PADOVA
neuroscience
CENTER

12 FEBRUARY 2026 3:00 pm
SALA SEMINARI VIMM
(Via Giuseppe Orus 2, Padova)

PNC SEMINARS

A talk by Marco Castellaro and Mattia Veronese
(University of Padova)

BRAIN PERFUSION AND CLEARANCE MEASURED WITH MRI: FROM MODELING TO ARTIFICIAL INTELLIGENCE QUANTIFICATION METHODS

(Marco Castellaro)

Brain perfusion and fluid clearance are tightly coupled processes that sustain brain metabolism and waste removal, and their impairment is increasingly linked to ageing and neurodegeneration. MRI offers a unique, non-invasive window into both domains; however, translating rich image signals into robust physiological markers remains challenging due to low signal-to-noise ratio, inter-subject variability, and the need to disentangle concurrent transport mechanisms.

This seminar presents a methodological pathway “from modelling to artificial intelligence” for quantifying perfusion and clearance with MRI. I will first introduce biophysical and kinetic models used to interpret dynamic perfusion data, and then discuss how AI-driven quantification—particularly deep learning—can improve parameter estimation and robustness.

In the second part of the talk, I will show how clearance can be indirectly investigated using AI-based segmentation techniques to provide a morphological characterization of the choroid plexus, a highly vascularized structure involved in cerebrospinal fluid production and brain homeostasis.

NORMATIVE MODELLING AND IMAGING TRANSCRIPTOMICS FOR NEUROIMAGING SCIENCES

(Mattia Veronese)

Despite numerous advancements in neuroimaging sciences, the use of neuroimaging as a quantitative biomarker for clinical applications remains limited. One key challenge is the predominant reliance on cross-sectional frameworks for analyzing neuroimaging data, rather than focusing on single-subject statistics. Additionally, cross-sectional approaches often fail to account for variability within the data, classifying it as noise or measurement error. While this may not pose significant issues for most neuroimaging studies, it becomes critically important in molecular neuroimaging due to the considerable inherent variability in molecular functions across populations.

This talk aims to address these limitations by presenting a framework to extract transcriptomic signatures from neuroimaging scans and exploring the technical feasibility of applying normative modeling to molecular neuroimaging modalities.

Biography

Marco Castellaro is currently Research Fellow in Biomedical Engineering at the University of Padua. He earned his Ph.D. in Bioengineering under the supervision of Prof. Alessandra Bertoldo with a thesis entitled “Quantitative neuroimaging of perfusion with Arterial Spin Labelling: Deconvolution and physiology-based models”. He was a post-doctoral fellow at the Department of Information Engineering, at the Padova Neuroscience Center of the University of Padova and at the Department of Neuroscience, Medicine and Movement of the University of Verona.

His research interests mainly include artificial intelligence applied to MRI, to study perfusion, brain clearance and related disorders exploiting both medical images and biomedical signals.

Mattia Veronese is Associate Professor in Biomedical Engineering at the Department of Information Engineering, University of Padua, and Honorary Senior Lecturer in Neuroimaging at King’s College London. He is a biomedical engineering by training and holds a PhD in PET kinetic modelling.

His main research interest is related to the development and validation of molecular neuroimaging biomarkers and to their use for drug development and precision medicine. With over 15 years of experience and 200+ peer-reviewed publications in analysing high-dimensional brain imaging data and large observational cohorts, his work focuses on transforming complex information into robust and clinically meaningful indicators.