Open PhD Position at the Department of Mathematics "Tullio Levi-Civita" - Academic Year 2020-21

Numerical methods for the calculation of Wasserstein-1 distances with application to WGANs

Project Aim: Development of efficient numerical methods for the calculation of Wasserstein-1 distances between two positive measures. The objectives are to extend and optimize the efficiency of the DMK approach developed at the Department of Mathematics "Tullio Levi-Civita", University of Padova, for applications to WGAN (Wasserstein Generative Adversarial Networks) artificial Intelligence algorithms.

Project Description: Recently the numerical analysis group at the Department of Mathematics "Tullio Levi-Civita", Universtisy of Padova has developed an efficient formulation of the Optimal Transport (OT) problem based on a Dynamic Monge-Kantorovich (DMK) approach. This PDE-based formulation provides an efficient numerical tool for the solution of OT problems and the evaluation of Wasserstein metrics.

This PhD project will address extensions and adaptations of this approach for their specific applications to WGAN, with the aim of improving their numerical efficiency and accuracy. Applications to several problems, including seismic inversion and medical imaging are envisioned.

The PhD student will need to acquire specific training in Optimal Transport theory and numerics as well as machine learning. The first year will be dedicated partially to courses (intensive or part of the teaching offered by the PhD School) on OT-related topics. In addition to courses, frequent visits to FBK will procure the necessary GAN and AI related background.

The PhD student will work in coordination with "Fondazione Bruno Kessler - Trento" and "Padova Neuroscience Center". The student will be asked to spend periods in the different institutions, in particular FBK, working on the topics of common interests.

Admission requirements: Highly motivated candidates are expected to have excellent analytical reasoning and a solid mathematical and numerical background, as well as good programming skills (at least one of Matlab, Python, C, Fortran). Ability to work in interdisciplinary research and good communication skills are required. Eligible candidates must hold a Master's degree by the beginning of the 2020-21 Academic Year.

Duration: The PhD scholarship is for three years starting from Academic Year 2020-21

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In collaboration with:

Fondazione Bruno Kessler - Trento (B. Lepri and G. Santin)
Padova Neuroscience Center (C. Campi and S. De Marchi)

Deadline for applications: June 16, 2020 (1pm).

Information: https://www.unipd.it/en/node/1053, https://dottorato.math.unipd.it/