach for early warning

Paloma Diaz, Monica Sanchez-Francisco, Teresa Onorati, Alvaro Montero, Ignacio Aedo

Early warning is the activity of the mitigation phase concerned with monitoring precursors of a potential hazard to decide whether it is evolving to real risk and eventually initiate an early response. The first step consists of collecting updated and reliable data to support situational awareness from emergency operators. Data-centered Early Warning Systems (EWS) are focused on gathering data and run simulations to support decision-makers. A more sustainable approach consists of a people-centered EWS that takes profit from citizens who act as intelligent sensors collecting and sharing purposeful information. This people-centered approach can contribute to raising community awareness of the local environment and its vulnerabilities. In this paper, the iWarn system is introduced. It is a system relying upon mobile to integrate citizens in this process. The system has been developed following an action research approach to involve different stakeholders, including professionals, volunteers and citizens.

3. Covid-19 in France: Crisis communication and on-the-fly training of populations

Elsa Negre

Among the countries of the world, 99.3 % have been affected by the Covid-19 pandemic, which has

been raging since the end of 2019 and continues today in 2021. This initially health crisis quickly turned into a pandemic affecting all possible aspects of a crisis (humanitarian, economic, social, etc.). This article focuses mainly on two important aspects of crisis management: communication / dissemination of information and preparing populations for risks. Following interviews with the population, an example of the importance of communicating information, preparing populations for future crises and the impact of populations' behaviors is presented.

4. Large-scale Zone-based Evacuation Planning: Generating Convergent and Non-Preemptive Evacuation Plans via Column Generation

Jorge Huertas, Pascal Van Hentenryck

In zone-based evacuations, the evacuated region is divided into zones, and vehicles follow the single evacuation path assigned to their corresponding zone. Ideally, these evacuation paths converge at intersections to reduce driver hesitation; and non-preemptive schedules ensure that the evacuation of a zone proceeds without interruptions once it starts. A column-generation algorithm that produces convergent and non-preemptive evacuation plans in real large-scale evacuation scenarios is presented. Furthermore, this algorithm is compared against existing models that produce convergent paths or non-preemptive schedules separately. Finally, a traffic simulator is used to evaluate the quality of the generated plans.

5. Developing an Adaptive Building Evacuation Simulation and Decision Support Framework using Cognitive Agent-Based Modelling

Therese Anne Rollan, Leorey Marquez, Caslon Chua

Preparing for an unprecedented event involving the movement of populations could take up large amounts of resources if done conventionally. The main motivation of this study is the behavioural modification approach which is an underexplored potential in evacuation dynamics, offering new possibilities in terms of practicality and ease of implementation. This paper tackles an adaptive building evacuation simulation and decision support framework that will serve as a guide to evaluate and propose evacuation strategies for disaster management researchers and decision-making authorities. The framework mainly involves the formulation of the cognitive agent model, the evacuation simulation, and the decision support.

The timeliness in the Philippine context of the long-overdue “Big One” earthquake, the vulnerability of the case study, and the capability of the framework to be a standard guide where components can be customized by users based on the disaster type and site-specific requirements make this research a significant undertaking.

6. Towards Digital Transformation of a City Resilience Framework

José Canós, M. Carmen Penadés, Marcos R. S. Borges, Salvador Bueno, Josune Hernantes, Leire Labaka, Víctor Bañuls Silvera

Improving city resilience is among the most challenging strategic goals for city administrators worldwide. To support their work, frameworks providing technical support and methodological guidance have been developed. Such frameworks define resilience improvement processes based on multidimensional resilience models to assess one city's resilience level, plus a collection of policies to increase such level in different dimensions. Although some frameworks include software tools to support the process, their scope is limited to a particular step of the process, and global management is still done manually, hindering agility in the process. In this paper, a work towards the digital transformation of a city resilience framework is presented. The use of process technology to specify and enact the process is combined with the application of model-based development techniques to provide interoperability of the different framework tools. The architecture of the solution proposed and the major features of the approach are also described.

7. Is this Digital Resilience? Insights from Adaptation and Exaptation of a Cyber-Physical-Social System

Sindisiwe Magutshwa, Jaziar Radianti

This paper is based on a qualitative case study that explores the adaptation and customisation of a Cyber Physical Social System (CPSS)-based patient monitoring solution for use during Covid19 in the Norwegian health sector. The study seeks to answer the following research questions: 1) what are the preconditions that enable the adaptive use of a CPSS in crisis response efforts? 2) what are the contributions of the adaptive use of technology in the building of digital resilience in a health organisation? The study identifies five main themes emerge as enabling factors forming a basis for the preconditions to adaptive use of the CPSS. The concluding discussion is dedicated to the practical and theoretical implications of this research and how it

contributes to crisis management and digital resilience theory.

8. Eliciting Uncertain Resilience Information for Risk Mitigation

Niles Egan, Vladimir Menkov, Paul Kantor

The literature of risk, mitigation, and resilience is rich in classifications and recommendations. The missing link is evaluation: ideally, data based; initially, based on expert judgment. A novel approach for eliciting probability distributions describing mitigation effectiveness is presented. This approach can be used by subject matter experts (SMEs) who are not specialists in mathematics or engineering. A visual interface permits each expert to sketch a distribution by moving five colored dots on the user interface. The engine can weight and combine estimates from several SMEs into an aggregate density function suitable for presentation, and an aggregate cumulated distribution for use in Monte Carlo simulations. Additional supporting software adapts the tool for real-time support of virtual Delphi-type sessions involving multiple distributed experts. Use of the tool in a study aimed at controlling information and communication technology supply chain risks yields valuable information on those threats, and on the tool itself.

9. Persistent physics-based crisis management framework: A case study of traffic in the Nantes city due to flood exposure

Nafe Moradkhani, Hélène Dolidon, Frederick Benaben

In the context of crisis, the characteristics of the crisis area and the operational measures of the community play key roles in managing the crisis. The Nantes ring road in France is always exposed to flooding and its disruptions. To anticipate the disruptions and timely preventive actions for this frequent phenomenon, the main challenges are (i) forecast of vehicles' flows, (ii) capacity of the ring road to handle the traffic (iii) evaluate the performance of alternate routes during the flooding. The flooded area as a system has components of (i) the flood (e.g. time of onset, magnitude, intensity, etc.), (ii) the area (e.g. geographical features, temporary perimeter barriers, dam, diversion canals), and (iii) the community (e.g. reaction time, emergency strain, evacuation delay). The approach chosen to conduct this anticipative study consists of collecting data about forecasts and using simulation models to work simultaneously on evaluating the performance of the ring road and its alternative routes.

10. A Framework of Social Media Messages for Crisis and Risk Communication: A Study of the Covid-19 Pandemic

Nic DePaula, Loni Hagen, Stiven Roytman, Deaundre Dyson, Dana Alnahass, Mihir Patel, Alex Hill

Social media are important channels for crisis and risk communication by government agencies. However, existing frameworks for studying these messages use loose and inconsistent terminology, making it difficult to build on this research and understand how message features impact message diffusion. In this study, a framework based on textual and media dimensions of messages for improved analysis of social media crisis and risk communication is provided. The framework is applied to a sample of Twitter posts from United States local, state and federal public health agencies during a year of the Covid-19 pandemic. Results show reasonable reliability levels for coding of message features; differences and similarities of messages across local, state and federal public health agencies; and significant associations between message features and message diffusion. The study contributes to research on crisis and risk messages, and the understanding of the impacts of message features on message diffusion.

11. Which Factors Govern the Use of Emergency Response Information Systems? Insights from an Ethnographical Study of a Voluntary Fire Department

Julian Weidinger, Sebastian Schlauderer, Sven Overhage

To realize the digitalization potential of emergency response processes, several information technologies have been proposed that shall support firefighters in their operations. In the incident command process, especially emergency response information systems (ERIS) are supposed to raise the situation awareness and overall efficacy. Despite their theoretical potential, these technologies only slowly disseminate in practice, however. While extant acceptance models can basically explain firefighters' intention to use them, the actual usage so far remained unexplored. To gain an in-depth understanding of the specific domain and its influence on the usage of technologies, a voluntary fire department has been ethnographically observed over several years. During its digitalization of command processes, operational specialties like flexibility, organizational requirements like error culture, and

social aspects like perceived importance that influence the introduction of an ERIS have been identified. These factors shall enrich existing acceptance models and help to better consider the special characteristics of the firefighter domain.

12. I am what I am – Convergence Behaviors on Online Discussion About the Safety of COVID-19 Vaccines

Tung Bui, Quang Loc Lam

Using data from an online discussion on the risk of getting blood clot from Johnson & Johnson vaccine moderated by the New York Times Facebook page, the presence of eleven convergence behaviors has been investigated, as well as the interaction between them. While recent research focuses on misinformation or fake news as the object of analysis, this article argues in this exploratory research that it is equally important to analyze who and, whenever possible, why people engage in information exchange given a particular crisis, hence their convergence behaviors. Mapping the types of postings to their authors would be an additional step to design, develop, implement, and possibly, regulate online discussions for a more effective and just civic engagement. As a mass manipulation of public opinion is witnessed, the findings suggest that the number of netizens that seek to correct misinformation is growing. If the society goal is to swiftly rebut as many conspiracy theories as possible, this article advocates for a dual social media control strategy: restrain as much as possible the misinformation spreaders/manipulators and encourage correctors to help propagate countervailing facts.

13. Modeling renewable energy production and CO2 emissions in the region of Adrar in Algeria using LSTM neural networks

Seif Eddine Bouziane, Julie Dugdale, Mohamed Tarek Khadir

This paper addresses the slow-onset crisis of global warming caused by CO₂ emissions. Although electrical load is a major influence in a country's growth and development, it is also one of largest sources of greenhouse gases (GHG), CO₂ in particular. Therefore, switching to cleaner energy sources is a clear objective and forecasting electricity load and its environmental cost is a necessary task for electrical energy planning and management. This paper addresses short-term load forecasting of renewable energy (RE) production in the region of Adrar in Algeria with Adrar's photovoltaic (PV) farm and

Kabertene's wind farm. The forecast is compared to the overall load demand, and the reduced amount of CO₂ resulting from using renewable energy instead of fossil fuels is calculated. The forecasting models are Long short-term memory (LSTM) neural networks, which were trained and validated using real data provided by the national state-owned company SONALGAZ. The results show good performance for the forecasting models with PV and wind models achieving a Mean-absolute-error (MAE) of 0.024 and 0.1 respectively, and that RE can help reduce CO₂ emissions by up to 25% per hour.