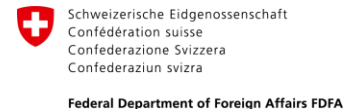


# AI IN MINE ACTION:

Current Trends, Challenges, and Future Directions



# Research Methodology

- **Research Approach:**
  - **Systematic Literature Review:** A comprehensive review of academic publications, conference proceedings, and reports on the application of AI and machine learning in humanitarian mine action
- **Search Strategy:**
  - **Databases:** IEEE Xplore, Google Scholar, ScienceDirect.
  - **Keywords:** "artificial intelligence ", "machine learning", "landmines", "mine action," "demining").
- **Inclusion/Exclusion Criteria:**
  - Publication date, language, focus on AI applications within the five pillars of Mine action.
- **Data Extraction and Analysis:**
  - Thematic approach to identify and synthesise the key findings and insights from the selected literature, in order to provide a comprehensive understanding of the current state of AI applications in humanitarian Mine action.



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Remote Sensing and **Artificial Intelligence** in the **Mine Action Sector**

M Jebens, R White - The Journal of Conventional Weapons ..., 2021 - commons.lib.jmu.edu  
 ... be useful for both the **mine action (MA)** and ... **mine action** sector. The following is a review of the key benefits and challenges discussed during the two days. In humanitarian **mine action** ( ...  
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**Artificial intelligence, machine learning** and process automation knowledge frontier and way forward for **mining sector**

D Ali, S Frimpong - **Artificial Intelligence Review**, 2020 - Springer  
 ... with regards to machine and operation automation, focusing on **artificial intelligence machine learning** usage, in the field of **mining**. The main objective of this study was to ...  
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A systematic review of **artificial intelligence** and data-driven approach strategic open-pit **mine planning**

R Noriega, Y Pourrahimian - Resources Policy, 2022 - Elsevier  
 ... **Artificial Intelligence (AI)** has seen a dramatic surge in interest from researchers and practitioners across all industries in the past few years, with successful real-world applic ...  
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[PDF] Use of **artificial intelligence, machine learning**, and autonomous technologies in the **mining industry**

Z Hyder, K Siau, FEH Nah - 2018 - researchgate.net  
 ... Implementation of **Artificial Intelligence (AI)**, **machine learning**, and autonomous it in the **mining** industry started about a decade ago with the first application to autonomo ...  
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Implementation of an **artificial intelligence** approach to GPR systems for **landmine detection**

OA Pryshchenko, V Plakhtii, OM Dumin, GP Pochanin... - Remote Sensing, 2022 - mdpi.com  
 ... In this article, we present an **artificial intelligence** approach to the problem, specifically using neural networks [21]. They are used for different applications [22,23,24], and their speed ...  
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[PDF] mdpi.com

How to implement drones and **machine learning** to reduce time, costs, and dangers associated with **landmine detection**

J Baur, G Steinberg, A Nikulin Ph D... - The Journal of ..., 2021 - commons.lib.jmu.edu  
 ... **landmines** were ... **Machine learning** is a subfield of **artificial intelligence** wherein a computer uses algorithms to improve at a task on its own only through experience. **Artificial intelligence** ...  
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[PDF] jmu.edu

**Landmine detection and classification using MLP**

R Achkar, M Owayjan, C Mrad - ... on Computational Intelligence ..., 2011 - ieeexplore.ieee.org  
 ... The system proved to be able to identify and classify different types of **landmines** under various ... of the **landmine** such as having a rotated **landmine**, or a partially covered **landmine**. ...  
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[PDF] academia.edu

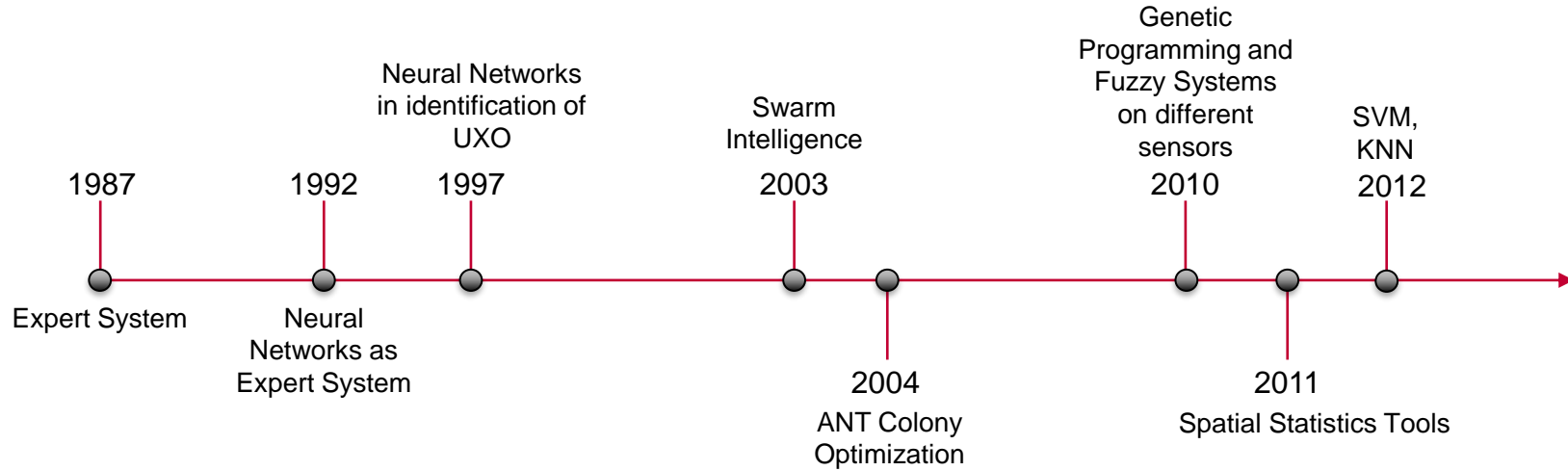
## Science Fiction or Tomorrow's Reality?



# THE JOURNEY OF AI IN MINE ACTION



# Evolution of AI Technologies in Mine Action



# AI Technology Researched in Mine Action

- 1) Deep Learning: CNNs, R-CNN, LSTM, etc.
- 2) Machine Learning: SVM, Random Forest, KNN, etc.
- 3) Reinforcement Learning and its applications.
- 4) Sensor Fusion and Multimodal Data Integration.
- 5) Geospatial AI and Semantic Web Ontologies.
- 6) Synthetic Data Generation and Simulation.



# AI APPLICATIONS IN MINE ACTION



# The Mine Action Pillars

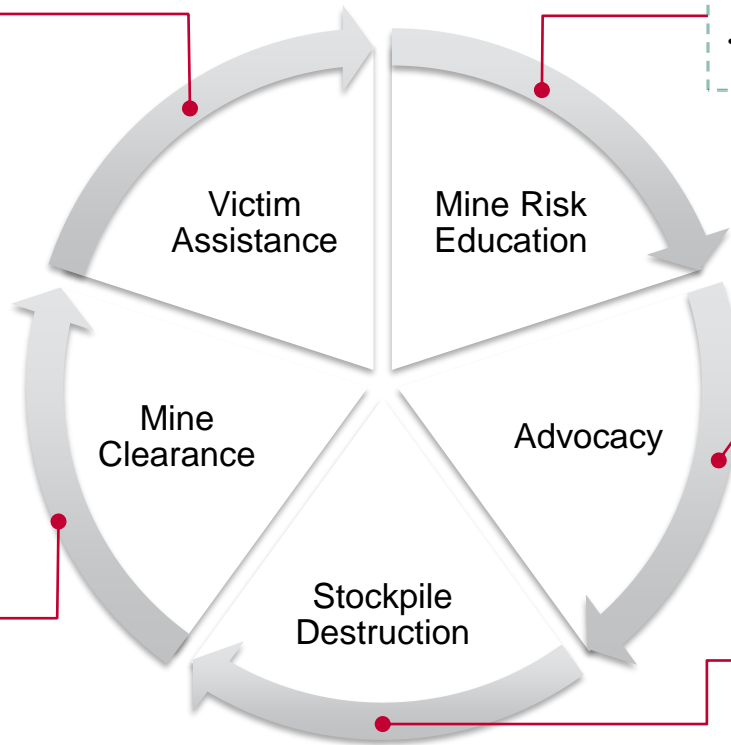
- AI-driven assistive technologies, prosthetics, AI components for survivors?
- Improve the assessment of individual needs to ensure personalised and timely support?
- AI help create better databases for tracking and monitoring the long-term recovery and integration ?”

- How effective are AI-driven educational tools?
- Risk patterns and targeting of educational campaigns?
- Improve the accessibility and relevance of safety information for different age groups

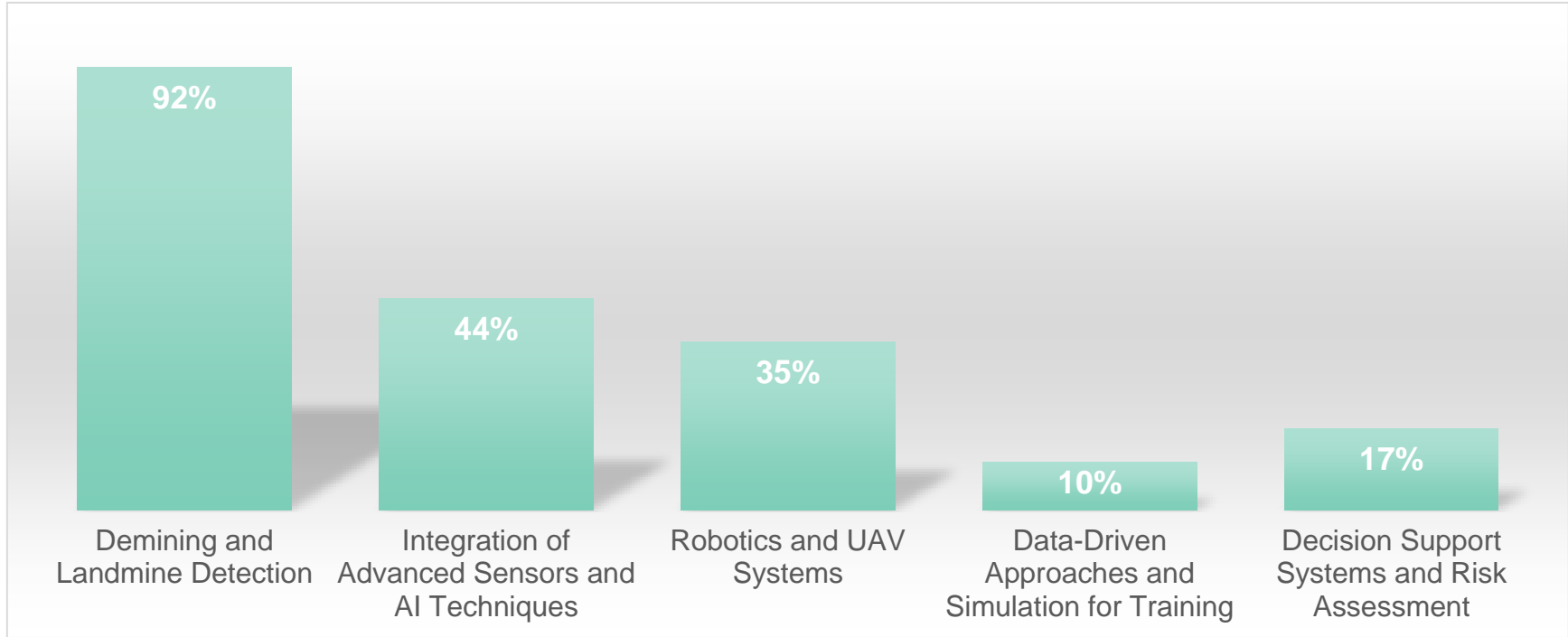
- latest AI-driven innovations in detection, mapping, and clearance?
- How do these technologies overcome limitations in traditional methods, and what are the current gaps?
- Help improve efficient use of resources in mine action operations ? (Prioritisation ?!!)
- Wthical and safety concerns have emerged when using AI in active minefields?’

- Gathering and analysing data to create compelling arguments for advocacy?
- Monitor compliance with international treaties or support transparent reporting on demining activities?
- Amplify the voices of affected communities and support evidence-based policymaking?

- Automated systems\ for safely handle and destroy stockpiles?
- Assess the stability and condition of old explosives to minimize risk during destruction?
- Ensure more accurate tracing, tracking, record keeping and reporting of stockpile destruction to support compliance with international regulations?”



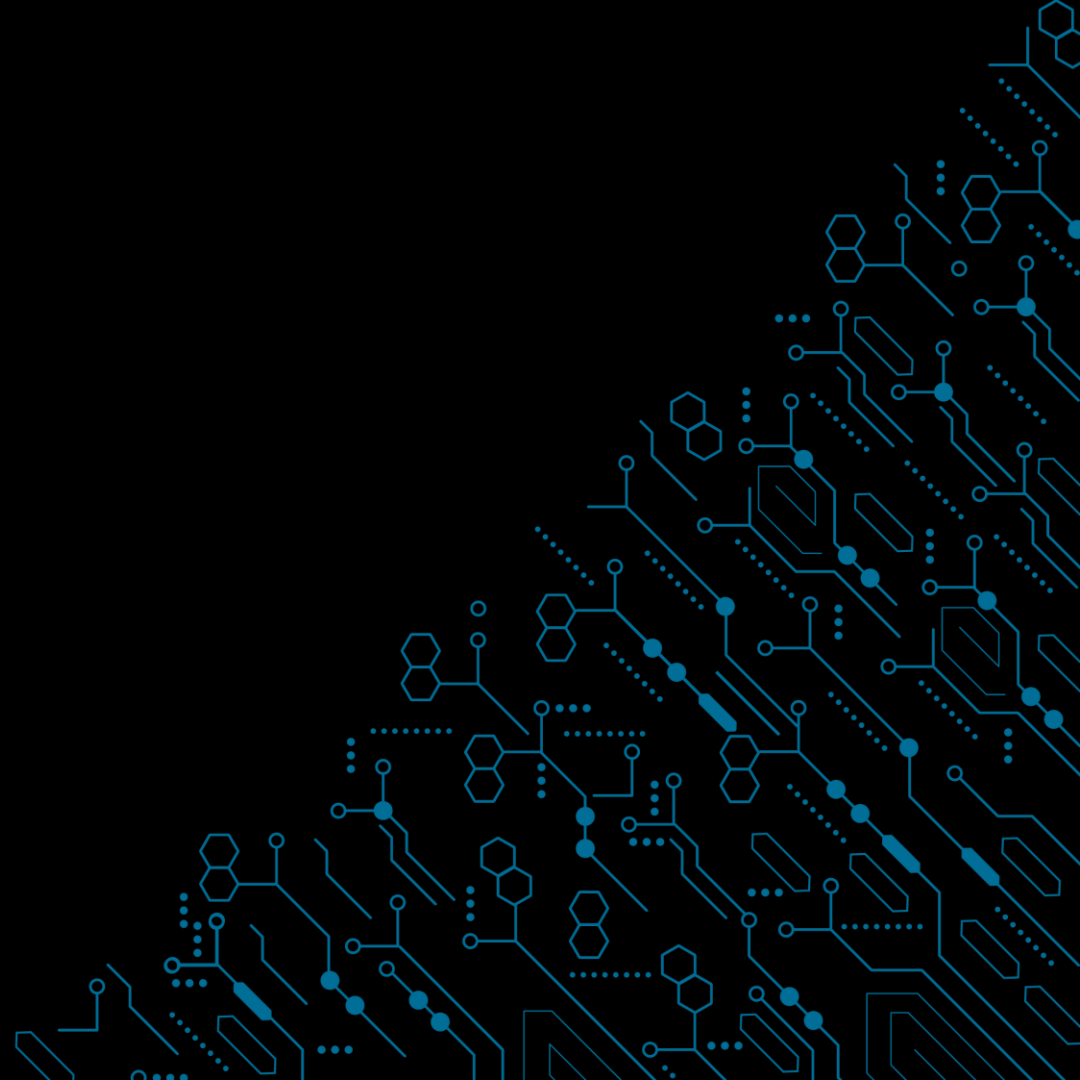
# Research Thematic



# Distribution of AI Research in Mine Action



# CHALLENGES



# Challenges in AI for Mine Action

- Limited labelled datasets and ground-truth data.
- Complexity of integrating heterogeneous sensors and data.
- Environmental and operational constraints.
- Ethical considerations.
- Safety considerations.
- Lack of Standardized Evaluation Metrics.
- High Costs and Resource Requirements.

# FUTURE DIRECTIONS IN AI FOR MINE ACTION



# Research Opportunities

- Emerging trends: AI-driven robotics, decentralized AI, and edge computing.
- Integration with newer technologies (e.g., 5G, cloud computing, IoT).
- Collaboration between AI researchers and mine action experts.
- Enhancing real-time decision support and automated demining solutions.



# THANK YOU

