



TechRank: A Graph-Based Framework for Identifying High-Growth Emerging Tech Companies

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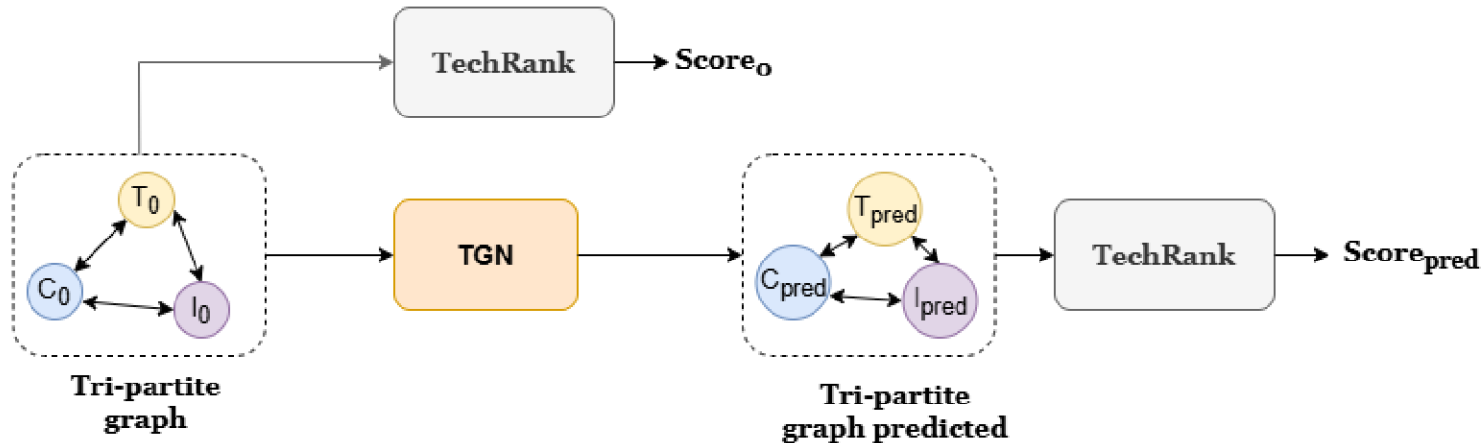
- Motivation
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- **Origin:** Developed for the Cyber Defence Campus (armasuisse), TechRank turns complexe data into a strategic map of innovation, helping defence client identify the most promising technologies.
- **What it does:** TechRank assigns a static score to companies and technologies based on their relationships in a graph that models how technologies and companies are interconnected within the ecosystem.
- **Limitation:** The graph modeling company-technology does not evolve over time.
- **Approach explored:** This project adds a temporal dimension in order to transform TechRank from a ranking tool for defence client into a forecasting engine for cyber defence.

Methodology: Overview

- **Tri-partite graph:** Technologies (T) – Companies (C) – Investments (I).
- **TechRank:** Static score
- **Temporal Graph Network (TGN):** Temporal predictions ($T_{pred} - C_{pred} - I_{pred}$)
 - Memory module
 - Continuous processing
 - Long-term context



Methodology: Dataset & Network Construction

- **Source:** Crunchbase is a global platform providing real-time data on companies, technologies, investors and funding offering insights into innovative and private markets.

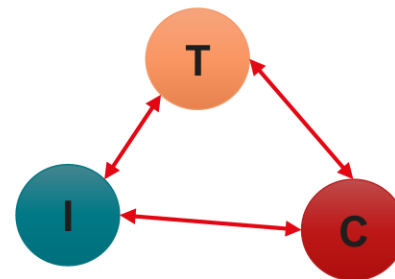
Entities
Acquisitions
Degrees
Event Appearances
Funding Rounds
...
Investment Partners
Investments
Organizations
People



Companies
Name
Categories
Funding Total
Technologies
UUID
Name
Investments
Name
Number Investors
Lead Investors

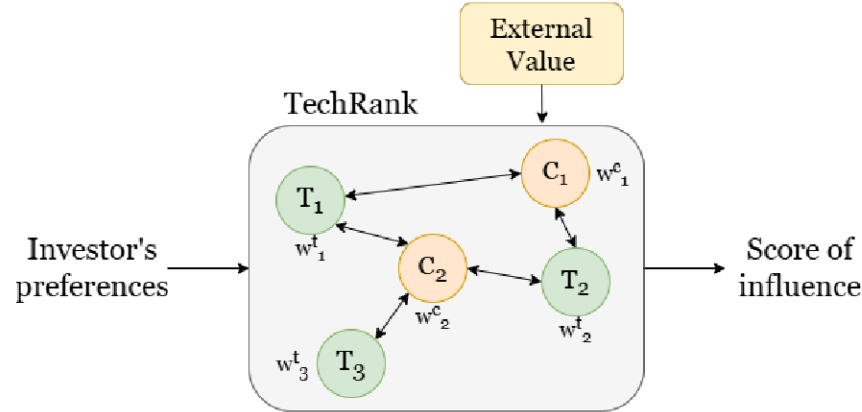
- **Network construction:**

- Extract and clean key entities and relationships.
- Built a tri-partite network structure.



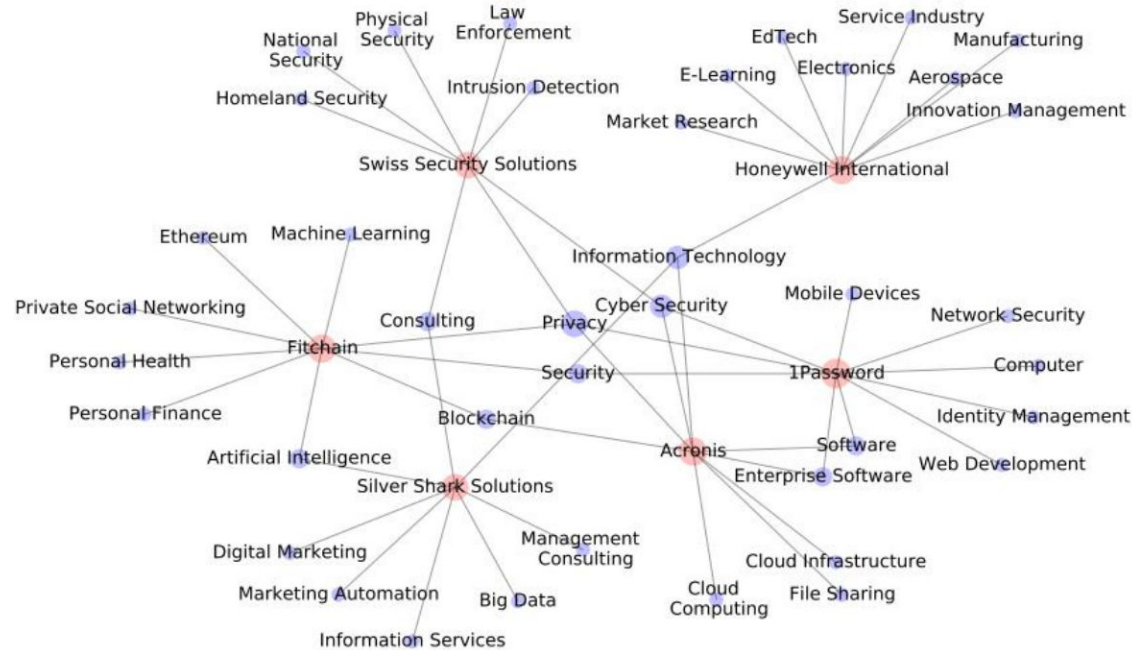
Methodology: TechRank Framework

- **Mutual reinforcement:** Company and technologies strengthen each other's influence recursively.
- **Customizable rankings:** Adapts to specific investor preferences and strategic priorities through the external variable.
- **Quantitative scoring:** Measures each entity's impact within the technological network.



¹. Anita Mezzetti, Loïc Maréchal, Dimitri Percia David, William Lacube, Sébastien Gillard, Michael Tsesselis, Thomas Maillart, and Alain Mermoud. Techrank: Modelling portfolios of cyber-related emerging technologies. arXiv preprint arXiv:2210.07824, 2022.

Methodology: TechRank a concrete example



¹. Anita Mezzetti, Loïc Maréchal, Dimitri Percia David, William Lacube, Sébastien Gillard, Michael Tsesselis, Thomas Maillart, and Alain Mermoud. Techrank: Modelling portfolios of cyber-related emerging technologies. arXiv preprint arXiv:2210.07824, 2022.

Expected Results

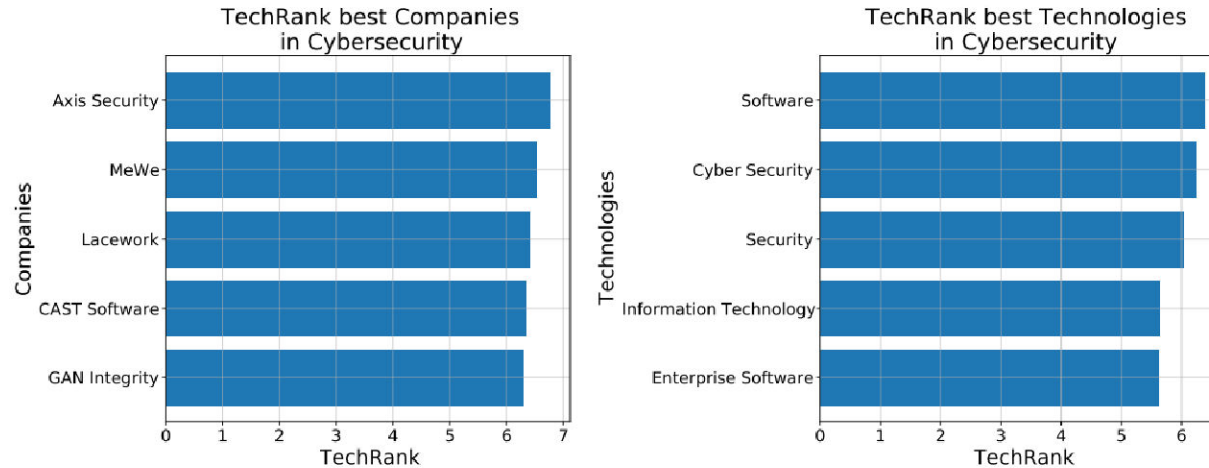


Fig. 11: TechRank top five scores in cybersecurity

This left (right) panel displays the top five companies (technologies) according to the TechRank score when run on a subset of 10 companies in cybersecurity.

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Challenges and limitations

- **Dataset:**
 - Biased toward high-visibility startups.
 - Incomplete informations.
 - Coverage strongest in North America and Europe.
- **Predictions:** Probabilistic, TechRank score might be uncertain.
- **Refinement:** Re-evaluation of the role of TechRank in the pipeline to determine the best configuration that yields the best results.

Summary: Work in progress

- **Current Stage:**

- Building a tri-partite graph connecting Companies, Technologies and Investments.
- Integrating TechRank's static analysis with TGN.

- **Next Steps:**

- Model refinement and parameter optimization.
- Validation on historical technology adoption data.
- Integration of additional data sources.

Thank you

Back-up: Temporal Graph Networks (TGN): Main Idea

