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AI IN MINE ACTION:

Current Trends, Challenges, and Future Directions

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german humanitarian assistance
DEUTSCHE HUMANITÄRE HILFE

Schweizerische Eidgenossenschaft
Confédération suisse
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Confederaziun svizra

Federal Department of Foreign Affairs FDFA

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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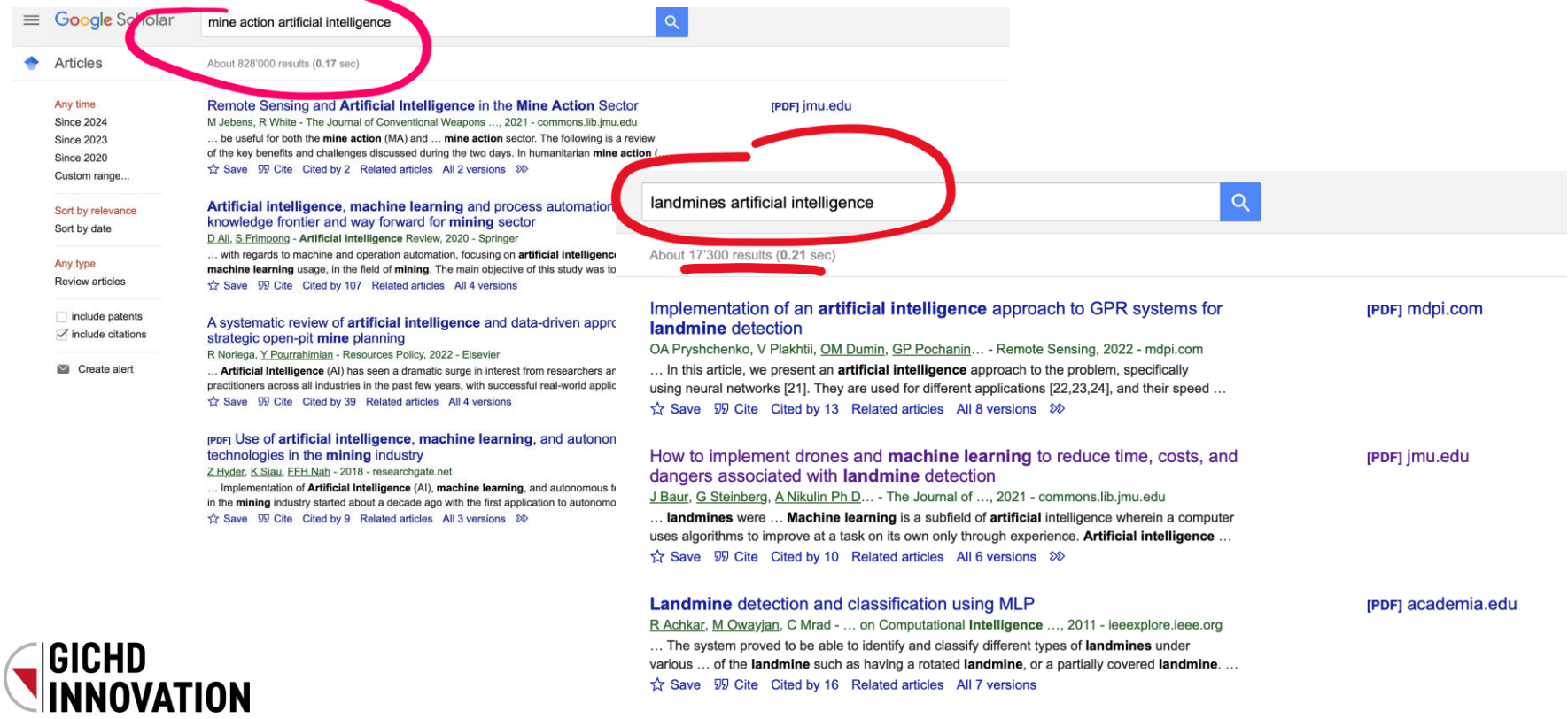

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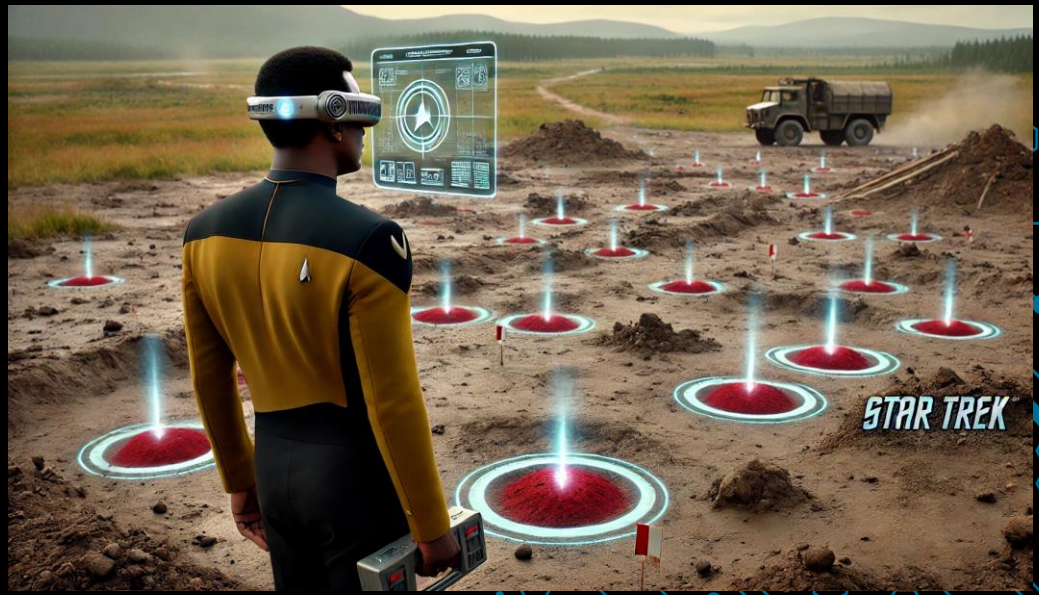
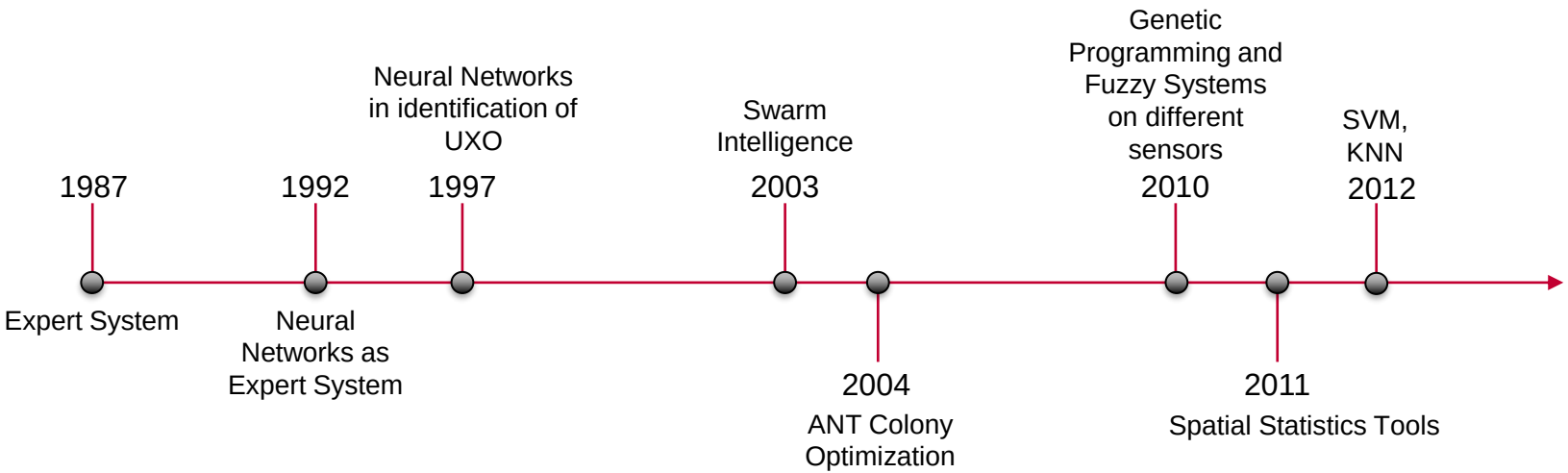
Science Fiction or Tomorrow’s Reality?



THE JOURNEY OF AI IN MINE ACTION

Evolution of AI Technologies in Mine Action



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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.

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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?”

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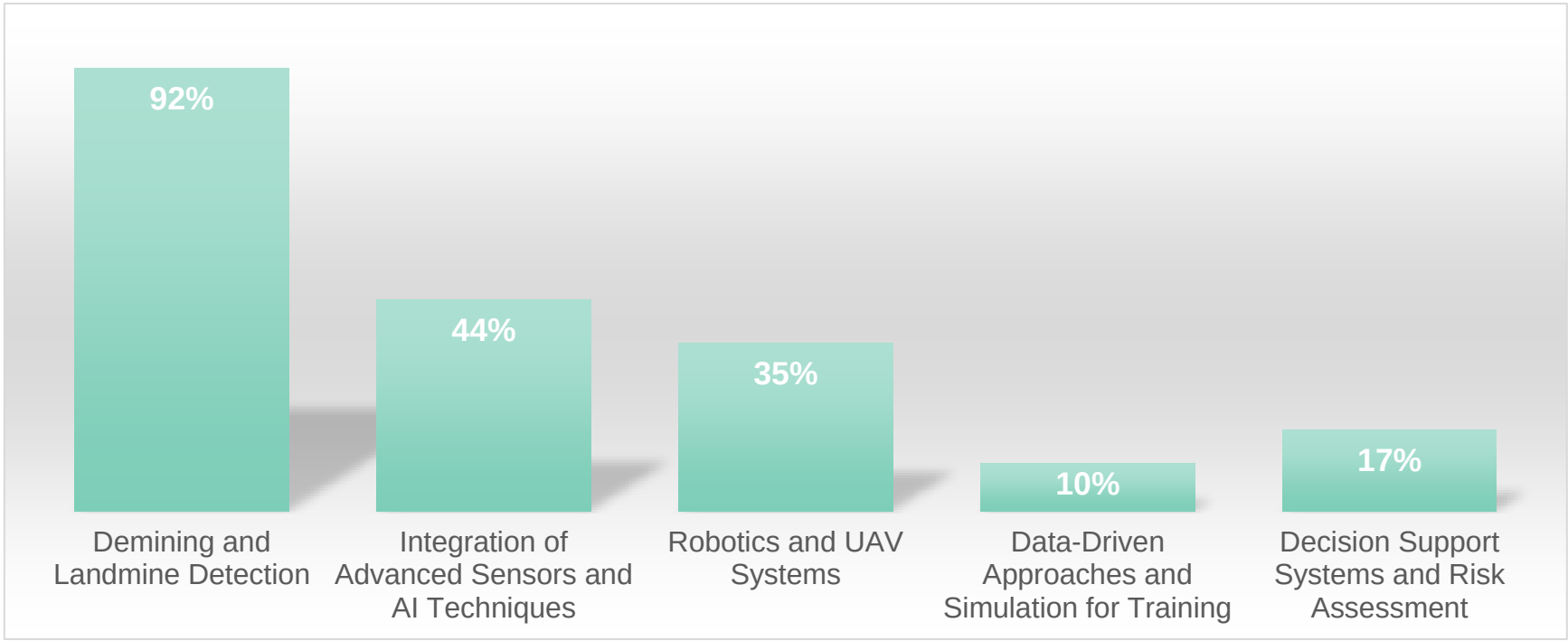
Research Thematic



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Distribution of AI Research in Mine Action

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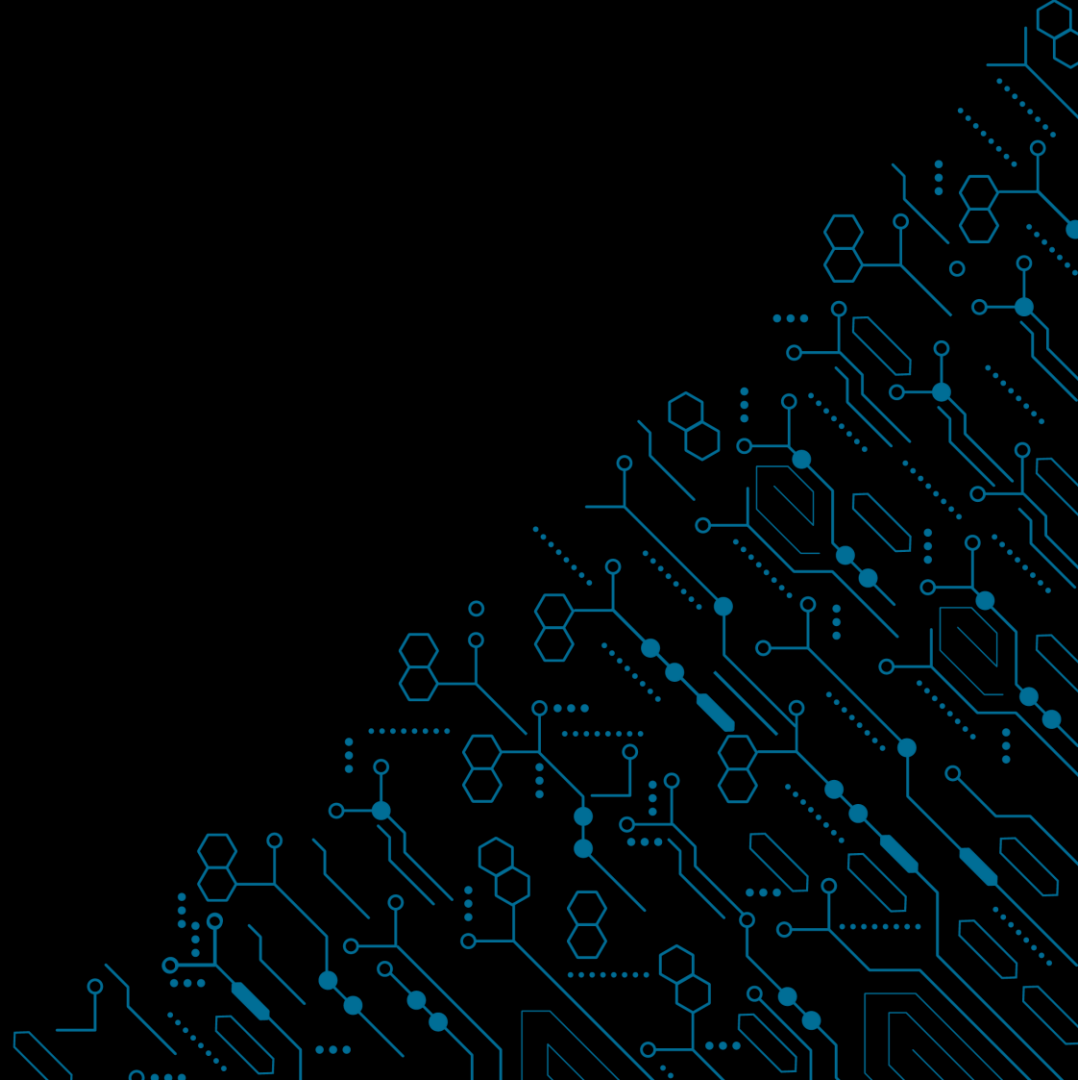
CHALLENGES



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.

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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.

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THANK YOU

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