

PhD Position - Revolutionizing 6G Networks: A Machine Learning-Based Digital Twin for Seamless Teleoperated Driving Experiences

Short description

This PhD thesis is proposed in the context of the European project 6GTWIN “Integrating Network Digital Twinning into Future AI-based 6G Systems” accepted in the second Horizon Europe call under the Smart Networks and Services Joint Undertaking (SNS JU) program.

This project involves more than ten European partners between academics, industrials and research organisms. It aims to provide a new 6G Network architecture driven by AI-based Digital Twin (DT) models at physical, network and application layers.

The DT technology consists in creating a replication of a physical world component based on the simulation of its behaviour and the analysis of data collected from different sources (sensors, recorded history, etc.). The aim of a digital twin is to provide a reliable tool to ensure behaviour prediction, collaboration and decision making for the most complex real-world systems.

The first DT models have been proposed in the manufacturing sector. This concept gains popularity in many other domains such as the communication networks where the advent of the 6th generation of mobile networks will encompass new upcoming challenges relevant to RAN (Radio Access Networks) heterogeneity, complex and dynamic topologies and automated management solutions.

In this context, we situate the hereby PhD thesis that aims to propose 6G compliant AI-based Network Digital twin (NDT) models for the particular case of “the teleoperated Driving” application. The teleoperated driving is identified as the pivot application around which the major experiments of the 6GTWIN project should be conducted.

For instance, the main goal of this thesis is to propose new AI-based (either native machine learning, graph-based or deep learning) models mainly at network and application layers compliant with “the teleoperated Driving” application. In the context of NDTs, AI-models should be combined with simulation frameworks to allow predicting the network behaviour and facilitating the decision making while reducing the need for human intervention and minimising the risk of human error.

Keywords: AI, Machine learning, Digital Twin, Simulation, Knowledge Distillation, Federated Learning, 6G Networks, vehicular networks.

PhD contract: 3-years CDD-FR.

PhD location: This PhD will take place in the premises of DRIVE Lab in Nevers (Bourgogne, France).

Expected starting date: February/March 2024.

Contacts:

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Dr. (HDR) Inès El-Korbi, University of Burgundy, Nevers, France.

Expected Profile:

- Candidates should own a Master (M.Sc.) or Engineer (B.Sc.) degree in Computer science or Telecoms.

- Good understanding of Machine Learning theory and techniques
- Good programming skills in programming languages and software tools (e.g., Python, Matlab, SUMO, OMNET++, etc.)
- Applications/ domain-knowledge in telecommunication is appreciated.
- Well developed communication skills
- Good English language skills in both writing and conversation.

How to Apply:

Application process (deadline **February 16th, 2024**)

The following documents are required:

- CV,
- motivation letter,
- statement of research experience and interests,
- transcripts and
- reference letters

as attachments of an email, whose subject will be "Application for PhD position at 6GTWIN", which must be addressed to Sidi Mohammed Senouci (sidi-mohammed.senouci@u-bourgogne.fr) and Ines El-Korbi (Ines.El-Korbi@u-bourgogne.fr)

Web links of research articles authored by the applicant or the internship report are welcome to be included, too.

The position offers:

Hands-on training in 5G/6G mobile networks, digital twins and AI models

Exclusive chance to collaborate with European leading partners in the domain

Participate in a dynamic, cooperative, culturally diverse, and English-speaking environment.

Opportunity to publish research findings in top-tier networking venues.

Some references:

- [1] D. Kim, J. Park, and S. Kim, "AI-native 6G wireless networks: Opportunities and challenges," IEEE Communications Magazine, vol. 59, no. 2, pp. 48-54, Feb. 2021.
- [2] Network World Europe STRIA (2022), 6G Architecture Landscape (2022).
- [3] ITU-T Recommendation Y.3090: Digital twin network - Requirements and architecture (2022).
- [4] Gupta, B. B., Gaurav, A., Marín, E. C., & Alhalabi, W. (2022). Novel graph-based machine learning technique to secure smart vehicles in intelligent transportation systems. IEEE transactions on intelligent transportation systems.
- [5] M. Camelo et al., "DAEMON: A Network Intelligence Plane for 6G Networks," 2022 IEEE Globecom Workshops (GC Wkshps), Rio de Janeiro, Brazil, 2022, pp. 1341-1346, doi: 10.1109/GCWkshps56602.2022.10008662.
- [6] TU Y.3090, Digital twin network - Requirements and architecture <https://www.itu.int/rec/T-REC-Y.3090>.