Artificial Intelligence Technologies in Humanitarian Aid: An Overview

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Abstract. This paper provides a brief literature review of the use of Artificial Intelligence (AI) in humanitarian aid operations, concentrating on current AI technologies. AI-powered technologies can improve supply chain optimization, information access, emergency preparedness, fundraising, and advocacy among other possibilities. The widespread use of AI technologies however raises ethical and practical issues like bias, data accuracy, and privacy. AI technology has the potential to transform humanitarian aid, but responsible implementation is essential for positive social impact.
Keywords Artificial Intelligence (AI), Machine Learning (ML), Humanitarian Aid, Disaster Management, Chatbots.

Background

Humanitarian actors have utilized digital technologies for decades to assist and safeguard populations impacted by conflict and crises. Recent advancements in the availability of large quantities of data and computational capacity have enabled a wider application of digital technologies in humanitarian aid, while the pandemic of COVID-19 has accelerated the trend of digital technology usage in the sector (Beduschi, 2022). Machine intelligence understanding and AI programs combined have contributed to the great achievements that have been reached today in AI. The 1970s marked the inception of artificialneural networks and deep learning research, with AI studies in finance, climate, and politics seeking solutions for emerging uncertainties. Fuzzy logic in the 1990s facilitated AI in tackling unclear problems, subsequently leading to genetic algorithm research (Efe, 2022).
Our current era witnesses a rapid digital transformation involving unmanned aircraft, autonomous missiles, language translation robots, and research, development, planning, and coding. AI has the potential to enhance resource-constrained humanitarian services by reducing inefficiencies, waste, and ineffectiveness (Ali, 2021).

Opportunities

With an increasing number of people in need of humanitarian aid (206.4 million in 2018) and high levels of forced displacement (79.5 million by end-2019), humanitarian action is facing significant challenges (Madianou, 2021). Conflict, climate-related disasters and displacement have been the main drivers for the global community to find new ways to support vulnerable communities.. AI has emerged as a possible answer to some of the most complicated humanitarian situations with its ability to learn, forecast, and make informed judgments (NetHope, 2020).
AI is described as "a collection of technologies that combine data, algorithms, and computing power (European Commission, 2020), despite its lack of a universally accepted definition. AI, particularly machine learning, is already widely used and contested in non-emergency contexts in metropolitan states(Marić, Galera-Zarco, & Opazo-Basáez, 2022).AI systems use massive amounts of data-including humanitarian aid data-, to learn, detect patterns, make judgments, and predict future behaviour. Social media and internet user-generated content—text, photographs, audio, and video—contributes to big data generation and is more relevant in humanitarian circumstances. Available text, photo, audio, and video content on social

media platforms offers channels for engagement and communication during conflicts or crises i.e. Facebook's safety check, which enables users to report their status during emergencies (Beduschi, 2022). AI (and machine learning) applications in disaster management, such as monitoring and mapping,geospatial analysis, remote sensing, robotics, drones, and telecommunications, can improve the technical and methodological elements of hazards and disaster research (Abid et al., 2021).

Several early practical implementations have demonstrated the potential of AI in the humanitarian sector to combat forced displacement and assist refugees in crisis-affected areas. Using public data from sources such as UNHCR and the World Bank, the Danish Refugee Council uses AI and ML technologies to anticipate forced displacement in West African countries. The International Rescue Committee uses these technologies to improve refugee service delivery, predict conflicts, facilitate job matching, and provide individualized learning experiences for affected children. Furthermore, the Norwegian Refugee Council's chatbot helps Venezuelan migrants in Colombia understand their immigration rights. Meanwhile, the Carter Center employs artificial intelligence to provide more detailed and timely analyses of the Syrian crisis (NetHope, 2020).

Disaster management is an essential process that includes mitigation, preparedness, response, and rehabilitation to protect communities and infrastructure from natural disasters. The planning for disaster response is influenced by several factors, including geography, climate, ecology, and the availability of resources (Hernandez and Roberts, 2020). Responding to challenges like these, humanitarian aid professionals have attempted to transcend from the "responsive" state of answering to disasters to a more "anticipatory" state with the involvement and use of early warning and forecasting systems that facilitate preparedness, prevention and mitigation (Swaminathan, 2018). Predictive analytics involves identifying patterns in historical data to estimate the probability of future events, entailing the use of large datasets as input for machine learning and statistical models. These models are subsequently employed to estimate the potential key components of humanitarian crises like pandemics, natural disasters, refugee flows and famines. This type of artificial intelligence is used to predict the locations and timing of these disasters, as well as the key features they will exhibit and which populations will be most affected. Precise advanced forecasting enables the strategic allocation of emergency relief funds, resources, and manpower (Hernandez and Roberts, 2020). A study by Hernandez and Roberts (2020) reveals that humanitarian predictive analytics is primarily used to predict event locations (71%), affected individuals (40%), key emergency features (26%), and likely event timing (18%). Also, AI has the potential to transform services in resource-poor environments, mitigating inefficiencies and waste, by providing data analytics to farmers in developing countries, to identify areas prone to conflict or natural disasters, enabling better management of crops and soil (Efe, 2022).

Also, search-and-rescue operations can be aided by AI-supported machines with learning and adaptation capabilities in disaster management. Their autonomy and AI allow them to effectively operate in unpredictably hazardous environments. Climate change as a result of global warming poses severe threats, such as droughts, diseases, floods, cyclones, heatwaves, forest fires, and famine (Efe, 2022). The 48 hours after a disaster occurs are crucial for saving lives; free of exhaustion and psychological effects, robots can operate in hazardous environments, detect structural damage, provide medical assistance, and transport victims, among other tasks. In addition, AI has the potential to streamline supply chains by identifying possible obstacles and recommending alternate routes to efficiently deliver supplies to those in need, particularly in the aftermath of natural disasters. (Efe, 2022). Utilizing operations research and management science criteria can improve the resilience of disaster relief while taking into account the effect of resource allocation on the affected population (Abid et al., 2021).

In disaster risk reduction, researchers, decision-makers, and government officials are aware of the significance of proactive measures. In humanitarian contexts, such as the Emergency Social Safety Net (ESSN) program administered by IFRC Türkiye, AI technology can be used to reduce human error and save time in identifying those in need and at high risk. Automatic decision-making (ADM) uses data or digital profiles to make decisions without human interaction, improve operational efficiency, save costs, mitigate biases, and prioritize personal data autonomy and control in humanitarian action (Coppi,2021). Forecasting crises, assessing migration status, and automating aid delivery are some examples of their applicability.

By anticipating emergency supplies and improving resource management, the integration of AI technologies, such as the Emergency Logistics Planning System (ELPS), has the potential to transform disaster management. Beyond disaster management, AI's applications include precision farming, poverty alleviation, and education gaps. AI-powered self-guided learning programs can help poor people get an education, while AI chatbots can help victims of abuse. (Efe, 2022).

Humanitarian agencies such as UNHCR and WFP, as well as private companies such as X2AI, have made significant strides in chatbot development. For example, 'Refugee Text' presented a chatbot to assist refugees, but it struggled to gain popularity despite being shown in London's Design Museum. Humanitarian organizations have investigated chatbots for information dissemination, community communication, and cost savings. UNHCR built a chatbot in Jordan in collaboration with Facebook, however, it was discontinued due to legal and data protection issues. The World Food Programme(WFP) has been heavily involved in chatbot development, primarily through its mVAM section, since 2016, initially utilizing Telegram and then migrating to Facebook. Chatbots encourage user engagement in surveys and feedback collecting while also being cost-effective. These chatbots can be used for three purposes: information dissemination, data collecting, and feedback systems. The CHITCHAT chatbot, which used Natural Language Processing, was tested in Kenyan refugee camps, but it ran into issues connected to digital inequality, such as phone ownership, internet access, and SIM card availability. The WFP's latest chatbot, 'Agrocha-tea,' gives agricultural commodities market rates via a user-friendly website. It was created in collaboration with the Peruvian government and the Centre for Innovation at Leiden University (Madianou,2021)

A globally accessible chatbot like ChatGPT provides some practical opportunities including creating content to amplify local voices and helping grassroots organizations with limited resources by drafting social media posts, media proposals, and press releases to communicate urgent fundraising requests and raise awareness during emergencies. ChatGPT can provide understandable information about funding options, making it simpler for local organizations to access available financial support when navigating complex funding processes. By streamlining documentation and contractual requirements, ChatGPT can assist in reducing administrative delays for local humanitarian responders, generate listings of local NGOs engaged in humanitarian efforts, and assist international organizations in identifying potential partners for crisis response. (The New Humanitarian, 2023)

The opportunities presented by AI in the humanitarian sector are vast and diverse. AI and machine learning can help stretch limited resources, improve efficiency, and leave a lasting impact. However, alongside these opportunities, humanitarians must be alert to the risks they face(Mahanand, 2023).

Ethical Considerations and Challenges

For their use in the humanitarian context, AI/ML integration must overcome several obstacles, with the lack of AI knowledge, especially among non-governmental program staff, being the main impediment. Humanitarian organizations are increasing their capability and

understanding to assess the relevance and appropriateness of AI and ML for long-term deployment. Developing and maintaining AI solutions in many circumstances requires external collaboration, which comes with challenges such as competing with the commercial sector for technical experts, onboarding volunteers from tech companies with cultural differences and timelines to consider, and managerial oversight difficulties. Additionally, the lack of relevant and representative data, resource-intensive data wrangling, and cost-prohibitive methodologies limit the flexibility and impact of AI projects. To attract donors who may be wary of unproven and risky solutions, a new funding approach is needed to support AI development, data infrastructure, and technical expertise, while accommodating exploration and iteration without immediate and significant short-term impact expectations. Addressing ethical concerns in AI, NGOs must establish the capacity to analyze ethical risks in AI and ML and operationalize ethical standards and principles across their operations. Efforts to democratize AI include the development of accessible AI and ML tools and services with no specialist knowledge requirements, such as no-code or low-code platforms (to address lack of expertise)(NetHope,2020).

The implementation of AI-based automated decision-making systems (ADMs) in the humanitarian sector raises concerns about accountability and adherence to humanitarian norms (Coppi et al., 2021). ADMs are able to target people based on particular traits or replace human decision-making, but they pose alarming risks.The governing principles of humanitarian organizations, such as humanism, neutrality, impartiality, and independence, must be carefully considered in the context of automated decision-making (Coppi et al., 2021). Humanitarians must keep in mind that digital data, algorithms, and automated decision-making are solely instruments to be used in conjunction with grounded knowledge of the populations impacted and practitioner experience (Hernandez and Roberts, 2020). Lack of openness can lead to discriminatory and deceptive ADM systems (OCHA, 2019).

More specifically, there are three major areas of concern: data quality, algorithmic bias, and data privacy. Poor data quality can result in substandard AI system outcomes, potentially affecting humanitarian action. For example, if past crime data used to predict future crime events and recidivism risk contains inaccuracies or biases, judicial decision-making might result in unfair and discriminatory consequences. Poor data quality in the humanitarian context may have a direct impact on vulnerable populations affected by conflicts or emergencies, sustaining and exacerbating errors in AI systems. Obtaining high-quality data for humanitarian operations can be difficult due to a variety of obstacles, such as limited internet access in rural areas and incomplete or overlapping datasets collected by diverse parties. (Beduschi, 2022). An overemphasis on predictive analytics may draw attention away from less predictable but equally important issues, potentially silencing the voices and experiences of marginalized populations. Because predictive models frequently use historical data, any biases and inequalities present in that data may continue to exist (Hernandez and Roberts, 2020).

Algorithmic bias is intimately related to issues of data quality and has broader societal repercussions. Bias in AI systems can originate from both technological and human sources, reflecting perspectives and prejudices of the designers and developers. Biased AI systems have the potential to perpetuate unequal outcomes and prejudice, particularly when it comes to gender and race. For example, facial recognition technologies that are less successful in recognizing people with darker skin tones can result in misidentifications and the refusal of humanitarian help(Beduschi, 2022).

Another major issue is the possibility of disinformation if chat bots deliver outdated or wrong information. This has significant consequences, especially in humanitarian situations where correct information is crucial. The source of such deception in human-machine interactions is unclear, raising concerns about accountability. While human oversight is necessary, efficiency concerns may limit the resources available for such oversight. (Madianou, 2021).

International human rights legislation protects the right to privacy, and the GDPR establishes critical criteria for personal data protection. However, due to the power imbalance between humanitarian organizations and beneficiaries, getting fully informed and unambiguous permission in a humanitarian setting may be difficult. The use of artificial intelligence (AI) systems by technology corporations and collaborations with humanitarian organizations raises worries about the effect of corporate interests on system design, potentially ignoring the demands and experiences of affected populations(Beduschi, 2022). An ethnographic study on Typhoon Haiyan recovery revealed that SMS hotlines, intended for feedback and accountability, were primarily used for audit reporting (Madianou et. al, 2016, as mentioned in Madianou, 2021). Another example is the case of AIDA and which used Facebook Messenger without a formal collaboration, leaving the WFP without control over data and metadata safeguards, data that are crucial when working with vulnerable individuals according to ICRC and Privacy International (2018) (as mentioned in Madianou, 2021). McDonald (2019) notes that even when humanitarian organizations develop collaborations with large technological businesses, it is unclear what leverage they have to enforce control and this disparity is amplified in chatbot scenarios where no contract with Facebook has been signed. Innovation in humanitarian settings creates awareness and interest in new products and services, making them appealing to companies seeking branding opportunities (Madianou, 2021).

International guidelines exist for fair, accountable, and transparent AI (Fjeld et al., 2020), but maintaining human, unbiased, and independent principles remains challenging. Distance can prevent digital humanitarians from fully comprehending the needs of affected individuals and organizations, potentially violating the principle of humanity. Merging disparate data sets can compromise impartiality and risk targeting religious, ethnic, or mobile groups. Additionally, lacking free press, data protection laws, civil society organizations, and human rights charters hinders local capacity to audit global humanitarians' geospatial data, tools, and algorithms (Marić, Galera-Zarco, & Opazo-Basáez, 2022). The lack of accountable artificial intelligence in non-emergency contexts in the global North increases the risk of injuring vulnerable populations in emergency contexts in the Global South (Sandvik, Jacobsen, & McDonald, 2017).

Limitations

The findings of the review rely on the availability and quality of data sources, which can vary in accessibility and timeliness while the interdisciplinary nature of this research requires a balance of expertise in both AI and humanitarian aid. While every effort has been made to ensure objectivity, the potential for bias in source selection and analysis cannot be completely eliminated. Lastly, as the field of AI in humanitarian aid is rapidly evolving, this review may need additions in the immediate future.

Conclusion

The integration of artificial intelligence (AI) in humanitarian aid holds immense promise for revolutionizing the sector's efficiency and impact. Humanitarian organizations may effectively address global concerns and reduce human suffering by using AI ethically and responsibly. There is no one-size-fits-all answer, and ethical commitment, accountability, and openness in the use of AI in humanitarian settings must be improved.

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