No.	Topic	Short Description	Offered by	Focus on Data Science or Computer Science	start paper (if available)
hda-1	**Use Case Categories of Firware Platform in Crisis Management and Smart City**	Fiware is an open source platform for smart solutions including digital twins of smart cities and urban areas. The goal of this topic is to explore the use cases in fiware and related research to crisis management. A classification of use cases and its characteristics shall be developed and put into context of taxonomies of crisis management methods and tools.	Eva Brucherseifer	Computer Science	https://www.fiware.org/ https://link.springer.com/chapter/10.1007/978-3-319-68606-6_27 https://docs.ogc.org/is/18-062r2/18-062r2.html
hda-2	**Genetic Programming Applications in the Context of Crisis Management and Infrastructure Modelling**	Genetic Algorithms (GA) are an Optimization Method, where Genetic Programming (GP) esp optimizes structures. Where has GA and esp GP been used in the context of crisis management and infrastructure modelling/operation? What categories of use cases have been adressed already, are additional use cases described in literature?	Eva Brucherseifer	Computer Science, Data Science	https://dl.acm.org/doi/pdf/10.1145/3583131.3590499
hda-3	**HCI approaches to support crisis managmeent**	Concept proposal for situation picture and action planning in crisis management under uncertainty, decision support under uncertainty. Explore state of the art, evaluate, concept proposal	Eva Brucherseifer	Computer Science	https://www.sciencedirect.com/science/article/abs/pii/S1569190X18300273
hda-4	**Digital Twin use cases approaches for broadband and cellular network operators**	Digital Twins are being more and more common within manufacturing, also offer opportunities for improved understanding and management of infrastructure networks. For this topic the state of the art for communication networks is to be explored, categorized and the central aspects discussed. What case studies exist, which open research questions remain? Identify use cases of Digital Twins in this domain. Addon-questions: Are use cases applicable to crisis management? How can the physical network structure of those networks be estimated from open street map and other public information?	Eva Brucherseifer	Computer Science	https://ieeexplore.ieee.org/abstract/document/9854866 https://www.mdpi.com/2076-3417/12/15/7794 https://ieeexplore.ieee.org/abstract/document/9789844

hda-5	**Managing Uncertainty in Knowledge Graph Construction for Urban Infrastructure Crisis Management**	Constructing knowledge graphs from multiple, unreliable data sources requires addressing incomplete and unreliable information. This uncertainty impacts decision-making during crises. What are current methods for handling uncertainty in knowledge graphs for urban infrastructure? What are the benefits and limitations of these approaches? Examine existing use cases for managing uncertainty when building a knowledge graph in the context of crisis management and identify their strengths and weaknesses. Concept proposal of a better system.	Mohannad Babli	Computer Science	https://inria.hal.science/hal-04596656/ https://link.springer.com/chapter/10.1007/978-981-15-3412-6_13 https://doi.org/10.1609/aaai.v33i01.33013363 https://doi.org/10.1155/2021/6624579 https://doi.org/10.1007/s00500-021-05735-z
hda-6	**Data Collection and Integration of Heterogeneous Data Methods in Urban Infrastructure Networks for Crisis Management**	This topic aims to explore existing open-source data sources for various German urban infrastructure networks such as transportation, water supply, and electricity. Students will investigate the reliability and completeness of the available data and examine current methods and technologies used for data collection, extraction, and integration of heterogeneous data in a knowledge graph. What are the existing open-source data sources for German urban infrastructure networks? How reliable and complete? What methods and technologies are currently used for data collection, extraction, and integration? What challenges are faced in integrating heterogeneous data and what are the approaches?	Mohannad Babli	Computer Science	https://doi.org/10.3390/w16121676 https://doi.org/10.3390/rs14051214 https://doi.org/10.3390/ijerph19020794 https://link.springer.com/chapter/10.1007/978-3-031-34985-0_7 https://doi.org/10.1016/j.future.2021.10.030

hda-7	**Resilience-Based Key Performance Indicators (KPIs) for Urban Infrastructure in Crisis Management**	This topic explores resilience-based Key Performance Indicators (KPIs) for assessing urban infrastructure networks during crises. Resilience is assessed through sociological factors (e.g., leadership commitment, learning culture, risk awareness, flexibility) and technical factors (e.g., redundancy, resource availability, physical durability). In energy grids, resilience is measured by metrics such as the number of households with power, average repair time, and resource availability, which indicate the system's ability to restore functionality after disruptions. What are the most commonly used KPIs for assessing the performance of different urban infrastructure networks during crises? How do different types of crises (e.g., natural disasters, energy overload, cyber-attacks) affect the relevance and applicability of various KPIs? Can we autonomously derive KPI from the data? Can these KPIs be integrated into knowledge graphs for reasoning to improve crisis management and how? What case studies exist?	Mohannad Babli	Computer Science	https://www.researchgate.net/publication/281251779_Resilience_Engineering_in_Practice_A_Guidebook https://doi.org/10.1016/j.ijcip.2019.03.003 https://doi.org/10.1016/j.ress.2016.08.013 https://www.driver-project.eu/discover-our-results/project-public-reports/
dlr-1	**Anomaly Detection of Residential Power Demand**	In this topic, methods for the detection of abnormal situations in power distribution grids shall be investigated. The focus is on (previously unknown) scenarios where the behavior of people (households) could affect the power grid in a critical way. Existing approaches for the detection of anomalies are reviewed, with a focus on data-based, unsupervised, and transparent methods. Exogenous variables (e.g. time of day, season, weather variables) can be used for modeling power demand and detecting deviations.	Tobias Gebhard	Data Science	https://www.frontiersin.org/articles/10.3389/fenrg.2021.779587/full https://ijournalse.org/index.php/ESJ/article/view/577

dlr-2	**Mean Field Reinforcement Learning für Mobilitätssimulationen**	Reinforcement Learning (RL) ist ein Bereich des maschinellen Lernens, der es Agenten ermöglicht, durch Interaktionen mit ihrer Umgebung optimale Strategien zu erlernen. Dabei lernen Agenten jene Aktion in ihrem Zustand (Zustand des Agenten + der Umgebung) auszuführen, die ihren Ertrag maximieren. Zentral ist dabei die Ertragsfunktion, die jedem Paar aus Aktion und Zustand (des Agenten und der Umgebung) einen Wert zuordnet. Diese Ertragsfunktion kann mittels Inverse Reinforcement Learning (IRL) aus verfügbaren Daten (bspw. großen Mengen an Mobilitätsdaten) geschätzt werden, die Kombination aus IRL und RL ermöglicht somit eine datenbasierte Simulation des betrachteten Phänomens. Bei Multiagentensystemen (z.B. Transportsysteme) kann der Zustand des einzelnen Agenten von den Zuständen aller anderen Agenten abhängen. Diese Abhängigkeit führt zu hoher Komplexität und rechnerischer Ineffizienz bei klassischem RL. Eine mögliche Alternative stellt Mean Field Reinforcement Learning (MFRL) dar. Beim MFRL haben nicht die Zustände aller anderen Agenten Einfluss auf die Aktion des Einzelnen, sondern nur deren Verteilung. Somit lassen sich große Multiagentensysteme effizienter modellieren. Dieses Seminarthema soll beantworten, inwiefern und wie Mean Field Reinforcement Learning (oder im weiteren Sinne auch Mean Field Games) eingesetzt werden kann, um die Mobilität in einem großen	Jonas Gunkel		RL für Mobilität: https://arxiv.org/abs/2009.01359 https://dl.acm.org/doi/10.1145/3469860# MFRL: http://proceedings.mlr.press/v80/yang18d.html vielleicht: https://ieeexplore.ieee.org/abstract/document/9446555 (MF)IRL: https://www.ifaamas.org/Proceedings/aamas2023/pdfs/p1088.pdf https://arxiv.org/pdf/2202.06401 https://ojs.aaai.org/index.php/AAAI/article/view/29021