MARIE SKŁODOWSKA-CURIE POSTDOCTORAL FELLOWSHIPS 2025
EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa, Lisbon, Portugal

RESEARCH GROUP AND URL

Data Science Research Stream: https://magic.novaims.unl.pt/en/about-us/research-lines/

SUPERVISOR (NAME AND E-MAIL)

Flávio Luís Portas Pinheiro (fpinheiro@novaims.unl.pt)

SHORT CV OF THE SUPERVISOR

Flavio L. Pinheiro is an Assistant Professor in Data Science at NOVA IMS – Universidade Nova de Lisboa. He holds a PhD in Physics from the Universidade do Minho (2016) and was a Postdoctoral Associate at the MIT Media Lab (2016-2018). His research applies data, network, and complexity sciences methods to study topics that include information diffusion and social contagion processes, strategic decision-making, local and global network patterns in education, and economic diversification and sophistication patterns. His interdisciplinary work has been published in top-tier journals and conference proceedings in various disciplines, such as Nature Communications, Research Policy, Regional Studies, EPJ Data Science, Physical Review Letters, PLOS Computational Biology, Theoretical Computer Science, Journal of the Royal Society Interface, Structural Change and Economic Dynamics, International Conference on Autonomous Agents and Multiagent Systems, Proceedings of the European Conference on Artificial Life. Moreover, he has experience in applied research projects and consultancies, including work for the World Bank on smart and inclusive economic diversification in several developing economies, for the OECD on promoting improved frameworks for public procurement contracts, and participation in the Bank of International Settlements conference in joint work with the Bank of Portugal.

5 SELECTED PUBLICATIONS

- **Pinheiro, F. L.**, Hartmann, D., Boschma, R., & Hidalgo, C. A. (2022). The time and frequency of unrelated diversification. *Research Policy*, *51*(8), 104323.
- **Pinheiro, F. L.**, Balland, P. A., Boschma, R., & Hartmann, D. (2022). The dark side of the geography of innovation: relatedness, complexity and regional inequality in Europe. Regional Studies, 1-16.
- Alshamsi, Aamena, **Flávio L. Pinheiro**, and Cesar A. Hidalgo. "Optimal diversification strategies in the networks of related products and of related research areas." Nature communications 9.1 (2018): 1328.
- **Pinheiro, Flávio L**., Francisco C. Santos, and Jorge M. Pacheco. "Linking individual and collective behavior in adaptive social networks." *Physical review letters* 116.12 (2016): 128702.
- Vasconcelos, Vítor V., Simon A. Levin, and **Flávio L. Pinheiro**. "Consensus and polarization in competing complex contagion processes." *Journal of the Royal Society Interface* 16.155 (2019): 20190196.

PROJECT TITLE AND SHORT DESCRIPTION

I am looking to supervise projects in areas related with applied Network and Data Science methods to the study of Economic and Social systems. Below I describe a few examples of projects.

1. **Smart Strategic Diffusion on Networks of Related Economic Activities.**

The success of what we choose to do next is often conditional on what we know. For instance, the difficulty of learning a new skill is certainly conditional on our initial knowledge base. Arguably, it is certainly easier for a Portuguese person to learn Spanish rather than Chinese as languages can be more/less similar in their structure. However, learning Spanish will certainly open different opportunities, perhaps more related, than Chinese. As such, choosing what to learn next is often a strategic decision that requires balancing the costs of learning with the benefits obtained. In this project, we will contribute to a recently growing literature on Knowledge Networks that have been empirically mapping the structures of relatedness between different types of activities — Industries, Occupations, Products, Academic Fields, etc. — given their overlap in related requirements. The goal is to find optimal learning diffusion strategies in such networks in a competitive environment but also, in the context of Economic Diversification, to offer a more comprehensive roadblock for diversification and inclusive economic growth in a competitive landspace.

2. Misinformation and Polarization: Between and Within Social Media Spaces

In recent years we have seen an increase of Social Polarization that threatens the functioning of traditional institutions, which have evolved to help society overcome some of its fundamental challenges. Nowadays, our institutions are seemingly inadequate to deal with the fast changing social attitudes that operate through social media platforms and that result in unexpected dynamics. Indeed, social polarization has been in part the consequence of such a new medium in which ideas, opinions, and world views are exchanged between individuals combined with the algorithmic inner workings of each platform to promote user retention. However, these platforms also leave individuals more exposed to the actions of ill-intended actors looking to shape social opinions (e.g., through the viral spread of misinformation).
In that sense, and although much research has been done about the social dynamics of users within platforms, little has been done to understand the dynamics of users between platforms. Do different platforms result in different degrees of polarization? Is there also polarization in terms of the audience of each platform? How is that better described? What top ics and types of misinformation spread more virally in each platform?
These are very broad questions that we look to start exploring in this project, by creating a curated dataset that can shed light on the dynamics within and between social media platforms, with a specific emphasis on the role of misinformation and the phenomena of social polarization.

3. The Moral Foundations of Political Discourse

Jonathan Haidt theory on Moral Foundations has allowed us to identify the key between Conservatives and Liberals. Recent works have used text mining to extract the morality embedded in political corpus, an approach that provides a view on to which audience each political actor is appealing to quantify how polarized are their views. While much work has been done in the US political sphere, which is characterized by the dominance of two political parties, in Portugal and Europe there is much to be done. Building on previous work, the goal of this project is to study how Portuguese political actors have used morality when discussing topics on abortion, climate, economy, church, and euthanasia. Does the more complex Portuguese political environment show the same key divide between Conservatives and Liberals previously reported in the US? How have the different political actors in our democracy have used morality? Is the Left/Right political spectrum a good characterization of our political ecosystem or are there better alternatives, such as Center/Extremes or Liberal/Conservatives? To this end we will work on a rich parliamentary speech data from Portuguese (50 years) and EU (~15 years) parliament and existing NLP tools for morality extraction.

4. Coordination and Cooperation in Heterogeneous Networked Multiagent Systems

With the increasing importance and deployment of intelligent autonomous systems, such as LLMs, it is crucial to understand their utility and impact to the functionality of social systems. Indeed, humans will participate more and more in environments that mix artificial with real agents. In that sense, I am interested in supervising projects that look to use LLMs in the context of

interacting multi agent systems and understand what the consequences to the dynamics of social systems are: opinion dynamics, cooperative games, coordination, misinformation propagation. This research has two possible outcomes: one is to provide a better understanding of the dynamics of such heterogeneous systems; a second is to elaborate on leveraging LLM based agents to deploy social interventions.

5. Science of Science – Academic Performance Indicators

As with many areas of our society and industry, academic institutions also resort to metrics to assess the quality of researchers, of their work, and of journals. Measures such as the number of citations, impact factors, SJR index, h-index, or i10 index have become core indicators used to determine grants or career progression but also the prestige of scientific journals and conferences. Moreover, the volume of publications has increased exponentially over the years. A straightforward implication of such growth is that citations (the fundamental currency of academic gravitas) are more abundant nowadays than before, and as such have less "value" (i.e., it is easier to obtain citations now than in the past). This simple idea of "Citation Inflation" is, however, not accounted for in all the metrics at use, but can have profound implications in the way we assess academic productivity across different fields. Indeed, the academic ecosystem is composed of many subfields (biology, economy, computer science, engineering, physics, etc …) that weakly interact (through citations) and that experienced growths at different rates (i.e., different inflation levels) meaning that citations from, say, economy might have a different value than citations from computer science. Again, this observation implies that, without a proper correction, it is not easy to compare the productivity of researchers from different fields.
The goal of this project is to leverage a dataset of academic publications and historical citations patterns — between papers and researchers — to estimate the true value of 1 citation unit across different academic fields. Drawing parallel with monetary theories and fundamentals, we look to reassess the impact of an inflationary correction in common academic metrics; identify which academic fields have more value; and provide a citation exchange chart to provide a fair comparison in terms of the academic productivity of researchers between different fields.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST*

Social Sciences and Humanities (SOC) • Economic Sciences (ECO) • Information Science and Engineering (ENG) • Mathematics (MAT) • Physics (PHY)