

Mines Saint-Etienne
Laboratoire d'Informatique, de Modélisation et d'Optimisation des Systèmes (CNRS
UMR 6158)
Institut Henri FAYOL

Post-doc position in Data Science and Statistical learning for quality control in medical device manufacturing - 12-month fixed-term contract¹ (2024)

Key words : *Quality Control, Statistical Learning, Machine Learning, Anomaly Detection, Root Cause Analysis, Medical Device, Value Stream Mapping*

Mines Saint-Etienne (MSE), one of the graduate schools of *Institut Mines Télécom*, the #1 group of graduate schools of engineering and management **in France** under the supervision of the Ministry of the Economy, Industry and Digital Technology, is assigned missions of education, research and innovation, transfer to industry and scientific, technological and industrial culture.

MSE consists of 2,400 graduate and postgraduate students, 400 staff (150 Faculty), a consolidated budget of €46M, 3 Campuses dedicated to i/ Industry in Saint-Etienne and Lyon (Auvergne Rhone-Alpes region) ii/ Microelectronics and connected objects in Gardanne (Aix Marseille Provence metropolitan area, SUD region) and iii/ Health Engineering in Saint-Etienne ; six research units ; five teaching and research centres and a science center: "La Rotonde" leader in France (> 50,000 visitors). Since 2019, MSE has been ranked around 400th worldwide in Engineering and Technology by the Time Higher Education (#1 higher education institution in both of its regions), and #1 in France for the Sustainable Development Goals (SDG) 11-Sustainable cities and communities and 13-Climate Action. Its work environment is characterised by high Faculty-to-Student, Staff-to-Faculty and PhD-to-Faculty ratios, as well as comprehensive state-of-the-art experimental and computational facilities. Member of the T.I.M.E. association of technological universities, MSE has +150 active international partnerships. As part of Institut Mines-Telecom, MSE is a member of the European University EULIST.

Its strategy for the next 5 years is oriented towards helping businesses and the society undergo the major ecological, digital and generational transitions ahead, as well as fostering national and European sovereignty in microelectronics, through education, research, technology transfer and science outreach.

The Laboratory of Computer Science, Systems Modelling and Optimization (LIMOS²), is a Mixed Research Unit (UMR 6158) in computer science, and more generally in Science and Information and Communication Technologies (STIC). It is linked with the Institute of Information Sciences and their Interactions (INS2I) of the CNRS and in a secondary way with the Institute of Engineering and Systems Sciences (INSIS). The LIMOS belongs to the University Clermont Auvergne (UCA) and Mines Saint-

¹ potentially renewable

² <https://limos.fr/>

Etienne (MSE). It is also a member of Clermont Auvergne INP. The scientific positioning of LIMOS is focused on Computer science, Modelling and Optimization of Organizational and Living Systems.

The Institut Henri Fayol, a training and research center at Mines Saint-Etienne, focuses on current transformations in the digital, ecological and industrial transitions that are at the heart of the efficiency, resilience and sustainability of industry and territories. It develops a multi-disciplinary strategy combining strong skills in mathematical and industrial engineering, computer science and intelligent systems, environmental and organizational engineering, and responsible management and innovation, in conjunction with the EVS UMR 5600, LIMOS UMR 6158 and COACTIS research units.

Scientific and industrial context

The postdoctoral position is part of a collaboration between Thuasne in Saint-Étienne and Mines Saint-Etienne with the Institut Henri Fayol.

Founded in 1847, Thuasne designs, develops and manufactures medical devices that enable people to take charge of their own health. For 6 generations, the Group has been offering practical, adapted and innovative healthcare solutions in the fields of orthopaedics, medical compression, homecare and sports.

Technological developments linked to Industry 4.0 can be used to solve quality control issues (Quality Control 4.0). The digitalization and digitization of production chains has made a numerous data, accessible and usable for quality control. However, these data are not sufficiently exploited to ensure improved control and production.

The aim of this project is to optimize quality control in the manufacture of medical devices by exploiting the various data available in the production chain. In order to achieve this objective, we will explore different statistical learning solutions applied to anomaly detection and adapted to the types of data coming from the manufacturing process. The aim is to optimize quality control by detecting potential anomalies among the available data and information, and by analysing the root causes of production faults.

Missions

In this project, the candidate will have to carry out the following tasks in collaboration with the industrial partner within the company, including:

- Understanding of the various types of quality control carried out as part of the manufacturing process, in conjunction with experts in the field (quality control mapping).
- Analysis of available data sets to identify data that could be used to analyse and control quality
- Prioritization and selection of the quality controls for these production processes that will be the focus of subsequent phases of work, depending on the duration and feasibility of the study.
- Selection of the state-of-the art machine learning methods that best fit the data selected for the detection of non-quality or manufacturing defects.
- Development, testing and validation of the various quality control methods.
- Transfer of knowledge and results to the industrial partner
- Dissemination of this work in conferences and journal papers of the domain.

Key words : *Quality Control, Statistical Learning, Machine Learning, Anomaly Detection, Root Cause Analysis, Medical Device , Value Stream Mapping*

Candidate's profile

The candidate should have a PhD in applied mathematics, or data science or computing sciences with a background in statistical learning. Experience in anomaly detection and causal analysis techniques will be particularly appreciated.

Expected skills include

- Data analysis and processing
- Data science, statistical learning
- Machine learning, deep learning and pattern identification
- Methods and algorithms for anomaly detection and cause identification techniques.

The candidate is also expected to demonstrate:

- Significant professional experience in the field of quality control and optimization of industrial production lines.
- The ability to process different types of data: quantitative, qualitative and/or textual.
- Proficiency in Python and R programming languages.
- Skills in implementing and industrializing the various algorithms developed.

Recruitment conditions

- The missions will be carried out in the **Saint-Etienne (42) Campus of Mines Saint-Etienne.**
- The duration of the contract is a **12 - month fixed-term contract, potentially renewable** for a further 6 months.
- Desired start date : **1er juin 2024**
- Remuneration will be set according to the candidate's profile, in line with the rules defined by the Institut Mines Télécom's management framework.
- Category II - Métier P - Post-doctorant according to the Management Framework

Application procedure

The application file includes the following:

- Application cover letter
- Curriculum vitae outlining research activities, and where appropriate skills and knowledge in above-mentioned fields (10 p. max)
- Recommendation letter(s)
- Copy of the Doctorate diploma (or PhD)
- Copy of an identity document

Applications must be submitted on the RECRUITEE platform **by 14th April 2024 at the latest**, via the following link (as soon as possible) :

<https://institutminestelecom.recruitee.com/o/post-doctorant-ou-post-doctorante-en-sciences-de-donnees-pour-le-controle-de-qualite-dans-la-fabrication-de-dispositifs-medicaux-cdd-12-mois-potentiellement-renouvelable-2>

Candidates selected for an interview will be informed promptly and the interviews of the shortlisted candidates will take place by video conference

As part of its Equality, Diversity and Inclusion policy, École des Mines de Saint Etienne is an employer committed to fair treatment of all applicants.

Positions offered for recruitment are open to all, with accommodations available on request for candidates with disabilities.

For further information concerning the position, contact:

Head of Institut Fayol : Olivier Boissier, boissier@emse.fr , tel : +33 (0)4 77 42 66 14
Pr. Mireille Batton-Hubert, EMSE/FAYOL.Mireille.BATTON-HUBERT@emse.fr tel :+33 (0)4 77 00 93
THUASNE : Oliver Carré, olivier.carre@thuasne.fr tel : +33 6 47 39 45 28 et Philippe Sautrey, philippe.sautrey@thuasne.fr tel 07 86 08 42 32.

For further administrative information, contact:

Julie JAFFRE, julie.jaffre@emse.fr, tel : + 33 (0)4 77 42 00 17

Information on : <https://www.mines-stetienne.fr/>