Leslie Comrie Seminar Series 2023/24

Wednesday 29 November 2023, 15:00-16:00

Speaker: Dr Angelica Aviles-Rivero, University of Cambridge

Deep Inverse Problems: From Plug-and-Play Methods to Implicit Neural Representations

Abstract

In recent years, the adoption of Plug-and-Play (PnP) methods in solving inverse problems has gained significant traction. However, recent developments in PnP algorithms have primarily focused on the integration of pretrained deep learning denoisers as priors, a process that demands substantial amounts of clean image data for denoiser pretraining. While data-driven deep learning models continue to evolve and deliver impressive results, the emergence of Implicit Neural Representations (INR) represents a noteworthy breakthrough. INR exhibits the ability to model complex and high-dimensional data without the need for explicit parameterisation. These implicit neural priors can efficiently serve as single shot denoisers within the PnP framework.

The first part of this talk introduces a novel framework for single-shot PnP methods, addressing the challenges associated with data-intensive denoiser pretraining. In the second part, we delve into the implicit neural representations, introducing a function designed to harness the combined strengths of strong spatial and frequency attributes, departing from conventional methodologies. Notably, our novel technique demonstrates remarkable performance improvements across a diverse range of downstream tasks, with a particular focus on applications like CT reconstruction and denoising. Through rigorous experimentation, we provide a comprehensive understanding of the advantages offered by our approach.

Biography

Dr Angelica Aviles-Rivero is a Senior Research Associate at the Department of Applied Mathematics and Theoretical Physics (DAMTP), University of Cambridge. Her work focuses on the confluence of computational mathematics, computer vision, and machine learning, where she addresses complex real-world problems on a large scale. Her expertise lies in developing large-scale mathematical and machine learning models with minimal or even no supervision. This has led to her being sought after for consultations by various centres and companies. She has large experience in organising scientific, including BMVC2022 & BMVC 2023 (co-organiser), MIUA22 (co-organiser), MICCAI Tutorials, ACCV Tutorials, IGARSS Tutorials, and GeoMedIA Workshop. She serves as a current SIAM SIAG/IS Officer. For more info: https://angelicaiaviles.wordpress.com/