



PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 37th cycle

Research Area n. 1 - Computer Science and Engineering

**PON - GREEN Research Field: DESIGN OF ARTIFICIAL INTELLIGENCE TECHNIQUES FOR
ONLINE PLANNING AND THEIR APPLICATION TO THE REGULATION OF GAS
DISTRIBUTION NETWORKS**

Monthly net income of PhDscholarship (max 36 months)

€ 1250.0

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field	This research aims at developing new artificial intelligence algorithms integrating offline ML techniques (to produce accurate predictions) together with online optimization techniques (for just-in-time reoptimization). Such algorithms are particularly suitable for planning in complex, dynamic settings. Natural applications include the green sector, particularly for smart grids. The techniques developed in this research will be applied to the gas pressure regulation in the distribution network.
Methods and techniques that will be developed and used to carry out the research	Innovative AI techniques capable of integrating offline ML approaches with online optimization techniques for just-in-time reoptimization will be developed. This is a new AI branch (e.g., by DeepMind [1]) that naturally applies to the green sector. [1] https://arxiv.org/abs/2104.06294 .
Educational objectives	The student will learn methods from data science, AI/ML, and optimization, that are central topics in computer science (e.g., [1]). Furthermore, she/he will learn knowledge on the green domain thanks to the collaboration with the company. [1] https://academicpositions.it/ad/kth-royal-institute-of-technology/2021/doctoral-student-in-machine-learning-for-smart-grids/163227 .



Job opportunities	Many utility companies are building AI teams, e.g., A2A and ATOS (which are currently signing an agreement with the JRC in AI of PoliMi). The expertise needed by those companies are: data science, machine learning algorithms, and optimization.
Composition of the research group	0 Full Professors 2 Associated Professors 1 Assistant Professors 2 PhD Students
Name of the research directors	Prof. Nicola Gatti

Contacts
Prof. Nicola Gatti nicola.gatti@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	566.36 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Terranova Software
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	King's College London
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Terranova company will share a large amount of data on the users' consumptions of gas and energy, including data from the Italian GME.</p> <p>EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student per year 2nd year: euros per student (1534)</p>



3rd year: euros per student (1534)

TEACHING ASSISTANTSHIP: (availability of funding in recognition of supporting teaching activities by the PhD student)

There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

COMPUTER AVAILABILITY:

1st year: individual use

2nd year: individual use

3rd year: individual use

DESK AVAILABILITY:

1st year: individual use

2nd year: individual use

3rd year: individual use

RELEVANCE TO THE THEMES OF THE PROGRAMME

The objective of the call is related to the topic "Tecnologie per le smart grid, le fonti rinnovabili e la generazione distribuita" of the Strategia Nazionale di Specializzazione Intelligente (SNSI) and to the topic "Reti intelligenti, flessibili, integrate, resilienti e digitalizzate per una piena integrazione delle FER" (Art. 2 of Area 5 "CLIMA, ENERGIA, MOBILITÀ SOSTENIBILE" of PNR, Pag. 123).

The techniques that will be developed in this research will optimize the distribution network to avoid quick pressure changes which are the main reason for gas leaks. Since gas has a greenhouse effect much higher than CO₂ (e.g., more than 70 times for methane), limiting the gas emission is crucial.