Open call for a doctoral candidate on assistant position

in the Institute of Mathematics of Polish Academy of Sciences

related to project 101120290 — GAP — HORIZON-MSCA-2022-DN-01

Applications must be submitted by **November 30, 2023**. Please send them via application form on Application | Gap Project (gapmscaproject.com) as well as to pdlotko@impan.pl. The application should contain a CV, a Research Statement, a list of publications and a brief description of the candidate's work in relation to the project. After inviting the Candidate to the interview two letters of recommendation will be required**.** DC can be of any nationality but must not have resided or carried out their main activity (work, studies, etc.) in the country of the recruiting organization for more than 12 months in the 36 months immediately before their recruitment date. DC must be available to enroll full-time in the PhD program at the Host institution; eventual suspensions for family or personal reasons shall be discussed with the granting authority. The Candidate must be available to move between the collaborating universities according to a mobility plan defined at recruitment time and to complete secondments (temporary transfer to another GAP partner) during the term of her/his employment.

About the project. The project provides multidisciplinary and comprehensive training for young and talented researchers leading to a combined experimental and numerical approach for accurate and precise detection of bone fractures (study of bone microarchitecture, understanding of damage mechanisms, improving the reliability of fracture risk indicators, performing a more accurate diagnosis of bone pathology) and their minimally invasive treatment. The key aspect of the training will be interdisciplinary discoveries using state-of-the-art multi-scale imaging equipment and advanced AI-based strategies.

The project will be implemented in cooperation with the following institutions:

Politecnico Di Milano (POLIMI), Italy
Ospedale Galeazzi Spa (IOG), Italy
Norges Teknisk-Naturvitenskapelige Universitet Ntnu (NTNU), Norway
Technische Universiteit Eindhoven (TU/e), Netherlands
Elettra – Sincrotrone Trieste Scpa (TCD), Italy
The Provost, Fellows, Foundation Scholars & The Other Members Of Board, of The College of The Holy & Undivided Trinity of Queen Elizabeth Near Dublin (TCD), Ireland
Centre National De La Recherche Scientifique Cnrs (CNRS), France
Technische Universiteit Delft (TU Delft), Netherlands.

Your work in the project. Your task will be to work at the Dioscuri Centre in Topological Data Analysis as part of the GAP project under the supervision of Paweł Dłotko. Our task in the project is a comprehensive analysis of the image structure of the trabecular bone based on the image from the synchrotron and microtomograph. In this aim we will adopt existing and develop new methods of computational geometry and topology to find important bone properties that will distinguish healthy bones from diseased bones.The algorithms we will design will operate on very large data (a typical synchrotron image contains about 1 terabyte of data), which will require effective implementation of the proposed algorithms with the use of selected HPC tools. Then, the obtained topological characteristics will be used with the help of machine learning methods and artificial intelligence to make predictions – both local (prediction of where in the bone a fracture may occur) and global (aiming to determine the risk of fracture in a given time horizon). In this project, you will expand your knowledge of topology and computational geometry, use the latest computing technologies that scale to big data, as well as machine teaching and artificial intelligence methods. You will also cooperate with PhD students and scientists from other fields of science represented in the project. The project requires good mathematical culture, knowledge of programming and openness to new experiences. In return, it offers an excellent working atmosphere in an international team, algorithmic Thursdays and financing at the European level.

About the Dioscuri Centre in Topological Data. The Dioscuri Centre is a part of the Max Planck Society environment. The Centre is led by Paweł Dłotko. Paweł is a mathematician and computer scientist; he graduated in 2012 from Jagiellonian University. Subsequently he was working as a researcher at the University of Pennsylvania, Inria in Saclay, and in Swansea University. Paweł's aim is to use rigorous methods of mathematics outside mathematics. To achieve this Paweł has developed a number of computational techniques that have been implemented in software libraries including Persistence Landscape Toolbox, taking part in development of the Gudhi library as well as the RBallMapper CRAN package. Paweł is actively working with experts in electrical engineering, economics, finance, material science, neuroscience, medical professionals and more. The Centre currently hires three postdocs (Justyna, Bartosz and Rafał and three PhD students Davide, Jan and Niklas). Please consult our webpage for further details. Feel free to email us about any informal questions.

Additional information you may find on https://dioscuri-tda.org/ and www.gapmscaproject.com. Any questions address to pawel.dlotko@impan.pl.

Deputy Director
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Prof. dr. hab. Adam Skalski