



MARIE SKŁODOWSKA-CURIE POSTDOCTORAL FELLOWSHIPS 2024 EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa

RESEARCH GROUP AND URL

Algebra and Logic Group

SUPERVISOR (NAME AND E-MAIL)

João Araújo (jj.araujo@fct.unl.pt)

SHORT CV OF THE SUPERVISOR

Full Professor of Mathematics Augmented Intelligence Theorem Proving (AgITP) applied to algebra and combinatorics System Proverx (<u>https://www.proverx.dm.fct.unl.pt/login.php</u>)

5 SELECTED PUBLICATIONS

- J. Araújo et al., The existential transversal property: a generalization of homogeneity and its impact on semigroups, Trans. Amer. Math. Soc. 374 (2021), no. 2, 1155–1195.
- J. Araújo et al., Integrals of groups, Israel J. Math. 234 (2019), no. 1, 149–178.
- J.Araújo et al., Orbits of primitive k-homogenous groups on (n-k)-partitions with applications to semigroups, Trans. Amer. Math. Soc. 371 (2019), no. 1, 105–136.
- J. Araújo et al., Between primitive and 2-transitive: synchronization and its friends, EMS Surv. Math. Sci. 4 (2017), no. 2, 101–184.
- J. Araújo et al., SAT-Based Techniques for Lexicographically Smallest Finite Models, Proceedings of the AAAI Conference on Artificial Intelligence 38 (8), 8048-8056
- J. Araújo et al., A survey on varieties generated by small semigroups and a companion website, J. Algebra 635 (2023), 698–735.
- J. Araújo et al., A transversal property for permutation groups motivated by partial transformations, J. Algebra 573 (2021), 741–759.

PROJECT TITLE AND SHORT DESCRIPTION

Project Proposal: Advancing the ProverX System for Augmented Intelligence Theorem Proving

Abstract: This project seeks to further develop the ProverX System, a sophisticated platform for Augmented Intelligence Theorem Proving. By integrating advanced mathematical algorithms, AI techniques, and deep mathematical knowledge, ProverX aims to automate operations traditionally performed by mathematicians (conjecturing, generalizing, proving, etc.). The system consists of a kernel capable of proving theorems or finding counter-examples. Built on it are numerous specialized packages that assist in conjecturing and proving diverse types of theorems, such as minimal defining bases of axioms, forbidden substructure theorems, and representation theorems,





among many others. Its power has already been demonstrated by producing theorems published in leading mathematics journals and solving a substantial number of open problems.

Objective: The goal of this project is twofold:

- 1. Algorithm Development: Extend ProverX's capabilities by encoding new algorithms in Python.
- 2. **Application of Existing Packages:** Use the current suite of packages to prove new mathematical results with aumented intelligence power.

Ideal Candidate: We seek applicants who can contribute to algorithm development, application of existing packages to find new theorems, or both, offering a unique opportunity to engage in cutting-edge mathematical research at the intersection of AI and theorem proving.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST*

Mathematics (MAT)

*Scientific Area where the project fits best – Please select/indicate the scientific area according to the panel evaluation areas: Chemistry (CHE) • Social Sciences and Humanities (SOC) • Economic Sciences (ECO) • Information Science and Engineering (ENG) • Environment and Geosciences (ENV) • Life Sciences (LIF) • Mathematics (MAT) • Physics (PHY)