1SC4296 – Epidemiology & Biostatistics on a Hospital Health Database

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Department: DOMINANTE - VIVANT, SANTÉ, ENVIRONNEMENT
Language of instruction: FRANCAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 40
On-site hours (HPE): 27,00

Description

partner : Assistance Publique - Hôpitaux de Paris.
The Health Data Warehouse (EDS) of the Assistance Publique - Hôpitaux de Paris (AP-HP) integrates the administrative and medical data of more than 8 million patients hospitalized or consulted in one of its 39 institutions. This warehouse allows to improve the management of hospital activity and to advance scientific research in the field of health by facilitating studies on real life data, the implementation of clinical trials and the development of decision support algorithms.
During this Integration Course, we propose to discover the AP-HP EDS and its specificities through the prism of epidemiological and biostatistical analysis. You will have the opportunity to process structured data (medico-economic data - diagnoses and procedures, demographic data, patient pathways and biological analyses) and unstructured data (medical reports), integrated into a synthetic database largely inspired by the structure of the EDS. You will have to answer two research questions (epidemiological surveillance study and analysis of predictive factors of lung cancer), while deciphering and correcting the biases inherent in routine clinical data.

Quarter number
ST 4

Prerequisites (in terms of CS courses)
Statistics and Learning
Biology and Statistics

ST4 – 43 – THE IOT (INTERNET OF THINGS) AND RELATED INFORMATION PROCESSING

Major: SCOC (Systèmes Connectés et Objets Communicants)
Language: English
Campus: Paris-Saclay

Engineering problem statement

The IoT (Internet of Things) is the next Internet evolution. It stands at the crossroads of telecommunications, computer science, electronic, signal processing, big data and artificial intelligence. Connected objects are only the early stage of the IoT as major evolutions are going to happen. The IoT, the future of the Internet, is sometimes coined as the Internet 4.0 , ambient intelligence or ubiquitous Internet…It is one of the main domain of investment for the European policy in science and technology, and for countries and companies in the rest of the world as well. The IoT is going to bring major changes in everyday life and in the industry.

During this sequence, we will deal with transmission, stockage, and processing of information together with Artificial Intelligence in communication systems for IoT.
Students will meet main actors of the IoT who will share with them their vision and their road maps.

During the challenge week, students will tackle the different aspects of IoT from the deployment of a sensor network to the processing of the data for a final application, related to a real actual case presented by a company in the sector.

Prerequisite

Core curriculum CIP-EDP, EIP, Algorithme & complexité

Context and challenge modules

Major companies in the domain will share their point of view and road maps. Different usage cases will be presented in order to understand the expectations and tradeoff in terms of information gathering, network architecture (both terrestrial and satellite) in relation with the required performances (robustness, security, bitrate, latency, energy consumption, density, availability, coverage...), and information processing (prediction, help for the decision, alerts…). Students will have the key to understand the

economical and societal impact and to evaluate the value brought by the IoT. There will be conferences, round tables and IoT forum.

Specific course (60 HEE): From Information Theory to IOT

Short description: The first part of the course will deal with Shannon Information and will give the prerequisite and the skills to understand the concept of information and its measures; to understand the fundamental limits and the concepts for the representation and the compression of different kinds of signal models; to understand the effect of analogic source compression, the loss or lossless reconstitution of a digital signal; to understand the tradeoff between the bitrate and the distortion; to design the compression and transmission chain.

The second part presents different wireless communication systems for IoT, short or long range (Zigbee, SigFox, LoRA, LTE-M, NB-IoT, etc.). It will deal with the main concepts behind a telecommunication system, with their design at the radio level for an efficient collect of data, as well as with the architecture for stockage and processing of data, centralized or distributed, adapted to applications requirements (execution time, security…). The learning outcomes and skills brought by this course are:

- understanding the mechanisms and communication protocols to transmit information with low cost sensors and high consumption constraints.
- dimensioning a wireless network for IoT applications with specific coverage and capacity requirements.
- designing a storage and processing system for IoT adapted to application requirements.

Challenge Week: sensor networks deployments and data processing for IoT

- **Industrial partners**: Bouygues Telecom, EDF, Objenious, Sigfox, ADLINK, Eutelsat, Nokia, Huawei
- **Location :** Paris-Saclay Campus
- **Short description:** The aim of the challenge week is to deploy a sensor networks and to process the collected data for a given application. The students will choose between various topics proposed by partners (Wind farm monitoring, smart city/smart building security, pollution monitoring, healthcare IoT, connected vehicles management…). The two main steps of the project will be:
  - Dimensioning and performance of the telecommunication system depending on the application and requirements (data size, bit rate, consumption, distance, bandwidth…)
  - Data processing (Machine Learning) for analysis and decision.