

Job description

Position: Contractual PhD Student
Occupation or Job Type: Researcher REME, REFERENS, BIBLIOFIL
Job Description Sheet
Position Category: A Status (Permanent, Non-permanent, Open): Non-permanent Expertise: Artificial Intelligence Workload: Full-time 100%
Assignment
Administrative: INSA Strasbourg Department or Platform: CSIP Research Team - Design, Information Systems, and Inventive Processes Location: INSA Strasbourg / 24 boulevard de la Victoire / 67084 Strasbourg Cedex
INSA Strasbourg
<p>The National Institute of Applied Sciences (INSA) of Strasbourg is a public institution with a scientific, cultural, and professional character. It hosts 2,000 engineering and architecture students on its campus located at Esplanade, near the city center. It employs 270 permanent and non-permanent staff members.</p> <p>Its missions include:</p> <ul style="list-style-type: none"> • Initial training of engineers and architects, scientific and technological research, lifelong training for engineers and technicians, dissemination and promotion of scientific and technical culture <p>INSA Strasbourg offers:</p> <ul style="list-style-type: none"> • 7 engineering specialisations: civil engineering, topography, electrical engineering, mechanical engineering, plastics engineering, mechatronics, Climate and energy engineering • 6 apprenticeship programs (FIP, FISA) • 1 architecture program <p>INSA Strasbourg gained extended responsibilities and competences on January 1st, 2013. INSA has implemented measures to address psychosocial risks (RPS) by focusing on prevention, detection, and intervention.</p> <p>Additionally, INSA Strasbourg has established mechanisms to address sexist, sexual, homophobic, or transphobic violence for both staff and students.</p> <p>Moreover, INSA Strasbourg has implemented a gender equality plan, demonstrating its commitment to advancing real equality between women and men.</p> <p>INSA is certified HRS4R (Human Resources Strategy for Researchers) since March 15, 2022.</p> <p>The school provides access to the University of Strasbourg's collective catering and sports facilities, as well as university libraries.</p> <p>As part of its sustainable development policy, INSA contributes to funding soft mobility for its staff (reimbursement of 50% of public transportation costs and sustainable mobility package for bicycles, carpooling, shared mobility services, etc.).</p> <p>Finally, eligible staff members have access to telecommuting according to the rules set by the school's governing bodies.</p>

The CSIP Research Team - Creative Design, Information Systems, and Innovative Processes

"You will join a team of highly qualified researchers and benefit from a stimulating research environment. The CSIP team is dedicated to the study, understanding, theoretical and practical development of new product/system/service design methods that consider their entire lifecycle, particularly the inventive phases.

Preferred application domains include manufactured products, production systems, and information systems. To rethink design process activities within the company, the team has identified four essential challenges to consider in our research:

- Knowledge management and exploitation.
- Modeling of designed products and evaluation of their performance.
- Modeling of the design process while integrating continuous improvement and robustness.
- Consideration of the product/system lifecycle, especially to integrate sustainable development dimensions."

Missions

Proposed Thesis Topic:

"Toward an Innovative Methodology for Knowledge Fusion from Patent Datasets: Application to Inventive Design"

Exploring the Potential of TRIZ and AI (NLP) to Extract and Merge Knowledge Graphs from Multi-Domain Patents and Produce a Generic and Transdisciplinary Representation of Problem-Solution Pairing (*description at the bottom of the job offer*).

Main Activities:

- Designing, developing, and implementing advanced AI models for analyzing data related to renewable energies.
- Collaborating on cutting-edge research projects with renowned researchers.
- Actively participating in data collection, preparation, and analysis.
- Contributing to the application of Deep Learning, Machine Learning, and NLP techniques to solve complex problems in the energy domain.
- Taking initiative and participating in the development and improvement of team solutions.

If you are ready to take on this challenge and contribute to the advancement of AI applied to renewable energies, we strongly encourage you to apply.

Special Conditions of Employment: Supervision: No Project

Management: Yes

Travel: Yes

The position is based at INSA Strasbourg, with opportunities for national and international collaboration.

Remuneration:

- €2,100 gross salary in 2024
- €2,200 gross salary in 2025
- €2,300 gross salary in 2026

Skills
<p>Knowledge:</p> <ul style="list-style-type: none"> • Excellent proficiency in Python language and practical experience in developing AI models. • In-depth understanding of Deep Learning, Machine Learning, and NLP techniques. • Familiarity with development environments such as GIT and web servers, Docker, and Kubernetes. • Experience with various databases and file systems (RDBMS, NoSQL, semi-structured data, etc.), as well as familiarity with creating and deploying REST APIs, would be a plus. • Understanding of data preprocessing and preparation for analysis, particularly textual data. • Research investigation methodology. •
<p>Expertise:</p> <ul style="list-style-type: none"> • Determine appropriate methods • Lead a research project • Practice scientific investigation techniques and documentary techniques • Transmit knowledge • Work in a team • Public speaking • Communicate to explain the meaning of actions • Ensure the validation of results
<p>Soft Skills:</p> <ul style="list-style-type: none"> • Passion for Research and Industrial Development • Strong interest in interdisciplinary research • Autonomy / Self-confidence • Organizational skills • Creativity / Innovation • Rigor / Reliability • Conceptualization skills • Critical thinking
Candidate Profile
<p>Education Level (with possible specialization details): Holder of a Master's degree (Master 2) in a relevant field.</p>
<p>Level of Experience: Solid foundations in engineering sciences would undoubtedly be a plus.</p>
<p>Language (and required level): Proficiency in English language, both written and spoken.</p>

Follow-up and Application Procedures
Job Vacancy Date: April 15, 2024
Publication Dates: April 5, 2024
Application Documents: <ul style="list-style-type: none"> ➤ Copy of identification document and diplomas/qualifications ➤ Curriculum Vitae (CV) ➤ Cover letter ➤ Any relevant documents
Address for Sending Applications: srh.recrutement@insa-strasbourg.fr
Contact Person for Information on the Position: denis.cavallucci@insa-strasbourg.fr

INSA/ArcelorMittal Thesis Description

ArcelorMittal Global Context:

In the context of decarbonization and digitalization activities, our society is undergoing unprecedented and sudden changes. This must be used as a catalyst for breakthrough innovation, not only in our ways to resolve problems but more importantly in how we understand and generate our problem statements.

As steel is the second most used material in the world, ArcelorMittal has the responsibility to seize the opportunity and lead the social, economic, and technological transformation, in view of reaching carbon neutrality by 2050.

The current creativity and innovation techniques are restricted in their capacity to completely redesign processes and products in the iron and steel industry. Our researchers must be supported by new techniques to create atypical/breakthrough ideas and bring them to maturity in a much shorter time than today. This may be achieved by leveraging the combination of AI to the existing knowledge in multi-domain literature.

Thesis Title:

"Toward an Innovative Methodology for Knowledge Fusion from Patent Datasets: Application to Inventive Design"

Abstract:

In the current era, characterized by an information explosion and increased competition in technological innovation, advanced methodologies for knowledge management and synthesis are required. This research proposes to develop a new methodology for fusing knowledge extracted from patent datasets to facilitate the inventive design process. Inspired by the research led on TRIZ and Artificial Intelligence, this project aims to create an innovative graphical representation that would ease the identification of problems, the proposal of partial solutions, and the evaluation of these solutions through specific action and evaluation parameters.

Objectives:

1. Conduct an in-depth analysis of existing work on knowledge fusion, inventive design, and specifically the contributions in AI + TRIZ.
2. Develop a methodology for effectively extracting and fusing knowledge from multi-domain patent datasets.
3. Design an innovative graphical representation that synthesizes fused knowledge, thereby facilitating the inventive design process.

4. Validate the methodology through case studies in various technological domains, in collaboration with ArcelorMittal's case studies.

Methodology:

The work will be structured around four main axes:

- Literature Review: Analysis of existing work on knowledge fusion, level of abstraction during semantic analysis, inventive design, and patent analysis, AI+TRIZ.
- Methodology Development: Design of the algorithmic approach for extracting and fusing knowledge from patents, relying on artificial intelligence techniques and semantic analysis.
- Graphical Representation Design: Development of an intuitive graphical interface for visualizing the interrelations between problems, partial solutions, and evaluation and action parameters.
- Validation and Case Studies: Application of the developed methodology to real cases, in collaboration with partnering companies, to demonstrate its effectiveness and applicability across different sectors.

Implications and Expected Outcomes:

The success of this research will have significant implications for both the scientific and industrial communities, offering a new approach to technological knowledge management and innovation. This work will facilitate the inventive design process, accelerate the development of new technologies, and enhance companies' competitiveness. Furthermore, the methodology and tools developed can be adapted to various domains of application, thus contributing to the advancement of research and innovation on a global scale.

Future potential enhancement:

Another potential source of knowledge residency is scientific publications. Often, they are either associated with patents or at the early stages of knowledge discovery. If the complexity of the progresses in AI allows us to achieve it, we would like also to explore the possibility to fuse knowledge from both patents and scientific publications to constitute and even larger corpus of knowledge representation dedicated to inventive design studies.

Conclusion:

This thesis aims to push the boundaries of knowledge management and inventive design. By leveraging technological advancements and innovative methodologies, it seeks to transform how companies and researchers access and use the knowledge contained in patents, paving the way for a new era of conscious and targeted innovation.