



Międzynarodowa Środowiskowa Szkoła Doktorska
przy **Centrum Studiów Polarnych**
w Uniwersytecie Śląskim w Katowicach

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No. of PhD project: IEDS/2024/IM/A

Title of PhD project: Topological methods in medical diagnosis.

The leading unit: Institute of Mathematics Polish Academy of Sciences

Requirements:

Good knowledge of mathematics, in particular topology and algebra, good programming skills in Python and C++, ability to learn and collaborate with interdisciplinary environments including industrial partners.

Tasks description:

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 microtomography. 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.

Other information:

The work will be carried out under supervision of: Paweł Dłotko, Dioscuri Centre for TDA, Institute of Mathematics Polish Academy of Sciences

Secretary of the IEDS Recruitment Committee: +48 32 3689 380, e-mail: polarknow@us.edu.pl

Information on the IEDS admissions: <https://www.mssd.us.edu.pl/en/admission-2024-2025-proj/>