

PROJECT DETAILS

Project Title:

Neuro-Symbolic AI-Enabled Digital Twins for Secure and Optimised Critical Infrastructure.

Project Summary:

This project aims to design a neuro-symbolic AI-enabled digital twin framework for secure and optimised critical infrastructure (e.g., advanced manufacturing systems). By integrating machine and deep learning models (i.e., learning patterns from data) with automated reasoning with symbolic AI (e.g., structured knowledge, semantic graphs, logic-/rule-based), the research will enable real-time performance optimisation, explainable decision-making, and proactive cyber-physical threat mitigation. The significance lies in aiding to address growing security and safety challenges in Industry 4.0 environments while embedding transparency and trust into intelligent automation. The expected research impact includes advancing trustworthy AI for critical infrastructure, improving resilience, and establishing a secure-by-design foundation for intelligent industrial systems, benefiting both large-scale enterprises and SMEs adopting AI-driven automation.

Preferred Applicant Skillset:

The preferred HDR applicant should possess a background in AI, machine learning, and cybersecurity, with demonstrated experience in Python-based development and data analytics. Knowledge of deep learning as well as knowledge representation and automated reasoning is highly desirable. Familiarity with digital twins, cyber-physical systems, or Industry 4.0 environments will be advantageous. The candidate should demonstrate strong analytical, problem-solving, and research writing skills, with the ability to work independently and collaboratively within interdisciplinary teams.

Internship Opportunity:

The candidate will have the opportunity to undertake an industry internship with partner organisations in advanced manufacturing and industrial cybersecurity. The internship will involve applying the proposed neuro-symbolic digital twin framework within real-world manufacturing environments, focusing on cyber-physical risk modelling, system optimisation, and secure AI deployment. The candidate will gain hands-on experience with industrial data, simulation platforms, and operational constraints, while contributing to translational research outcomes. This opportunity will enhance industry engagement, professional skills development, and potential pathways for technology transfer and commercialisation.

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