Job offer – PhD in AI & Computer Science

Research Project Short Title as Submitted to CEFIPRA: "ADEPT - AI-assisted Energy Portfolio Optimization Toolkit for Renewable Energy-rich Grid Management**"**
Principal Investigator contact: "Noel Crespi, noel.crespi@mines-telecom.fr**",** Telecom SudParis, Institut Polytechnique de Paris, France

Reference Number of the Job Offer: IFI_CEF_24_07

Project description

- **Keywords:** Artificial Intelligence Energy Forecasting, Time-Series Data, Predictive Models; Grid Management;

- **Context:**

  As per the International Energy Agency (IEA), the energy sector accounts for more than three-quarters of greenhouse gas emissions globally. Replacing coal, gas, and oil-fired power with renewable energy (RE) sources, such as wind and solar, would be key to dramatically reduce carbon emissions and meet the net-zero targets. Therefore, it is imperative to bolster the operations of the energy sector with RE-rich generation resources. However, the RE-rich grids are currently facing significant challenges in ensuring a stable and resilient energy supply due to the drastic and unpredictable variations in the energy supply from RE sources and also incurring significant penalties due to real-time deviations exceeding the permissible errors on the demand and supply of the energy. The rise in unpredictability on both supply and demand sides calls for the intervention of Artificial Intelligence (AI) based modeling and intelligent energy analytics.

- **Abstract of the Research Project:**

  The PhD candidate will take part in the ADEPT project which aim is to build the energy portfolio optimization toolkit for the RE-rich grid operators that enable accurate energy forecasting using AI/ML-based models, data-driven energy scheduling, and efficient power procurement decisions and augment with the blockchain technology to manage the energy operations database. Overall, we envision such a framework will help improve grid energy balancing, reliability, and maximize the cost-effectiveness, and transparency of operations to enable successful transition toward the cleaner and sustainable power system. Accordingly, in this project, we will first build an ensemble of RE forecasting models that provide more reliable and accurate energy forecast data. Second, we will develop a multi-objective stochastic optimization-based scheduling platform to optimally plan the power procurement decisions based on the prevailing power generation and load demand. Third, we will build an immutable energy database to realize transparent, traceable, and secure decision-making for RE grid operations.

- **Scientific Objectives of the Project:**

  To assist the grid operators in matching the demand and supply of power in the grid, the accurate forecasting of the real-time and day-ahead renewable energy generation, the load demand to be supplied and prevailing electricity market prices is required. However, renewable energy generation processes, load and price variations can be very hard to model due to their inherent natures of intermittency, stochasticity and fluctuation. A fundamental step in this process involves the creation of a data standardization pipeline to unify large-scale time-series data from disparate sources and thereby facilitating intelligent data analysis and the subsequent development of predictive models. The development of models should encompass the

investigation of a wide range of methodologies, including shallow models, deep learning models, and hybrid approaches. Given the time-series nature of the data, it is also essential to implement a continuous learning pipeline and establish monitoring metrics to ensure that the models remain up-to-date to deliver robust forecasting results.

- **Methodology and Timeline**

This project will be jointly worked by the India and French Academia and Industry partners for the duration of 3 years. Accordingly, there are four key work packages in this project. We plan to develop the key AI models and energy scheduling toolkit by the end of second year with preliminary testing at the Institutional infrastructure. Further, the Industry partners in India will help us take the prototype developments for the deployment, testing and validation at the Industry scale testbed for the period of third year to ensure the quality of our deliverables to reach the desired level TRL-4. By the end of the project, we aim to have impactful publications in relevant top tier conference and journals, and deliver the i) Ensemble of AI-models ii) Algorithm for Grid Scheduling iii) Blockchain database and all the necessary transfer learning reports.

Candidate profile

The Data Intelligence and Communication Engineering Lab (https://dice.wp.telecom-sudparis.eu/) of Institut Polytechnique de Paris, Telecom SudParis invites applications for a PhD position in Data Science (PhD from Institut Polytechnique de Paris https://www.ip-paris.fr/en/education/phd-programs). The institute is a telecommunications and IT research and education centre, located in the South of Paris, France (https://www.ip-paris.fr/en/about).

- Only Indian candidates or candidates with a research experience in India are eligible; French candidates are not eligible
- Recent master degree in Data Science, Computer Science.
- Research background in relevant technologies (Machine learning, AI, NLP, etc)
- Experience in research is mandatory, track record of publications in known venues.
- Coding experience in python and familiarity with ML libraries and databases
- Talented individuals with strong motivation, team spirit, autonomy.
- Excellent English skills are a prerequisite. French is not needed as English is the working language.
- <u>Expected starting date</u>: **September 2024**

Application Process:
Documents to be provided :
   i. Cover letter (reasons for the candidature, professional project …) max 2 pages
  ii. Copy of the master's degree or a proof of the program followed (and expected date of end). Transcript of Bachelor and Master degrees.
  iii. A copy of results for previous scholarship (optional, max 3 pages)
  iv. Curriculum vitae
  v. Two letters of recommendation: one from any Indian institution and one from the French institution planned to host the candidate –mandatory- (max 2 pages)
  vi. All should be submitted within 1 pdf file of no more than 10 pages.

Applications should be submitted to the following email address: msi@ifindia.in mentioning the reference number of the Job offer clearly.

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Candidates are requested to contact the French scientific principal investigator of the project before submission. A recommendation letter from the scientific principal investigator is mandatory.

Benefits:

- Monthly allowance of 1710 euros for PhD
- Travel allowance
- University fee
- Carte de séjour fee
- Campus France management fee
- Registration to the French social security scheme

Selection process:

Selection is made by a dedicated selection committee of at least 4 persons. Decisions will be transmitted by the Embassy of France to CEFIPRA. **No consideration will be given for candidates with no recommendation letter from the French institution.**

Criteria for applicants' selection:

 Academic excellence

- Excellence of the Academic background, Academic records, Honors, Letters of support, Participation to international research projects, exchange programmes and conferences.

 Motivation and qualities

- Academic maturity: appropriation of the thesis project (stakes and contexts) • Quality of the presentation (oral expression, skills for synthesis, English level) • Maturity of the professional project: capacity to project her/himself within five years in terms of career development.

About CEFIPRA:
Indo-French Center for the Promotion of Advanced Research (CEFIPRA/IFCPAR) is an Indian body which promotes scientific cooperation between France and India in advanced fields of Science and Technology. It is supported by the Department of Science and Technology, Government of India and the Ministry of Europe and Foreign Affairs of the French government.