

Artificial intelligence and decision support system for the smart building and the smart city

The digital transition in the building and the city mainly rests on the exploitation of numerical data coming from different sources, primarily networks of sensors and connected objects (the IoT: Internet of Things) when one deals with technical urban systems (transport, energy, water ...).

As an alternative to domain-oriented models, the machine learning approach and techniques (a branch of AI) enables to process datasets for achieving complex tasks like prediction (traffic, air pollution ...) or anomaly detection (water leakage, HVAC predictive maintenance ...).

This study program aims at learning and finding how to adapt, optimize and integrate AI models and tools (especially machine learning), for issues and applications in the smart city and the smart building. One of the main challenges is to consider the specific domain and contextual knowledge – relative to the urban context - in the machine learning process, through different topics like feature selections (which sensors to select for a prediction?), or how to integrate a rule-based reasoning. Another challenge is the integration of AI tools in the digital twin of the city / building.

Applications, software developments and proof of concepts will use the Python environment and tools (scikit-learn and other Python libraries).

Mentor

Gilles MOREL is a state civil engineer and PhD in computer science. He has been developing for more than thirty years decision support systems in various domains linked to the land and city management, like flood management, dike design, acoustics, air pollution ... He's an expert in knowledge engineering and AI technics and has been applying them more recently in the context of the smart city and the smart building, with the perspective of transforming the digital twin to the "cognitive twin", a systemic smart system of the built area.

At UTC, Gilles Morel is in charge of the lecture "Data Science for the Smart City", in which engineering students learn how to apply AI technics to urban issues. He also develops international academic programs for engineering cursus mixing industry partnership, innovation, inter-culturality, along with a project-oriented approach.

Student profile

Master in data science or AI, or final undergraduate in computer science.
Good level in Python and Python tools for data science.

Subjects

Anomaly detection and predictive maintenance in the smart building

Automatization and optimization of a machine learning process for a smart city/building use case (with data from sensors)

Coupling machine learning and a rule-based approach for smart city/building diagnosis

Integration of IoT and BIM/CIM for the smart building/city – Use of structural and temporal data in a AI process

