

Subject: **Implicit neural representations for biomedical image analysis**

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Description: Implicit Neural Representations (**INRs**) are gaining momentum in deep learning and computer vision. These networks, typically implemented as multi-layer perceptrons with specialized architectures, are used to represent various quantities, starting from image pixels in computer graphics to complex physical parameters in biomedical imaging. INRs are still in their infancy in the context of biomedical image analysis, providing space for exploration and innovation. Efficient implicit networks have the potential to fundamentally reshape numerous biomedical imaging tasks, such as disease diagnosis, image reconstruction, atlas generation and data visualization.

The aim of this PhD project is to advance the field of implicit representations on a fundamental level. The project consists of two main tracks:

Methodology part:

- Developing novel neural network architectures and training methods
- Efficient representation of complex fields (e.g. multimodal data, ultra high-resolution images)
- Learning in weight spaces as a new paradigm for pattern recognition
- Meta-learning for developing implicit networks that can represent large datasets

Applied part:

- Physics-informed implicit networks for estimation of physical quantities in ultrasound and magnetic resonance imaging
- Implicit methods for reconstruction of biomedical images
- Diagnostic applications, e.g. efficient transfer learning techniques for cancer detection

Profile of the Candidate:

Applicants should have a Master's degree in computer science, engineering, applied physics or related areas. Potential candidates should have a good understanding of modern machine learning methods and basic familiarity with one of the commonly used deep learning frameworks, such as PyTorch. Candidates are advised to email Michał Byra (mbyra@ippt.pan.pl) before submitting the documents.