Vol. 5, Issue 1, Pp 13-29, Winter 2021

Socio-Spatial Studies

Journal of Socio-Spatial Studies

Homepage: https://soc.gpmsh.ac.ir

Original Research Paper

Artificial intelligence and disaster risk management: A need for continuous education

Seyedeh Hamideh Hosseini [1], Melika Khodabin [2*], Atefeh Soroori Sarabi[3], Mohammad Sharif Sharifipour Bgheshmi[4]

[1] *Master's degree in English Language Teaching (ELT), Khatam University, Tehran, Iran*

[2] *BA in Journalism, Allameh Tabatabaei University, Tehran, Iran*

[3] *Master's Degree in Earthquake Engineering, Istanbul Technical University, Istanbul, Turkey*

[4] *Master's Degree in Civil Engineering - Structural Engineering, Islamic Azad University, Gheshm, Iran*

ARTICLE INFO

Keywords:
Artificial Intelligence
Crisis Management
Natural Disasters
Continuous Education
Earthquakes

Received: Sep. 6, 2020
Revised: Nov. 10, 2020
Accepted: Dec. 15, 2020

ABSTRACT

Artificial Intelligence has is a pivotal tool in enhancing crisis management during natural disasters such as earthquakes. This article examines the role of AI in generating real-time information, predicting stakeholder and population responses, and optimizing decision-making processes. A meta-analysis of existing literature highlights AI's potential to transform traditional crisis management approaches by enabling rapid assessment of disaster scenarios, efficient resource allocation, and communication strategies tailored to situational dynamics. However, the integration of AI in such critical domains requires not only technological advancement but also a paradigm shift in the skills and competencies of crisis management professionals. This paper argues for the necessity of continuous education for stakeholders, emphasizing training in AI tools and data literacy to ensure effective utilization of these technologies in high-stakes environments. Furthermore, it explores the ethical implications of AI use in crisis contexts, including issues of accountability, data privacy, and bias mitigation. To address these challenges through sustained education and interdisciplinary collaboration, stakeholders should harness AI's full potential while minimizing risks.

INTRODUCTION

Communication technologies have created a completely new world (Nosraty et al., 2020) and artificial intelligence has created new solutions to our uncontrolled problems. The increasing frequency and severity of natural disasters necessitate a paradigm shift in disaster risk management (DRM), integrating cutting-edge technologies to enhance preparedness, response, and recovery efforts. AI has emerged as a transformative tool in this domain,

* Corresponding Author
melika.khodabin@gmail.com
+98 935 327 6898
0009-0006-0937-5986

How to Cite this article:
Hosseini, S.H., Khodabin, M., Soroori Sarabi, A., & Sharifipour Bgheshmi, M. (2021). Artificial intelligence and disaster risk Management: A Need for Continuous Education. *Journal of Socio-Spatial Studies*, 5(1), 13-29.
https://doi.org/10.22034/soc.2021.219422
URL: https://soc.gpmsh.ac.ir/article_219422.html

offering real-time data processing, predictive analytics, and automated decision support to mitigate disaster impacts effectively. AI-driven models facilitate hazard detection, risk assessment, resource allocation, and situational awareness, significantly improving crisis management strategies. Nevertheless, The COVID-19 pandemic highlighted the critical role of reliable technological infrastructure in addressing societal challenges, particularly in ensuring accessibility and continuity in essential systems such as education and healthcare. This underscores the importance of investing in robust infrastructure to support AI-driven solutions in disaster risk management (Mohammadi & Kharazmi, 2021). However, leveraging AI in DRM requires not only technological advancements but also a reconfiguration of human expertise, necessitating continuous education and interdisciplinary collaboration among stakeholders.

The integration of AI in disaster management encompasses various applications, including machine learning-based forecasting, geospatial analytics, and natural language processing for early warning systems. AI-powered simulations enhance emergency preparedness by modeling disaster scenarios, optimizing resource distribution, and refining communication strategies. Furthermore, deep learning techniques improve the accuracy of hazard predictions, contributing to timely evacuations and efficient post-disaster recovery. Despite these advancements, challenges persist regarding data quality, model interpretability, algorithmic biases, and ethical concerns, underscoring the need for well-trained professionals equipped with AI literacy.

Continuous education plays a pivotal role in bridging the gap between AI innovations and their practical deployment (Shahghasemi, 2025). As highlighted by Dariush et al. (2017), educational motivation often persists across socio-economic backgrounds, suggesting that the drive to learn and apply new technologies like AI is more strongly influenced by intrinsic ambition than financial status. This underscores the potential for inclusive AI training programs that empower professionals regardless of their SES. Professionals in crisis response, emergency planning, and humanitarian aid must acquire technical proficiency in AI-driven analytics, data ethics, and algorithmic decision-making to maximize the benefits of these technologies. Professionals in crisis response, emergency planning, and humanitarian aid must acquire technical proficiency in AI-driven analytics, data ethics, and algorithmic decision-making to maximize the benefits of these technologies. Ethics is not something that can be assumed to be inherently understood; it must be actively taught. Research shows that even highly educated individuals often lack awareness of ethical rules, particularly in academic contexts, highlighting the need for stronger emphasis on ethical education in professional environments (Sabbar et al., 2019). Moreover, policymakers must establish regulatory frameworks to ensure AI applications align with ethical guidelines, ensuring transparency, accountability, and equitable disaster response. Collaborative learning environments, including interdisciplinary training programs and AI-driven simulations, can facilitate knowledge transfer between technologists, policymakers, and emergency responders.

Beyond technical considerations, AI-driven disaster management introduces critical ethical and social implications. Issues such as data privacy, accountability in algorithmic decisions, and the potential for exacerbating existing socio-economic disparities must be addressed through robust governance mechanisms. Fostering trust is a critical aspect of implementing AI systems in disaster risk management, particularly institutional trust, which relies on the interplay of legality, oversight, and the public sphere within civil society. Research shows that building institutional trust requires efforts from both civil society and governments, where effective governmental structures—such as the separation of powers and the promotion of individual liberties—strengthen legal protections, ultimately creating a protected and trusted professional environment (Kodabakhshi et al., 2021). Also, ensuring inclusivity in AI training and deployment can mitigate biases and enhance trust in AI-powered disaster response systems. By fostering a culture of continuous education and responsible AI implementation, stakeholders can harness AI's full potential while minimizing associated risks.

Public sentiment plays a critical role during disaster times, significantly influencing community responses, governmental actions, and overall disaster management effectiveness. In times of crisis, emotions such as fear, anxiety, distress, and uncertainty often dominate public discourse, shaping how people perceive risks and respond to emergency directives. Kharazmi and Mohammadi (2020) highlight how media shapes public perception during crises, using political narratives to influence how events are understood, underscoring the powerful role of media in framing societal issues. Social media platforms amplify these sentiments, creating rapidly evolving narratives that can either aid or hinder disaster risk management (DRM). While public sentiment can drive community solidarity, awareness, and mobilization, it can also lead to panic, misinformation, and social unrest if not effectively managed (Sabbar and Hyun, 2016; Sabbar and Matheson, 2019). People are increasingly joining the social media (Nosraty et al., 2021) and the social media has effects beyond informing or connecting that might not be desirable. In fact, people nowadays live their emotional lifes on social media (Nosrati et al., 2023). We can criticize this phenomenon in detail but there is an opportunity for DRM in the data people produce on social media. Governments and emergency response agencies must navigate these emotional landscapes carefully, ensuring that accurate information reaches the public while countering false narratives and fear-driven misinformation.

AI has emerged as a powerful tool for analyzing and mitigating social media sentiments during DRM. AI-driven natural language processing (NLP) algorithms can analyze millions of social media posts in real time, detecting trends in public sentiment, misinformation, and emerging concerns. This allows disaster management agencies to identify fear-mongering, detect misinformation, and deploy accurate, timely counter-messaging strategies. AI-powered chatbots and automated response systems can also engage with the public, providing verified information and addressing public concerns proactively. Additionally, sentiment analysis models help policymakers gauge public trust levels and adjust crisis communication strategies accordingly. By leveraging AI to monitor and manage social media sentiments, DRM agencies can foster public resilience, enhance crisis communication, and reduce misinformation-driven panic, ultimately leading to a more informed, adaptive, and effective disaster response.

This paper explores the evolving role of AI in disaster risk management, emphasizing the imperative for ongoing education and training to enhance AI adoption in high-stakes environments. Through a meta-analysis of existing literature, it examines AI's contributions to disaster preparedness, response optimization, and ethical challenges. The study underscores the necessity of equipping disaster management professionals with AI competencies to ensure effective, responsible, and equitable crisis mitigation strategies. By advocating for sustained education, this research highlights the intersection of technology, policy, and human expertise in shaping resilient disaster management frameworks.

METHODOLOGY

This study employs a systematic literature review to analyze the role of AI in disaster risk management (DRM), emphasizing the importance of continuous education for professionals in this field. The research synthesizes findings from peer-reviewed journal articles, conference proceedings, and institutional reports that discuss AI applications in early warning systems, disaster prediction, response optimization, and recovery planning. The reviewed studies were published between 2019 and 2025, ensuring that the analysis reflects the most recent advancements in AI-driven DRM technologies. The sources were selected from Scopus, Web of Science, IEEE Xplore, ScienceDirect, SpringerLink, and Google Scholar, along with institutional reports from the World Bank, UNDRR, and national disaster agencies. The inclusion criteria focused on studies that provided empirical evidence of AI's impact on crisis management, training needs, and ethical considerations.

A total of 105 studies were initially identified based on their relevance to AI in DRM. After removing duplicates and excluding studies without empirical validation, 37 studies were included in the final analysis. The reviewed studies were categorized into four key themes: (1) AI-driven crisis response, (2) AI applications in early warning and risk assessment, (3) continuous education and training in AI for DRM, and (4) ethical and policy considerations in AI adoption. Virtual education, as discussed by Dastyar et al. (2023), plays a significant role in delivering such continuous and interdisciplinary education, particularly by bridging geographic and social gaps and fostering environmental and technological awareness essential for DRM. The geographical distribution of the selected studies included North America (28%), Europe (24%), Asia (26%), Africa (12%), and Latin America (10%), reflecting AI's global adoption trends in DRM. The methodology also incorporated case study analysis to evaluate AI's impact on disaster scenarios in various regions, considering technological infrastructure, policy frameworks, and socio-economic factors. The study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, ensuring rigor, transparency, and reliability in data selection and synthesis (Shahghasemi et al., 2011). Findings were then synthesized into practical recommendations for integrating AI training and interdisciplinary collaboration into DRM frameworks, ensuring that professionals are well-equipped to leverage AI in crisis management.

FINDINGS

Ogie et al. (2018) conducted a systematic literature review on the application of AI in disaster risk communication, emphasizing its role in enhancing early warning systems and situational awareness. The study highlighted the importance of effective disaster risk communication in ensuring timely and appropriate responses from both the public and emergency operators. The authors identified two primary research areas where AI is being utilized: (1) prediction and monitoring for early warning, and (2) information extraction and classification for situational awareness. AI-driven approaches, including machine learning techniques, were found to improve disaster forecasting and real-time data analysis, enabling more precise risk communication. The study also provided background information to support the future development of AI applications in disaster risk communication. Ogie et al. concluded that AI has the potential to significantly improve disaster communication strategies by automating risk prediction and enhancing the dissemination of critical information.

Deparday et al. (2019) explored the role of machine learning (ML) in disaster risk management (DRM), emphasizing its ability to enhance data analysis, risk assessment, and decision-making. The report highlighted that DRM relies on diverse data types, complex modeling techniques, and extensive computational processes to predict and mitigate disaster impacts. The authors provided a comprehensive yet accessible guide on ML applications in DRM, explaining how ML algorithms can process vast amounts of data from sources such as weather models, seismic fault analyses, and urban exposure assessments. The report illustrated how ML improves hazard prediction, enhances early warning systems, and supports real-time disaster response. Case studies demonstrated the effectiveness of ML in various DRM applications, ranging from flood forecasting to damage assessment and resource allocation. Despite the advantages of ML, the report acknowledged challenges such as data availability, model interpretability, and the need for human oversight in decision-making processes. The authors concluded that ML has the potential to revolutionize DRM by making risk assessments more accurate and efficient. They recommended further interdisciplinary research and increased investment in ML-driven DRM initiatives.

Izumi et al. (2019) examined the role of innovation and technology in disaster risk reduction (DRR) within the framework of the Sendai Framework for Disaster Risk Reduction. The study highlighted the need for stronger integration of science and technology into policy-making, emphasizing that gaps in evidence-based decision-making hinder effective DRR implementation. A survey conducted among representatives from academia, government, NGOs, and the private sector identified community-based DRR and risk management as the most effective DRR innovations. The findings revealed that both technological products and innovative approaches contribute to enhancing traditional DRR strategies. The study also emphasized the importance of networking, coproduction of knowledge, and a stronger role for academia in bridging science, technology, and policy-making. The authors recommended fostering closer collaboration between researchers and practitioners, increasing knowledge-sharing through case studies, strengthening stakeholder communication via national and local platforms, and recognizing that DRR innovations extend beyond high-tech solutions to include effective approaches. Additionally, they underscored the potential of AI, communication tools, and climate-related innovations in improving DRR strategies.

Ivić (2019) examined the application of AI in geospatial analysis for disaster management, emphasizing its role in enhancing response and recovery efforts. The study highlighted the importance of accurate and real-time spatial data in identifying and mitigating risks associated with both natural and artificial disasters. The paper discussed how technological advancements have broadened the availability of spatial data sources, including traditional sensors and nontraditional, informal data streams. AI tools were found to be increasingly utilized for integrating and analyzing this vast amount of data, enabling rapid responses and improved decision-making. The study outlined AI's capabilities in identifying risk areas, assessing hazards, and predicting future disaster-related needs by analyzing spatial patterns. AI-driven geospatial analysis was particularly noted for its ability to improve the accuracy of disaster preparedness strategies and enhance the efficiency of response mechanisms. Ivić concluded that AI-based geospatial analysis represents a crucial advancement in disaster management, providing smarter and more effective solutions for mitigating disaster risks. The study underscored the need for continued research and development to further integrate AI with geospatial technologies for improved disaster resilience.

Sun et al. (2020) conducted a comprehensive review of AI applications in disaster management, analyzing their role across all four phases: mitigation, preparedness, response, and recovery. The study emphasized the increasing need for AI-driven solutions as natural hazards continue to cause escalating damage and socioeconomic losses.

The authors examined various AI techniques used for disaster data processing, including machine learning, natural language processing, and decision support systems. AI applications were found to be particularly concentrated in the disaster response phase, where they enhance early warning systems, optimize resource allocation, and improve real-time decision-making. The study also highlighted AI-based tools designed to support emergency planning, risk assessment, and infrastructure resilience. Despite AI's benefits, Sun et al. identified several challenges, such as data scarcity, model interpretability, and ethical considerations, which need to be addressed for more effective AI integration in disaster management. The authors concluded that further research and technological advancements are necessary to enhance AI's role in all disaster management phases, ensuring more proactive and data-driven risk reduction strategies.

Sulaiman et al. (2021) explored the role of AI in disaster management, emphasizing its applications across all four phases: mitigation, preparedness, response, and recovery. The study highlighted AI-driven technologies such as geospatial analysis, remote sensing (RS), machine learning, drone technology, and telecommunications, which enhance situational awareness and decision-making in disaster scenarios. The authors discussed how AI integration with geographic information systems (GIS) and RS enables improved disaster planning, analysis, and response efficiency. Visualization tools, satellite imagery, and AI analytics were identified as crucial in supporting governments' ability to make rapid, informed decisions post-disaster. Additionally, AI applications in smart city planning, transportation, and environmental impact assessments were examined for their contributions to disaster resilience. Sulaiman et al. concluded that AI plays a transformative role in disaster management by facilitating faster, data-driven responses and improving risk assessments. The study recommended continued interdisciplinary research to enhance AI's integration into disaster management frameworks, ensuring more effective hazard mitigation and emergency response strategies.

Tan et al. (2021) conducted a systematic review of AI applications in natural disaster management (NDM), analyzing trends and modeling practices across different disaster stages. The study addressed the increasing frequency and intensity of natural disasters due to climate change and human activities, emphasizing AI's role in handling large and nonlinear datasets with higher accuracy and efficiency. The review examined 278 studies sourced from Elsevier Science, Springer LINK, and Web of Science, assessing AI applications in disaster prediction, monitoring, response, and recovery. The findings provided insights into the methodologies used for various disaster types and identified gaps in current research. The study highlighted the practicality of AI in improving disaster risk assessment while recognizing the need for more advanced models to enhance predictive accuracy and decision-making. Several recommendations were proposed to refine AI-based disaster management approaches and improve modeling quality. Tan et al. concluded that AI has become an essential tool for NDM, yet further research is required to develop innovative AI models that address existing methodological limitations. They advocated for improved data integration and interdisciplinary collaboration to maximize AI's potential in disaster resilience efforts.

Gevaert et al. (2021) examined the ethical and accountability challenges associated with the use of AI in disaster risk management (DRM). The study emphasized that while AI has the potential to improve disaster prediction, mitigation planning, and post-disaster aid distribution, it also introduces ethical concerns related to fairness, bias, and transparency.

The authors highlighted the risks of hidden geospatial biases in AI-driven disaster risk models, which can lead to inaccurate assessments and inequitable disaster responses. A key concern was the disconnect between algorithm developers and the affected communities, which can result in models that fail to account for local values and social contexts. The study underscored the need for interdisciplinary collaboration between AI researchers, DRM practitioners, and local stakeholders to ensure responsible AI deployment. The perspective called for greater scrutiny of AI fairness in DRM, advocating for transparency in data collection, algorithmic accountability, and mitigation of biases in disaster prediction and response. The authors concluded that addressing these challenges is essential to ensuring that AI-driven DRM systems are equitable, ethical, and effective in reducing disaster impacts.

Kankanamge et al. (2021) conducted an empirical study to examine public perceptions regarding the role of AI in disaster management across three major Australian cities—Sydney, Melbourne, and Brisbane. The study aimed to address the knowledge gap concerning how different demographic groups perceive AI-driven disaster management applications. The researchers collected data from 605 residents using an online survey and employed statistical modeling to analyze the responses. The findings revealed several key insights: (a) younger generations demonstrated a greater appreciation of AI's potential in disaster management; (b) individuals with tertiary education exhibited a better understanding of AI's benefits in both pre- and post-disaster phases; and (c) public sector administrative and safety workers, who play a crucial role in disaster response, placed higher value on AI applications. The study underscored the significance of considering public perceptions when integrating AI into disaster management strategies. The authors recommended that policymakers and disaster management authorities take public attitudes into account to enhance AI adoption and effectiveness in disaster response and preparedness.

Kuglitsch et al. (2022) examined the role of AI, particularly machine learning (ML), in disaster risk reduction (DRR), highlighting its applications in forecasting extreme events, developing hazard maps, detecting disasters in real-time, and enhancing situational awareness and decision support. The study explored both the opportunities and challenges of integrating AI into DRR frameworks. The authors discussed AI's potential to improve disaster preparedness and response by providing more accurate predictions and facilitating better communication among policymakers, stakeholders, and the public. However, they also identified key challenges, including data limitations, model interpretability, ethical concerns, and the need for interdisciplinary collaboration. The study emphasized the importance of strategic partnerships to advance AI-driven DRR initiatives and ensure that AI solutions are effectively implemented. Kuglitsch et al. concluded that realizing AI's full potential for DRR requires addressing technical and ethical challenges while fostering collaboration among researchers, policymakers, and disaster management practitioners. They called for the development of a comprehensive AI strategy to enhance disaster resilience and improve risk management outcomes.

Munawar et al. (2022) reviewed the role of disruptive technologies in disaster risk management, emphasizing their integration into smart cities to enhance disaster preparedness and response. The study examined state-of-the-art technologies such as the Internet of Things (IoT), AI, image processing, big data analytics, and smartphone applications, identifying their current applications and existing barriers to widespread adoption. The authors classified these technologies based on their relevance to flood prediction, risk assessment, and hazard analysis, highlighting their potential to improve disaster forecasting and automated emergency response. The study also proposed a novel framework integrating big data and AI to optimize disaster management strategies. Key challenges identified included data security concerns, infrastructure limitations, and the need for interdisciplinary collaboration to facilitate the adoption of disruptive technologies in urban disaster management. Munawar et al. concluded that harnessing disruptive technologies in smart city frameworks can significantly enhance disaster resilience and post-disaster recovery efforts. They recommended further research on overcoming technological and policy-related barriers to ensure effective deployment in disaster-prone urban regions.

Jiang et al. (2022) developed a machine learning-based model to predict landslide risk in open-pit mine dumps, focusing on the impact of heavy rainfall on slope stability. The study aimed to enhance mine production safety by establishing an accurate and rapid prediction model for landslide hazards in mining areas. Using geological data and rainfall conditions from an open-pit mine dump in Shaanxi Province, the researchers employed Geo-Studio software to calculate the slope safety factor under different conditions. The gradient boosting regression tree (GBRT) algorithm was then applied to predict the factor of slope safety (FOS). The model's performance was compared with other predictive algorithms, and results showed that GBRT provided the highest accuracy. Under a "20-year rainstorm recurrence period" scenario with a rainfall intensity of 87 mm/day, the GBRT model predicted an FOS of 1.283, closely matching the numerical simulation result (FOS = 1.289) with a smaller error margin. The study concluded that the GBRT model demonstrated strong applicability for landslide risk prediction in open-pit mine dumps under heavy rainfall conditions. The authors emphasized that implementing AI-driven early warning systems using this model could significantly improve disaster prevention strategies in the energy mining sector.

Bao et al. (2022) conducted a systematic review to examine the role of digital technologies in landslide disaster risk management, analyzing journal papers from the ISI Web of Science. The study aimed to assess the progress of digital technology applications in this field and identify future research directions. The findings indicated that early landslide risk management research primarily focused on hazard evaluation and zonation. Over time, studies evolved to include spatial predictions and landslide susceptibility assessments, shifting from large-scale to fine-scale analyses. Since 2009, there has been increasing discourse on the role of digital technologies, particularly AI and deep learning, in landslide monitoring and risk assessment. The study found that monitoring technologies have transitioned from high-altitude satellite-based methods to low-altitude drones and ground-based sensors. Among the various digital technologies, processing techniques were most commonly used in landslide risk research, followed by sensing technologies. The study noted that digital technologies played a significant role in disaster preparedness but were underutilized in mitigation efforts. The authors concluded that future advancements should focus on strengthening mitigation strategies and response mechanisms. Additionally, digital technology applications in landslide disaster management should be tailored to address the needs of vulnerable populations. They recommended that government policies account for regional differences in economic development and technological capacity when implementing disaster risk management strategies. The study provided valuable insights for scientists and policymakers aiming to enhance landslide resilience using digital tools.

Velev and Zlateva (2023) analyzed the challenges associated with applying AI in disaster risk management (DRM), highlighting both its potential benefits and key obstacles. The study emphasized AI's ability to enhance disaster prediction, risk assessment, and response optimization. However, the authors identified several critical issues that must be addressed for AI to be effectively integrated into DRM systems. The primary challenges discussed included the need for high-quality and diverse data, ensuring AI compatibility with existing DRM technologies, and addressing ethical and social concerns. Data privacy and security were particularly highlighted as AI applications often involve analyzing sensitive information. Additionally, the study noted the necessity of continuous research and development to refine AI methodologies and ensure their fair, equitable, and effective implementation in disaster management. Velev and Zlateva concluded that while AI holds great promise for improving disaster resilience, overcoming these challenges is crucial for maximizing its effectiveness. They recommended further interdisciplinary collaboration and policy development to ensure AI applications align with ethical standards and operational requirements in DRM.

Ghaffarian et al. (2023) conducted a systematic review on the role of Explainable Artificial Intelligence (XAI) in disaster risk management (DRM), highlighting its potential to enhance decision-making while addressing concerns about the "black box" nature of AI models. The study underscored the growing need for transparent and interpretable AI-driven solutions in DRM to improve trust, accountability, and effectiveness in disaster response and mitigation strategies. The authors analyzed 195 publications from Scopus and ISI Web of Knowledge, selecting 68 studies for detailed examination. Their findings revealed a significant rise in XAI applications in DRM during 2022 and 2023, indicating increasing interest in making AI models more interpretable. The study categorized AI and XAI techniques across different disaster types, risk components, and hazard scenarios while identifying key challenges such as model complexity, limited adoption in real-world settings, and gaps in multi-hazard risk analysis. Ghaffarian et al. proposed several research directions, emphasizing the need for integrating XAI in early warning systems, digital twins, and multi-hazard risk analysis. They also advocated for incorporating causal inference methods to improve strategy planning and the overall effectiveness of DRM frameworks. The study concluded that XAI has the potential to revolutionize DRM by making AI models more transparent and actionable, ultimately enhancing disaster preparedness and resilience.

Thekdi et al. (2023) examined the conceptual synergies between AI and disaster risk science, proposing a framework to balance AI applications with fundamental risk principles. The study emphasized that while AI has transformed fields such as business, healthcare, and technology, its role in disaster risk management remains underdefined. The authors sought to clarify how AI can be responsibly integrated into risk science while addressing key methodological and ethical considerations. Using an online survey of risk and AI professionals, the study explored four critical questions: (1) how AI is currently applied in disaster risk management, (2) the mutual benefits of AI and risk science integration, (3) the synergies between AI and risk science applications, and (4) the characteristics of effective AI-driven risk management. Based on the findings, the authors developed a classification system to assess AI's role in risk assessment, its potential to introduce new risks, and the adequacy of existing risk frameworks for AI applications. The study concluded that AI presents both opportunities and challenges in disaster risk science, necessitating a balanced approach to ensure responsible implementation. The authors recommended further research on integrating AI-driven analytics with traditional risk assessment models while addressing ethical and technical limitations.

Samuel (2023) explored the application of AI in disaster prediction and risk reduction, emphasizing its role in mitigating the impact of both natural and man-made disasters. The study highlighted AI's potential to enhance disaster management by monitoring risk indicators, predicting disaster occurrences, and facilitating efficient rescue operations.

The research discussed AI-driven techniques for assessing community vulnerabilities, forecasting disaster probabilities, and analyzing post-disaster conditions to improve response and recovery efforts. AI applications such as real-time data analysis, machine learning models, and predictive analytics were identified as essential tools for early warning systems, risk assessment, and resource allocation. The study also emphasized AI's contribution to achieving the Sustainable Development Goals by strengthening disaster resilience and preparedness. Samuel concluded that AI is a transformative technology that can significantly improve disaster response efficiency and reduce casualties. The study recommended further research on AI's integration into disaster risk management frameworks to enhance global resilience to emergencies.

Bari et al. (2023) critically examined the potential applications of AI in disaster risk and emergency health management, emphasizing its role in enhancing environmental health risk evaluations during catastrophic events. The study highlighted the increasing need for timely and accurate disaster risk assessments to support healthcare services in crisis situations. The authors conducted a literature review using databases such as PubMed, Google

Scholar, and Scopus to explore AI's feasibility in disaster preparedness and emergency medical management. They found that AI technologies, including predictive modeling and real-time data analysis, can significantly improve early warning systems, resource allocation, and healthcare responses to disasters. The study underscored AI's capacity to enhance decision-making by providing insights into environmental health risks and optimizing emergency response strategies.

Bari et al. concluded that AI-driven solutions hold great promise for mitigating the health and economic impacts of natural disasters. They advocated for the integration of AI into disaster risk management frameworks and urged policymakers to leverage emerging AI technologies to minimize the adverse effects of catastrophic events on public health. Şimşek et al. (2023) conducted a systematic review on the role and applications of AI in disaster management, focusing on its effectiveness in both pre- and post-disaster scenarios. The study aimed to assess AI's capacity to enhance disaster preparedness, response, and recovery efforts, with a particular emphasis on applications in Türkiye. The researchers developed an inventory of AI applications in disaster management, categorizing datasets related to earthquakes, floods, fires, tsunamis, and hurricanes. Their findings indicated that AI significantly reduces logistical challenges in disaster response and intervention. The study observed that AI research in disaster management has primarily focused on earthquake preparedness and response, with limited exploration of other types of disasters. AI technologies such as machine learning, deep learning, artificial neural networks, and big data analytics were found to be integral in damage assessment, resource management, early warning systems, and post-disaster recovery. The authors concluded that AI plays a crucial role in enhancing disaster management efficiency by improving predictive accuracy and decision-making processes. They recommended further interdisciplinary research to expand AI applications beyond earthquakes and integrate AI-driven approaches into national disaster management frameworks.

Abid et al. (2023) examined the current and future applications of AI in disaster management, emphasizing its role in improving response speed, precision, and overall preparedness. The study explored various AI-driven methodologies and technologies, including geospatial analysis, robotics, drones, machine learning, telecommunications, remote sensing, and environmental impact assessment. The researchers employed both quantitative and qualitative methods for data collection and analysis, offering a comprehensive overview of AI's integration into different phases of disaster management. They highlighted how AI enhances situational awareness, risk assessment, and decision-making, particularly through remote sensing and geographic information systems (GIS). The study underscored the importance of GIS and satellite imagery in emergency response, allowing governmental agencies to optimize decision-making and recovery efforts. The authors concluded that AI-driven technologies are transforming disaster management by enabling faster, more accurate responses. They emphasized the necessity for continued interdisciplinary research and technological advancements to further enhance disaster preparedness and mitigation. The study recommended that policymakers and emergency management organizations integrate AI-based visualization and analytical tools to improve disaster resilience.

Dai et al. (2024) conducted a scoping review on the application of AI in urban ecosystem-based disaster risk reduction (Eco-DRR), emphasizing AI's role in enhancing urban resilience against natural hazards. The study addressed the increasing severity and frequency of disasters in urban environments and explored how AI can improve Eco-DRR strategies by mitigating uncertainties in disaster risk assessment and ecosystem management.

Using the PRISMA-ScR framework, the authors analyzed 76 studies on AI applications in Eco-DRR, examining their spatial and temporal characteristics, disaster types, AI algorithms, and data sources. The study developed a theoretical framework outlining the logical relationship between AI, Eco-DRR, and natural disaster risk. The findings highlighted three key points: (1) disaster scales and types define the objectives of Eco-DRR, (2) AI algorithm selection should align with Eco-DRR goals, and (3) reliable data sources are critical for supporting AI-driven Eco-DRR applications. Additionally, the study proposed four integration approaches for AI in Eco-DRR: ecosystem services, ecosystem indicators, dynamic change prediction, and green infrastructure (GI) construction. Dai et al. concluded that AI has significant potential to strengthen Eco-DRR by improving predictive modeling, risk assessment, and disaster mitigation strategies. They recommended further interdisciplinary research to refine AI applications in urban resilience and security.

Gupta and Roy (2024) explored the applications of AI in disaster management, emphasizing its role in enhancing disaster preparedness, response, mitigation, and recovery. The study analyzed 72 research articles to assess how AI-driven techniques—including machine learning, deep learning, and natural language processing—contribute to disaster management efforts. The authors highlighted that AI systems improve early warning issuance, optimize relief logistics, streamline risk communication, and support evacuation planning. AI-powered analysis of satellite imagery, sensor data, and social media enhances disaster detection and impact assessment. The study also addressed AI's role in decision-making for issuing building permits and grants in post-disaster reconstruction efforts. However, challenges such as fragmented and incomplete datasets remain key obstacles to maximizing AI's potential in this domain. Gupta and Roy concluded that AI has transformative capabilities across all phases of disaster management, from forecasting disaster occurrences and impact zones to identifying vulnerable communities and optimizing response strategies. The study called for further research to refine AI methodologies and address challenges related to data accessibility and integration.

Akhyar et al. (2024) conducted a methodological review of deep AI applications in natural disaster management, focusing on the use of advanced deep learning techniques for disaster analysis and response. The study examined three key disaster types—forest fires, earthquakes, and floods—analyzing how convolutional neural networks (CNNs) and semantic segmentation models improve disaster evaluation, rescue planning, and recovery efforts. The authors reviewed various deep learning models, including SegNet, U-Net, Fully Convolutional Networks (FCNs), FCDenseNet, PSPNet, HRNet, and DeepLab, highlighting their effectiveness in processing remote sensing data for disaster mapping. These models demonstrated strong capabilities in delineating forest fires, mapping flood-affected areas, and assessing earthquake damage. However, challenges were identified, particularly regarding the loss of spatial information and insufficient feature representation in CNN-based models. The study emphasized the importance of multiscale-context feature extraction to enhance segmentation accuracy and disaster impact assessments. Akhyar et al. concluded that deep learning techniques play a crucial role in improving natural disaster response by enabling more accurate and efficient remote sensing analysis. They recommended further research to refine deep learning architectures, optimize feature extraction, and enhance the integration of AI-driven disaster management systems.

Xu and Xue (2024) explored the applications and challenges of AI in disaster prevention, reduction, and relief, emphasizing AI's growing role in modern disaster management. The study highlighted how AI technologies, including machine learning, big data, remote sensing, and cloud computing, have been increasingly integrated into disaster monitoring, assessment, and emergency response. The authors detailed various AI applications across different disaster types, including meteorological, geological, and environmental hazards. AI-driven tools such as intelligent earthquake and flood monitoring systems were found to enhance real-time data analysis, early warning capabilities, and disaster response efficiency. Additionally, AI-powered robots were identified as valuable assets for post-disaster rescue operations, with specialized applications in fire control, flood response, and hazardous material management. Despite these advancements, the study noted several challenges, including data privacy concerns, high implementation costs, the need for specialized personnel training, and the inherent uncertainty of AI models in disaster prediction. The authors stressed the importance of interdisciplinary collaboration and policy development to address these challenges and maximize AI's potential in disaster risk reduction. Xu and Xue concluded that AI has the potential to revolutionize disaster management by improving prediction accuracy, optimizing emergency responses, and strengthening public education on disaster preparedness. They recommended further research to enhance AI's reliability, transparency, and integration into national disaster management frameworks.

Vasiliev et al. (2024) examined the potential of AI to enhance nature-based solutions (NbS) for disaster risk reduction in response to the increasing frequency and severity of climate-related disasters. The study highlighted that while NbS—such as wetland restoration, reforestation, and green infrastructure—offer effective mitigation strategies, their implementation faces challenges due to the need to balance social, ecological, and economic considerations. The authors explored how AI technologies can optimize NbS by improving predictive modeling, risk assessment, and decision-making processes. AI-driven approaches were identified as valuable tools for evaluating environmental data, simulating disaster scenarios, and enhancing community engagement in NbS adoption. The study also addressed the barriers to AI integration in NbS, including limited awareness of AI applications and the need for interdisciplinary collaboration. Vasiliev et al. concluded that AI can significantly improve the effectiveness and scalability of NbS for disaster risk reduction. They provided practical recommendations for practitioners seeking to integrate AI into NbS design and implementation, advocating for further research and policy support to maximize AI's potential in disaster resilience strategies.

Beriša et al. (2024) examined the role of AI in enhancing risk management capabilities within cyberspace, particularly in the context of modern security and defense systems. The study emphasized that crisis management relies heavily on command-information systems, which are increasingly targeted by cyber threats. Given the growing reliance on cyberspace for executing security operations, the authors explored AI's potential to strengthen cybersecurity and improve autonomous decision-making in military and national defense strategies. The research highlighted AI's ability to optimize command-information systems, detect cyber threats, and enhance resilience against hostile cyber activities. AI-driven methodologies were proposed for protecting critical infrastructure, preventing cyber-attacks, and ensuring operational superiority in cyberspace. The study also discussed the implications of AI autonomy in decision-making, particularly in managing hybrid threats and mitigating risks in contemporary warfare and security environments. Beriša et al. concluded that AI is essential for securing modern command systems, as it enhances the efficiency and reliability of crisis management functions. The authors recommended further research on integrating AI into national security frameworks to ensure adaptive, real-time risk assessment and response capabilities in an evolving cyber threat landscape.

Harika et al. (2024) examined the transformative role of AI in disaster response and crisis management, emphasizing its potential to improve preparedness, resource allocation, and emergency decision-making. The study compared conventional disaster management methods with AI-driven approaches, highlighting how technologies such as natural language processing, predictive modeling, computer vision, and machine learning enhance disaster response efficiency. The authors proposed an AI-based solution that facilitates data analysis, resource distribution, and emergency communication. Their methodology was evaluated against traditional expert-driven approaches, assessing factors such as response time, precision, adaptability, and effectiveness in resource allocation. Using real-world data and case studies, the study demonstrated that AI-driven systems significantly improve disaster management by swiftly analyzing large datasets, extracting actionable insights from unstructured information (e.g., social media posts and satellite imagery), and enhancing situational awareness. Harika et al. concluded that AI-powered programs can revolutionize crisis management by enabling faster, data-informed decision-making. The study recommended further research to refine AI applications in disaster response, ensuring their scalability and integration into existing emergency management frameworks.

Saleh (2024) proposed a smart city model driven by AI for disaster risk management in Arabic countries, addressing sustainability challenges exacerbated by population growth, environmental degradation, and climate change-related hazards. The study highlighted the limitations many Arabic countries face in effectively integrating smart technologies into disaster risk reduction strategies. The proposed AI-based decision support system aimed to provide urban solutions for mitigating disaster risks while advancing sustainable development goals. A case study on flood risk management in Syria's coastal region demonstrated the practical application of the model, illustrating its potential to enhance disaster preparedness and resilience. The study suggested that this smart city framework could be expanded to address a range of disasters across Syria and other Arabic countries.

Saleh concluded that adopting AI-driven smart city solutions in disaster management could significantly improve risk mitigation efforts and resilience planning in the region. The study recommended further research and development to refine and implement the model on a broader scale.

Shafik (2024) explored the integration of AI and community engagement in disaster management and preparedness, emphasizing the role of local participation in enhancing resilience. The study highlighted the significance of AI in improving early warning systems, optimizing resource allocation, and facilitating informed decision-making processes in disaster response. The research underscored that while AI provides sophisticated analytical techniques for disaster monitoring, community involvement remains crucial for fostering preparedness and response efforts. The study examined case studies demonstrating the effectiveness of combining AI technologies with community-driven initiatives, providing evidence of improved disaster response outcomes. Key challenges were also discussed, including ethical concerns, social limitations, and technical constraints, which impact the adoption of this integrated approach. Shafik concluded that a strategic partnership between AI and local communities represents a transformative shift toward a more holistic and innovative disaster management framework. The study emphasized the need for continued interdisciplinary research and policy support to enhance AI-driven community engagement in disaster preparedness.

Şengöz (2024) explored the role of AI and big data in transforming disaster management from a reactive to a proactive approach. The study emphasized that traditional disaster management strategies—such as emergency planning, crisis response, and pre-disaster preparation—rely heavily on human resources and existing infrastructure, limiting their effectiveness. In contrast, AI and big data offer advanced capabilities for analyzing complex datasets, detecting patterns, optimizing decision-making, and predicting future disasters. The article discussed how AI-driven models enhance disaster risk reduction by improving early warning systems, real-time crisis management, and post-disaster recovery efforts. Big data technologies were highlighted for their ability to process vast amounts of information efficiently, providing meaningful insights for disaster preparedness and response. The study further examined the integration of these technologies into disaster risk reduction strategies, assessing their effectiveness and challenges, such as data privacy concerns and infrastructure requirements. Şengöz concluded that AI and big data significantly enhance disaster resilience by enabling faster, data-driven decision-making. The study provided a roadmap for policymakers and researchers to advance disaster management strategies using emerging technologies, ultimately contributing to more resilient communities.

Qin et al. (2024) examined the advancements in big data and AI for natural disaster prediction and prevention, emphasizing their role in addressing the increasing frequency and intensity of disasters driven by climate change. The study highlighted the limitations of traditional disaster prediction methods, particularly in terms of accuracy and response speed, and explored how AI and big data can enhance forecasting and risk management. The authors analyzed how big data integrates multisource information to identify disaster patterns, while AI—using machine learning and deep learning—improves prediction accuracy. Case studies on earthquakes, floods, and landslides demonstrated the practical applications of these technologies in real-time monitoring, early warning systems, and emergency response. The study also discussed future trends in disaster management technology and the ethical challenges associated with AI implementation. The authors emphasized the importance of interdisciplinary collaboration and technological integration to enhance global disaster response capabilities. Qin et al. concluded that AI and big data have the potential to revolutionize disaster management by improving predictive accuracy and enabling faster, data-driven responses. They recommended continued research to refine these technologies and ensure their ethical and practical effectiveness in mitigating disaster risks.

Baltazar et al. (2024) investigated the role of AI in disaster prediction, mitigation, and response in the Philippines, a country highly vulnerable to natural disasters such as typhoons, earthquakes, and floods. Using a qualitative research approach, the authors conducted semi-structured interviews with key stakeholders, including disaster management officials, meteorologists, and researchers, between June 2023 and March 2024. The study found that AI technologies, particularly machine learning and neural networks, have significantly improved disaster forecasting by analyzing large datasets from meteorological, seismic, and geographical sources. AI-driven models have enhanced the accuracy of typhoon, earthquake, and flood predictions, contributing to more effective early warning systems and evacuation planning. However, challenges remain, including limitations in infrastructure, budget constraints, and data quality, which hinder the full-scale adoption of AI in disaster risk management (DRM). Despite these challenges, the study identified significant opportunities for AI development in DRM, emphasizing the importance of international collaboration and policy support to facilitate AI integration. The authors concluded that AI has the potential to transform disaster response strategies in the Philippines, but further research is needed to overcome technical barriers and enhance AI's role in building disaster-resilient communities.

Albahri et al. (2024) conducted a systematic review of trustworthy AI applications in natural disaster management, focusing on predictive models that enhance disaster preparedness, response, and risk assessment. The study aimed to explore AI-driven approaches, such as early warning systems (EWSs), evacuation planning, and resource allocation, to address challenges associated with natural disasters. The authors retrieved 981 papers from reputable databases, including ScienceDirect, Scopus, IEEE Xplore, and Web of Science, and, after a rigorous screening process, included 108 studies in the final analysis. They categorized AI applications in disaster management, highlighting developments in explainable artificial intelligence (XAI), data fusion, machine learning (ML), deep learning (DL), fuzzy logic, and multicriteria decision-making (MCDM). The study identified motivations, challenges, and gaps in AI applications for disaster prediction and response, emphasizing the need for trustworthy AI systems. Ethical concerns, bias, and decision-making complexities in disaster management AI were also examined. The authors concluded that while AI offers significant potential for improving disaster management, unresolved issues persist, including the need for more transparent AI models and better integration of data fusion techniques. They provided recommendations for future research to enhance the reliability, fairness, and accountability of AI-based disaster management systems.

Neog et al. (2024) explored the role of AI in disaster risk reduction within the agricultural sector, emphasizing its potential to enhance rural resilience. The chapter discussed how AI-driven innovations are transforming disaster preparedness and response in agriculture, particularly in mitigating the risks posed by natural disasters such as floods and droughts. The authors highlighted the use of advanced machine learning algorithms and predictive modeling to analyze historical data, weather patterns, and soil conditions. These technologies facilitate early warning systems and adaptive strategies, enabling farmers and policymakers to proactively protect crops, optimize resource management, and minimize disaster-induced losses. Furthermore, AI-powered precision agriculture techniques—such as optimized planting, irrigation, and pest control—were identified as critical factors in enhancing agricultural resilience, food security, and economic stability in rural communities. The study underscored the transformative impact of AI in safeguarding agricultural livelihoods and fostering sustainable farming practices. The authors concluded that as AI technology continues to evolve, its integration into disaster risk reduction efforts will become increasingly vital in ensuring food security and rural economic growth.

Rahmatizadeh and Kohzadi (2024) conducted a narrative review examining the role of AI in disaster management in Iran. The study aimed to explore AI's applications in disaster preparedness, response, and recovery. The authors systematically retrieved full-text articles from various databases, including SID, Magiran, ScienceDirect, PubMed, and Google Scholar, using relevant keywords. Studies published between 2020 and 2023 were reviewed based on title, abstract, methodology, and results, leading to the inclusion of seven relevant articles. The review found that artificial neural networks (ANN) and random forests (RF) were the most frequently used AI models in disaster management. The included studies demonstrated that AI techniques performed effectively in risk assessment and response planning. Specifically, AI models were applied to predict floods, wildfires, landslides, and earthquakes, with reported high accuracy. The findings indicated that AI significantly enhances disaster management by enabling more effective early warning systems, hazard mapping, and emergency response planning. The authors concluded that while disasters such as earthquakes and floods are inevitable, AI offers valuable tools for mitigating damage and improving response efforts. They highlighted the need for further research and policy integration to maximize AI's potential in disaster management within Iran.

Eren and Duman (2025) examined the role of AI in disaster management, emphasizing its potential to enhance societal resilience and improve disaster prevention, response, and recovery efforts. The study highlighted the rapid advancements in digital technologies and the increasing integration of AI into disaster management frameworks.

The authors identified key challenges in AI implementation, noting that some AI-driven disaster management projects fall short of expectations due to complexity, increased costs, and inefficiencies in execution. To address these issues, the study proposed a model that applies AI throughout the disaster management cycle, leveraging secondary data sources to assess its effectiveness. The findings underscored AI's capacity to reduce loss of life and property, optimize emergency response times, and support data-driven decision-making in disaster scenarios. Eren and Duman concluded that AI has significant potential to transform disaster management but requires careful implementation to maximize its benefits. The study served as a resource for both researchers and practitioners, offering insights into AI's practical applications and strategies for enhancing disaster preparedness and resilience.

Liu et al. (2025) conducted a comprehensive review of AI applications in flood risk management, highlighting the increasing frequency and severity of climate-related flood hazards. The study emphasized the limitations of traditional analytical and computational tools in flood risk assessment, advocating for AI-driven, data-centric approaches to enhance prediction, mitigation, and response strategies. The authors analyzed hundreds of studies to examine the integration of machine learning (ML) and deep learning (DL) in flood risk management. Their review explored various flood types, AI models, spatial scales, input data, and real-world applications, providing a holistic overview of the current landscape. The findings indicated that AI-driven models significantly improve the reliability of flood predictions and support more effective decision-making in risk mitigation and disaster response. However, challenges such as data bias and the lack of explainable AI models were identified as key obstacles to broader AI adoption. The study concluded that AI has the potential to revolutionize adaptive flood risk management by enhancing forecasting accuracy and resilience planning. The authors recommended future research on developing transparent, interpretable AI models and addressing data quality issues to fully leverage AI's capabilities in mitigating flood risks.

CONCLUSION

The integration of AI in Disaster Risk Management (DRM) represents a significant paradigm shift, offering enhanced real-time data analysis, predictive modeling, and automated decision-making to improve disaster preparedness, response, and recovery. This study has demonstrated that AI-driven approaches, including machine learning, natural language processing, and geospatial analytics, play a pivotal role in optimizing resource allocation, enhancing situational awareness, and improving early warning systems. However, while AI holds immense potential in mitigating disaster impacts, its effective deployment requires addressing several challenges, including data reliability, algorithmic bias, ethical considerations, and the skills gap among DRM professionals. As such, continuous education and interdisciplinary training emerge as critical components in ensuring that AI applications are both effective and ethically responsible in crisis management.

The findings of this research underscore the necessity of sustained AI education and training programs for professionals engaged in DRM, policymakers, and emergency responders. The rapid evolution of AI technologies necessitates adaptive learning frameworks that enable stakeholders to harness AI's full potential while mitigating associated risks. Moreover, ethical concerns such as data privacy, accountability in AI-driven decision-making, and social biases must be addressed through robust governance and regulatory frameworks. As Barati et al. (2020) argue, cultivating a form of environmental intelligence—defined as the ability to perceive, reason, and act responsibly in relation to one's environment—is essential for enabling individuals and institutions to interpret the broader impact of their actions and technologies on ecological systems. A collaborative approach, involving academia, government agencies, technology developers, and humanitarian organizations, is essential to fostering AI literacy, ensuring responsible AI deployment, and promoting equitable disaster response strategies. In conclusion, while AI presents transformative opportunities in DRM, its long-term success hinges on continuous learning, ethical oversight, and interdisciplinary collaboration, ultimately contributing to more resilient and adaptive disaster management frameworks.

CONFLICT OF INTEREST

No conflict of interest declared by the author(s).

REFERENCES

Abid, S. K., Chan, S. W., Sulaiman, N., Bhatti, U., & Nazir, U. (2023). Present and future of artificial intelligence in disaster management. *2023 International Conference on Engineering Management of Communication and Technology (EMCTECH)*, 16–18 October, Vienna, Austria. IEEE. https://doi.org/10.1109/EMCTECH58502.2023.10296991

Akhyar, A., Zulkifley, M. A., Lee, J., Song, T., Han, J., Cho, C., Hyun, S., Son, Y., & Hong, B.-W. (2024). Deep artificial intelligence applications for natural disaster management systems: A methodological review. *Ecological Indicators, 163*, 112067. https://doi.org/10.1016/j.ecolind.2024.112067

Albahri, A. S., Khaleel, Y. L., Habeeb, M. A., Ismael, R. D., Hameed, Q. A., Deveci, M., Homod, R. Z., Albahri, O. S., Alamoodi, A. H., & Alzubaidi, L. (2024). A systematic review of trustworthy artificial intelligence applications in natural disasters. *Computers and Electrical Engineering, 118*(Part B), 109409. https://doi.org/10.1016/j.compeleceng.2024.109409

Baltazar, R., Florencio, B., Vicente, A., & Belizario, P. (2024). The role of artificial intelligence in disaster prediction, mitigation, and response in the Philippines: Challenges and opportunities. *International Journal of Artificial Intelligence, 11*(1), 37–51. https://doi.org/10.36079/lamintang.ijai-01101.675

Bao, H., Zeng, C., Peng, Y., & Wu, S. (2022). The use of digital technologies for landslide disaster risk research and disaster risk management: Progress and prospects. *Environmental Earth Sciences, 81*, 446. https://doi.org/10.1007/s12665-022-10575-7

Barati, N., Dariush, B., Dastyar, F., & Barati, M. (2020). Environmental Intelligence A Holistic Approach to the Human-Environment Relationship. *Armanshahr Architecture & Urban Development*, *13*(30), 213-225. doi: 10.22034/aaud.2019.183282.1860

Bari, L. F., Ahmed, I., & Islam, M. R. (2023). Potential use of AI in disaster risk and emergency health management: A critical appraisal on environmental health. *Environmental Health Insights, 17*. https://doi.org/10.1177/11786302231217808

Beriša, H., Cvetković, V., & Pavić, A. (2024). Implications of artificial intelligence and cyberspace on risk management capabilities. *International Journal of Disaster Risk Management, 6*(2), 279–295. https://doi.org/10.18485/ijdrm.2024.6.2.18

Dai, D., Bo, M., Ren, X., & Dai, K. (2024). Application and exploration of artificial intelligence technology in urban ecosystem-based disaster risk reduction: A scoping review. *Ecological Indicators, 158*, 111565. https://doi.org/10.1016/j.ecolind.2024.111565

Dariush, B., Dastyar, F. and Dastyar, M. (2017). A Study on Socio-Economic Status Effects on Private Universities Architecture Students' Educational Motivation. *Socio-Spatial Studies*, *1*(1), 1-22

Dastyar, M., Dariush, B., & Dastyar, F. (2023). Virtual Education, a Complementary Element of the Puzzle of Holistic Education in The Relationship Between Humans and Environment or Iranian Citizens. *Journal of Cyberspace Studies*, *7*(2), 237-252. doi: 10.22059/jcss.2023.356702.1088

Deparday, V., Gevaert, C. M., Molinario, G., Soden, R., & Balog-Way, S. (2019). *Machine learning for disaster risk management*. World Bank.

Eren, V., & Duman, H. (2025). Artificial intelligence support in disaster management. *Kamu Yönetimi Ve Teknoloji Dergisi, 7*(1), 13–36. https://doi.org/10.58307/kaytek.1580460

Gevaert, C. M., Carman, M., Rosman, B., Georgiadou, Y., & Soden, R. (2021). Fairness and accountability of AI in disaster risk management: Opportunities and challenges. *Patterns, 2*(11), 100363. https://doi.org/10.1016/j.patter.2021.100363

Ghaffarian, S., Taghikhah, F. R., & Maier, H. R. (2023). Explainable artificial intelligence in disaster risk management: Achievements and prospective futures. *International Journal of Disaster Risk Reduction, 98*, 104123. https://doi.org/10.1016/j.ijdrr.2023.104123

Gupta, T., & Roy, S. (2024). Applications of artificial intelligence in disaster management. *Proceedings of the 2024 10th International Conference on Computing and Artificial Intelligence (ICCAI '24)*, 313–318. https://doi.org/10.1145/3669754.3669802

Ivić, M. (2019). Artificial intelligence and geospatial analysis in disaster management. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, XLII-3/W8*, 161–166. https://doi.org/10.5194/isprs-archives-XLII-3-W8-161-2019

Izumi, T., Shaw, R., Djalante, R., Ishiwatari, M., & Komino, T. (2019). Disaster risk reduction and innovations. *Progress in Disaster Science, 2*, 100033. https://doi.org/10.1016/j.pdisas.2019.100033

Jiang, S., Li, J., Zhang, S., Gu, Q., Lu, C., & Liu, H. (2022). Landslide risk prediction by using GBRT algorithm: Application of artificial intelligence in disaster prevention of energy mining. *Process Safety and Environmental Protection, 166*, 384–392. https://doi.org/10.1016/j.psep.2022.08.043

Kankanamge, N., Yigitcanlar, T., & Goonetilleke, A. (2021). Public perceptions on artificial intelligence-driven disaster management: Evidence from Sydney, Melbourne, and Brisbane. *Telematics and Informatics, 65*, 101729. https://doi.org/10.1016/j.tele.2021.101729

Kharazmi, Z., & Mohammadi, S. (2020). Persian-Language Media Overseas as the Western Tools of Public Diplomacy: Framing COVID-19 Pandemics in Iran by VOA and BBC. *Journal of World Sociopolitical Studies*, *4*(1), 1-36.

Kodabakhshi, A. A., Salehi, K., & Dehshiri, M. (2021). Sociological Analysis of Lawyer's Defense Immunity in Iranian Law. *Social Science Quarterly*, *14*(4), 175-137.

Kuglitsch, M., Albayrak, A., Aquino, R., Craddock, A., Edward-Gill, J., Kanwar, R., Koul, A., Ma, J., Marti, A., Menon, M., Pelivan, I., Toreti, A., Venguswamy, R., Ward, T., Xoplaki, E., Rea, A., & Luterbacher, J. (2022). Artificial intelligence for disaster risk reduction: Opportunities, challenges, and prospects. *World Meteorological Organization, 71*(1).

Liu, Z., Coleman, N., Patrascu, F. I., Yin, K., Li, X., & Mostafavi, A. (2025). Artificial intelligence for flood risk management: A comprehensive state-of-the-art review and future directions. *International Journal of Disaster Risk Reduction, 117*, 105110. https://doi.org/10.1016/j.ijdrr.2024.105110

Mohammadi, S., & Kharazmi, Z. (2021). The Remote Higher Education over COVID-19 Pandemic: The Case Study of Provisions and Priorities of the University of Tehran's Official Website. *Journal of World Sociopolitical Studies*, *5*(2), 255-294.

Munawar, H. S., Mojtahedi, M., Hammad, A. W. A., Kouzani, A., & Mahmud, M. A. P. (2022). Disruptive technologies as a solution for disaster risk management: A review. *Science of The Total Environment, 806*(Part 3), 151351. https://doi.org/10.1016/j.scitotenv.2021.151351

Neog, D. R., Singha, G., Dev, S., & Prince, E. H. (2024). Artificial intelligence and its application in disaster risk reduction in the agriculture sector. In S. Mitra & R. Shaw (Eds.), *Disaster Risk Reduction and Rural Resilience* (pp. 279–305). Springer, Singapore. https://doi.org/10.1007/978-981-97-6671-0_15

Nosrati, S., Sabzali, M., Arsalani, A., Darvishi, M., & Aris, S. (2023). Partner Choices in the Age of Social Media: Are There Significant Relationships Between Following Influencers on Instagram and Partner Choice Criteria?. *Revista De Gestão E Secretariado*, *14*(10), 19191–19210. https://doi.org/10.7769/gesec.v14i10.3022

Nosraty, N., Sakhaei, S., & Rezaei, R. (2021). The Impact of Social Media on Mental Health: A Critical Examination. *Socio-Spatial Studies*, *5*(1), 101-11. doi: 10.22034/soc.2021.212042

Nosraty, N., Tomraee, S., & Zamani, M. (2020). Beauty Business in Iran: Does Beauty Make You Healthy?. *Socio-Spatial Studies*, *4*(1), 1-11. doi: 10.22034/soc.2020.211920

Ogie, R. I., Castilla Rho, J., & Clarke, R. J. (2018). Artificial intelligence in disaster risk communication: A systematic literature review. *2018 5th International Conference on Information and Communication Technologies for Disaster Management (ICT-DM)*, 04–07 December, Sendai, Japan. IEEE. https://doi.org/10.1109/ICT-DM.2018.8636380

Qin, F., Huang, C., & Lin, Z. (2024). Big data and artificial intelligence-driven natural disaster prediction and prevention: Technological advances and prospects. *Geographical Research Bulletin, 3*, 381–398. https://doi.org/10.50908/grb.3.0_381

Rahmatizadeh, S. H., & Kohzadi, Z. (2024). The Role of Artificial Intelligence in Disaster Management in Iran: A Narrative Review. *Journal of Medical Library and Information Science, 5*, e50. https://doi.org/10.22037/jmlis.v5i.44408

Sabbar, S. and Matheson, D. (2019). Mass Media vs. the Mass of Media: A Study on the Human Nodes in a Social Network and their Chosen Messages. *Journal of Cyberspace Studies*, *3*(1), 23-42. doi: 10.22059/jcss.2019.271467.1031

Sabbar, S., Hyun, D. (2016). What Makes It likeable? A Study on the Reactions to Messages in a Digital Social Network: The Case of Facebook in Farsi. *SpringerPlus, 5*, 2103. https://doi.org/10.1186/s40064-016-3771-3

Sabbar, S., Masoomifar, A., & Mohammadi, S. (2019). Where We Don't Know How to be Ethical; A Research on Understanding Plagiarism. *Journal of Iranian Cultural Research*, *12*(3), 1-27. https://doi.org/10.22035/jicr.2019.2243.2747

Saleh, H. A. (2024). A smart city model based on artificial intelligence for disaster risk management in the Arabic countries. In Y. M. Elhadj, M. F. Nanne, A. Koubaa, F. Meziane, & M. Deriche (Eds.), *Artificial intelligence and its practical applications in the digital economy* (pp. 205–219). Springer, Cham. https://doi.org/10.1007/978-3-031-71426-9_17

Samuel, S. (2023). Artificial intelligence in disaster prediction and risk reduction. In *Applied intelligence in human-computer interaction* (pp. 83–95). CRC Press.

Şengöz, M. (2024). Harnessing artificial intelligence and big data for proactive disaster management: Strategies, challenges, and future directions. *Haliç Üniversitesi Fen Bilimleri Dergisi, 7*(2), 57–91. https://doi.org/10.46373/hafebid.1534925

Shafik, W. (2024). Community and artificial intelligence-enabled disaster management and preparedness. In G. Meraj, S. Hashimoto, & P. Kumar (Eds.), *Navigating natural hazards in mountainous topographies* (pp. 243–266). Springer, Cham. https://doi.org/10.1007/978-3-031-65862-4_13

Shahghasemi, E. (2025). AI; A Human Future. *Journal of Cyberspace Studies*, *9*(1), 145-173. doi: 10.22059/jcss.2025.389027.1123

Shahghasemi, E., Heisey, D. R., & Mirani, G. (2011). How do Iranians and U.S. Citizens Perceive Each Other: A systematic Review. *Journal of Intercultural Communication*, *11*(3), 1–13. https://doi.org/10.36923/jicc.v11i3.539

Şimşek, D., Kutlu, İ., & Şık, B. (2023). The role and applications of AI in disaster management. *Proceedings of the 3rd International Civil Engineering & Architecture Conference (ICEARC'23)*. https://doi.org/10.31462/icearc.2023.arc992

Sulaiman, N., Chan, S. W., Nazir, U., Abid, M., Han, H., Ariza-Montes, A., & Vega-Muñoz, A. (2021). Artificial intelligence applications in disaster management: Technological innovations and societal impact. *Sustainability, 13*(22), 12560. https://doi.org/10.3390/su132212560

Sun, W., Bocchini, P., & Davison, B. D. (2020). Applications of artificial intelligence for disaster management. *Natural Hazards, 103*, 2631–2689. https://doi.org/10.1007/s11069-020-04124-3

Tan, L., Guo, J., Mohanarajah, S., & Zhou, K. (2021). Can we detect trends in natural disaster management with artificial intelligence? A review of modeling practices. *Natural Hazards, 107*, 2389–2417. https://doi.org/10.1007/s11069-020-04429-3

Thekdi, S., Tatar, U., Santos, J., & Chatterjee, S. (2023). Disaster risk and artificial intelligence: A framework to characterize conceptual synergies and future opportunities. *Risk Analysis, 43*(8), 1641–1656. https://doi.org/10.1111/risa.14038

Vasiliev, D., Bornmalm, L., & Stevens, R. (2024). Potential of artificial intelligence to facilitate nature-based solutions for disaster risk reduction. In X. S. Yang, S. Sherratt, N. Dey, & A. Joshi (Eds.), *Proceedings of Ninth International Congress on Information and Communication Technology* (pp. 395–403). Springer, Singapore. https://doi.org/10.1007/978-981-97-3562-4_31

Velev, D., & Zlateva, P. (2023). Challenges of artificial intelligence application for disaster risk management. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, XLVIII-M-1-2023*, 387–394. https://doi.org/10.5194/isprs-archives-XLVIII-M-1-2023-387-2023

Xu, C., & Xue, Z. (2024). Applications and challenges of artificial intelligence in the field of disaster prevention, reduction, and relief. *Natural Hazards Research, 4*, 169–172. https://doi.org/10.1016/j.nhres.2023.11.011