Trustworthy AI for Digital Engineering Transformation

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The fast diffusion of technologies, such as the Internet of Things (IoT), cloud computing, big data, artificial intelligence and machine learning (AI and ML), digital twins, 3D printing, Blockchain, and others, is shifting the landscape of engineering processes, from concept definition, design, manufacturing, operations, and sustainment through retirement and recycling. Digital Engineering, the digital transformation of engineering, is emerging globally with different names and focuses. The US Department of Defense (DoD) launched their Digital Engineering Strategy in 2018 (https://fas.org/man/eprint/digeng-2018.pdf). From the perspective of engineering practice, "DoD defines digital engineering as an integrated digital approach that uses authoritative source of system data and models as a continuum across disciplines to support lifecycle activities from concept through disposal." No doubt, the implementation of DoD Digital Engineering Strategy will significantly change how engineering practice is conducted in DoD enterprise, the US defense industry, and beyond. Digital engineering transformation is a deep societal scale process, which transforms engineering standards, engineering practice paradigms, engineering processes (from design to disposal), engineering knowledge, engineering workforce, and engineering environment, including culture. Digital Engineering will operate in a digital and connected environment with shared or standardized digital artifacts, including models and data, thus every process in the engineering lifecycle will operate significantly differently. In particular, engineering systems design will face unprecedented richness of information from various sources in the shared digital connected environment. The changing conditions and technologies will also change the way we design engineering systems.

AI (incl. ML, Knowledge Representation, and Semantic Web) is a fundamental enabling technology for Digital Engineering. In Digital Engineering transformation, an essential move is to "digitalize" a vast number of engineering artifacts and processes. AI can provide solutions for digitalizing engineering artifacts, including digital representation of the system of interest. AI can support automatic processing, understanding, and reasoning about the digital artifacts. AI can support digital systems formal verification. ML can be leveraged in every process in engineering lifecycle for knowledge discovery from the Big Data of digital engineering systems and their digitally connected environment. The fast growth and broad applications of AI systems (particularly ML) in recent years also raise concerns about the

trustworthiness of AI systems. Generally, an AI system is expected to be reliable, safe, secure, explainable, bias-free, and privacy-preserving. In Digital Engineering, all those concerns apply.

Given the above context about digital engineering, the relevance of the theme to the journal, the role of AI to digital engineering, and associated trust concerns, this special issue for the Transactions of SDPS – Journal of Integrated Design and Process Science (JIDPS) solicits high-quality papers on the theme of "trustworthy AI for digital engineering transformation". The special issue accepts four types of papers: 1) research papers, 2) case studies or projects on digital engineering, 3) literature review, and 4) position papers. Many research topics are relevant, some examples of interested topics include (but not limited to):

- Reliable, secure, explainable, bias-free, and privacy-preserving AI/ML in Digital Engineering
- Digitalization of engineering artifacts
- Data semantics and standardization
- Data & models sharing, integration and interoperability
- Domain taxonomies, ontologies, and tools for Digital Engineering
- Search mechanisms for shared digital artifacts in Digital Engineering
- Security in Digital Engineering
- Trust in Digital Engineering
- Digital business process integration in Digital Engineering
- Digital Enterprise Integration
- Digital twins and other high-fidelity models for Digital Engineering
- Reasoning with multi-modal digital artifacts
- Digital engineering processes (such as design, manufacturing, maintenance, reuse and recycle)
- Transformation of traditional engineering to Digital Engineering
- Test, evaluation, verification, and validation in Digital Engineering
- Life-cycle support and management of artifacts in digitalized environment
- Big Data in Digital Engineering
- Principles, theories, paradigms, models, and methodologies for Digital Engineering

Some other examples of topics relevant can be found at
https://sercuarc.org/research-roadmaps/
https://arxiv.org/abs/2002.11672

Important Dates:

Paper submissions due:	Mar. 31, 2020
First-round review due:	May 15, 2020
Revision due:	July 15, 2021
2nd review/final decision due:	Aug. 15, 2021
Final version due:	Sept. 15, 2021
Publication on journal	Oct. 15, 2021

Instruction for Submissions

- All submissions will be anonymously reviewed by at least three reviewers. The selection for publication would be made on the basis of these reviews and the academic/industrial value of the contribution.
- By submitting their manuscripts to JIDPS, authors agree to the publishing principles of SDPS and to its personal data handling and privacy policy.
- Information about the format and style required for JIDPS manuscripts, as well as about submission, can be found in the manuscript template file.
- Queries and information about submissions for this special issue should be addressed to the co-guest editors, and not to the editor in chief.

- Manuscript for review and revised articles for publication should be submitted online through the journal's submission handling system at: https://jidps.rndsphere.com
- New users should first create a user account on the submission handling system.

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