

Digital Twin for Cognitive Manufacturing Industry: Artificial Intelligence and Machine Learning methodological framework for the knowledge and experience transfer between physical and virtual world production systems

Summary

The doctoral research project uses DT and VR/AR technologies as an experimental environment and develops AI and ML algorithms to enable the virtual industrial equipment's self-learning. Work will be in two groups - Department of Mechanical and Industrial Engineering, Smart Industry Research Group and Virumaa College, innovation centre ViDRIK

Research field:	Mechanical engineering
Supervisors:	Tauno Otto Dr. Vladimir Kuts
Availability:	This position is available.
Offered by:	School of Engineering Department of Mechanical and Industrial Engineering
Application deadline:	Applications are accepted between May 03, 2021 00:00 and May 31, 2021 23:59 (Europe/Zurich)

Description

The doctoral research project uses Digital Twins and VR/AR technologies as an experimental environment and develops AI and ML algorithms to enable the virtual industrial equipment's self-learning. Cognitive manufacturing aims developing sustainable digital solutions for data driven manufacturing and intelligent products. There is a need to develop methodology and a concept of how to train virtual machines and analyze and transfer this knowledge to the physical equipment without interfering with those. The upcoming doctoral project's central hypothesis is that exploiting virtual environments can save time for re-programming the machines by self-adaptation of manipulation with the virtual objects. Digital Twin synchronized with the physical environment [1] will be used to transfer virtual and physical production environments.

Future research will also address cybersecurity, connectivity methods (between physical and virtual worlds) optimization, and the development of virtual distributed infrastructure with open access for experimental design environment with various machinery for system integrators and end-users, and researchers.

The placement of the PhD student is at TalTech Virumaa College innovation centre ViDRIK.

Responsibilities and tasks:

- Research on the defined topic
- Virtual environment development
- Robot programming self-learning methodology through AI and ML
- Representation of the Industrial VR/AR laboratory at events, conferences, demos [2]
- Teaching assistance in Digital Manufacturing, Production Digitalization courses (labs)

References:

[1] Kuts, V.; Otto, T.; Tähemaa, T.; Bondarenko, Y. (2019). Digital twin based synchronised control and simulation of the industrial robotic cell using virtual reality. JOURNAL OF MACHINE ENGINEERING, 19 (1), 128–145.2010.5604/01.3001.0013.0464.

[2] <https://ivar.taltech.ee/> [Online]

The applicants should fulfil the following requirements:

Mandatory:



- Programming languages: C#/C++, Python
- Familiar with VR/AR domain
- Familiarity with Machine Learning and data analytic concepts
- Industrial Robots programming knowledge (at least two various brand robots)
- Unity3D / Unreal Engine software knowledge
- MatLab

Good to have:

- Robot Operation System (ROS)
- 3D Modelling (CAD/Blender/3DMax etc.)
- Knowledge of manufacturing equipment domain
- Machine vision experience
- Estonian language skills



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