POLITECNICO DI MILANO

PhD in DATA ANALYTICS AND DECISION SCIENCES - 40th cycle

INTERDISCIPLINARY Research Field: HARNESSING ARTIFICIAL INTELLIGENCE TO TURN COMMERCIAL TRAINS INTO INFRASTRUCTURE MONITORING DEVICES

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0
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	Interdisciplinary PhD Grant The PhD research will be carried out in collaboration with research groups of the PhD programme in "**MECHANICAL ENGINEERING**". See https://www.dottorato.polimi.it/?id=422&L=1 for further information.
Methods and techniques that will be developed and used to carry out the research	We will *apply recent machine learning techniques, in particular **multimodal Large Language Models (LLMs) and related Deep Learning techniques**, to analyse sequences of accelerometer data from sensors on commercial trains*. The aim is to learn models for estimating the rail geometry directly from the noisy sensor data, using measurements from dedicated track recording vehicles as ground truth. Once a valid model has been found, redundancy provided by data from an entire fleet of vehicles should enable continuous validation, and the possibility to carry out preventive maintenance. In developing the project, we will make use of a large amount of real data from a commercial fleet operator together with the ground truth geometry monthly measured by a dedicated vehicle. By facilitating near-continuous monitoring of track geometry through sensors on commercial fleet vehicles, we envisage *massive improvements in track monitoring and resulting economic benefits.*

Educational objectives	The research will be carried out in collaboration with an interdisciplinary team of computer systems and mechanical engineers. Knowledge of the data and current analysis techniques are specific to the rail context and require expertise from mobility and mechanical engineering, while knowledge of advances in deep learning requires a machine learning expert from this subfield of data analytics. Within this lively and stimulating academic research environment, the doctoral student will be educated to become a skilful researcher in data science, deep learning, and mobility engineering.
Job opportunities	The profile of data scientist and deep learning engineer with expertise at the PhD level are in short supply and highly sought after by industry. Moreover, the technological solutions proposed in this project will be of interest to a range of actors, including transportation companies and policy makers.
Composition of the research group	0 Full Professors 2 Associated Professors 1 Assistant Professors 0 PhD Students
Name of the research directors	Proff. Carman, Somaschini, Facchinetti

Contacts
Prof Mark Carman (DEIB) Prof Claudio Somaschini (DMECC) Prof Alan Facchinetti (DMECC) Contact: Prof. Mark Carman E-Mail: mark.carman@polimi.it Voice: 0223993628 Web https://www.deib.polimi.it/eng/people/details/1439980

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	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

There are various forms of financial aid for activities of support to the teaching practice.

Educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences):

Financial aid per PhD student per year:

1st year: max 1.902,38 euro per student

2nd year: max 1.902,38 euro per student

3rd year: max 1.902,38 euro per student

Teaching and lab assistantship: availability of funding in recognition of supporting teaching and lab activities by the PhD student.

Further support is available for students who engage in activities of teaching or additional lab duties coherent with their academic mission and doctoral training.

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*