



2<sup>ND</sup> AND 3<sup>RD</sup> YEAR SPECIALISATION

# DATA ANALYSIS AND APPLICATIONS IN SIGNAL AND IMAGE PROCESSING

The objective of this specialisation is to train multidisciplinary engineers to design and implement methodological and algorithmic solutions to data processing problems in various industrial application fields.

The courses are based on the theory and the practice of methods from computational statistics, applied mathematics, signal and image processing, as well as applied computer science and scientific computing. These courses also offer application-oriented content from healthcare, research and development, imaging science, information and communication technology.

This specialisation confers Centrale engineers the skills needed for a professional orientation to research and innovation in industrial and academic fields related to data sciences, audio engineering, industrial imaging, computer-aided decision and biomedical engineering



## COURSE CONTENT

### AUTUMN SEMESTER

- > Signal representation and analysis
- > Image processing and analysis
- > Scientific computing and numerical optimization
- > Statistical data modelling and analysis
- > Machine learning theory and practice
- > Multi-modal sensor data analysis
- > Imaging and inverse methods
- > Biomedical signal analysis
- > Project in signal and image processing

### SPRING SEMESTER

- > Time-series modelling and prediction
- > R&D applications
- > Audio content analysis and information retrieval
- > Biomedical imaging
- > Project in signal and image processing
- > Internship



Siren from ambulance going to the Med Center

Daily Traffic

Metro Rail



## INDUSTRY SECTORS

- > Data sciences
- > Biomedical engineering
- > Digital, sound and multimedia
- > Industrial R&D (troubleshooting, decision support)
- > ICT

## CAREER PROSPECTS

- > R&D engineer
- > Data scientist
- > Digital applications design
- > Data acquisition and processing project manager

## TEACHING STAFF

### HEAD OF SPECIALISATION:

Saïd Moussaoui

### CENTRALE NANTES LECTURERS:

Sébastien Bourguignon, Diane Mateus, Eric Le Carpentier, Jean-François Petiot, Mira Rizkallah

### CNRS NANTES:

Jérôme Idier, Mathieu Lagrange, Vincent LOSTANLEN

### EXTERNAL SPEAKERS:

Oscar Acosta (LTSI, Rennes), Ewen Carcerff (TPAC/DB SAS, Nantes), Thomas Carlier (CHU Nantes), Guy d'Urso (EDF), Bertrand Rivet (GIPSA-lab Grenoble), Laurence Rouet (Philips), Pauline Trouve-Pelloux (Onera), Aurélien Van Langhenhove (CHU Nantes)

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## EXAMPLES OF PREVIOUS PROJECTS

- > Joint detection-estimation of hemodynamic responses from functional MRI data
- > Ultrasound data analysis for depth estimation in non-destructive testing
- > Convex k-means clustering from approximate pairwise comparisons
- > Unsupervised data clustering for acoustic quality assessment in urban areas
- > Implementation of deep learning algorithms for CT scan image segmentation
- > Optimization of a Brain-Computer Interface including a Virtual Reality feedback
- > Online acquisition and unmixing of hyperspectral images

## EXAMPLES OF PREVIOUS INTERSHIPS

- > Short-term audio source separation filter estimation from recurrent convolutional networks (Orange, Rennes)
- > Automatic detection of vine rows on aerial images (Avion Jaune, Paris)
- > Predicting the risk of delays for the operation of major train stations (SNCF, Paris)
- > Correlation between foot and hand movement in pedestrian navigation (IFSTTAR, Nantes)
- > Machine learning on biomedical images (CHU Nantes)
- > Evaluation of the mental load induced by a brain-computer interface system coupled with virtual reality (OnePoint and CHU Nantes)
- > Development of an image processing algorithm for the correction of artifacts in 2D and 3D mammography acquisition (GE Healthcare, The Netherlands)



graduate programme | Ingénieur grande école

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