**Nombre de Tutor del proyecto:** Mariella Dimiccoli

**Nombre del Grupo de investigación asociado a AI-HUB:** RobIRI: Robot Perception and Manipulation at IRI (Instituto de Robótica e Informática Industrial)

**Ubicación del centro donde se disfrutará la beca:** Carrer Llorens i Artigas 4-6, 08028, Barcelona

**Título del proyecto:** Advancing self-supervised deep learning in graph-structured domains.

**Descripción del proyecto**: During the last decade, supervised deep learning based methods have achieved impressive performance in a variety of tasks ranging from image classification to automatic language translation. However, supervised approaches require to label huge amounts of data, which is often too time-consuming or even impracticable because of data scarcity or expert knowledge requirements. Additionally, supervised approaches are

To cope with this problem, self-supervised approaches have recently emerged as a new deep learning paradigm that allows to train a model on a proxy-task with pseudo-labels that automatically generated from the data themselves, without the need of manual annotations. These techniques are particularly attractive in real world scenarios and have already proven successful in many domains, e.g., vision, natural language processing, or robotics, where they may even outperform the supervised counterparts [1]. However, these developments are still limited to the Euclidean domain, hence strongly limiting their application range. Graphs are commonly used to describe the geometry of non-Euclidean structured data in a wide range of data science domains, including social networks, physical and biological systems. Yet, the development of self-supervised learning on graph-structured data remains a challenge to the current status of the research [2].

In this project, the student will join recent efforts of the group towards developing a generative approach that learns graph node representations in a self-supervised fashion, while preserving relevant graph properties.
The originality and potential of our approach resides in the use of graph structure local and global properties to provide supervisory signals for the pretext task.
Given the practical advantages of self-supervised learning and the fact that graph structured data is ubiquitous throughout several disciplines and real world problems, the results of this work are expected to have high impact.

Through this project the student will acquire significant knowledge and skills in several aspects. From a methodological point of view, he will be confronted with and manipulate the most recent machine learning models in graph neural networks and self-supervised learning.
From a practical point of view, he will be working on an important and concrete application problem using public benchmarks for representation learning on graphs and gain expertise in the latest deep learning development frameworks (such as PyTorch).

[1] Jing L, Tian Y. Self-supervised visual feature learning with deep neural networks: A survey. IEEE Transactions on Pattern Analysis and Machine Intelligence. 2020 May 4.
[2] Jin W, Derr T, Liu H, Wang Y, Wang S, Liu Z, Tang J. Self-supervised learning on graphs: Deep insights and new direction. arXiv preprint arXiv:2006.10141. 2020 Jun 17.