POLITECNICO MILANO 1863
DEPARTMENT OF ELECTRONICS INFORMATION AND BIOENGINEERING

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5:30 p.m.
Room 21.6.1 - Building 21

PhD seminars in Biomedical Engineering

RE-ENGINEERING THE DISORDERED MIND

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Biosketch

Dr. Hamidreza Jamalabadi is a tenure-track Assistant Professor of Computational Psychiatry and Data Science at the University of Marburg, Germany, and a Visiting Assistant Professor at the Djavad Mowafaghian Centre for Brain Health, University of British Columbia, Vancouver, Canada. Trained in electrical engineering and computational neuroscience, his research integrates neuroimaging, artificial intelligence, and dynamical systems theory to advance mechanistic and translational models of mental health and psychiatric disorders. He has held research positions at leading institutions including the University of Munich, the University of Tübingen, the University of Marburg, the University of British Columbia, and the Max Planck Institute for Biological Cybernetics. Dr. Jamalabadi serves as principal or co-principal investigator on several national and international research initiatives, including The Adaptive Mind (Hessen, Germany), the German Collaborative Research Center on trajectories of affective disorders (CRC/TRR 393), and a EU-funded Child and Maternal Health initiative (BRAWO; Germany, Italy, Spain)

Abstract

Despite decades of research, treatments for mental illness remain suboptimal, with low remission rates and frequent relapse. Recent advances across artificial intelligence, neuroscience, and psychiatry converge on a shared insight: mental states arise from low-dimensional neural manifolds embedded within high-dimensional brain–environment systems.
These manifolds are structured, locally linear, and—crucially—amenable to targeted perturbation. In this talk, I present a control-theoretic framework for mental health treatment that conceptualizes affective disorders as maladaptive attractors in multistable neural systems.

By integrating generative AI, neuroimaging, and neurostimulation, I outline a data-driven pipeline to (1) infer cognitive–affective manifolds, (2) learn dynamical models from partial and multiscale observations, and (3) design optimal interventions that reshape manifold topology rather than merely shifting system states. This perspective reframes neuromodulation as an engineering problem: the goal is not only to move the brain within its existing state space, but to redesign the underlying energy landscape that governs cognitive and affective dynamics. I conclude by highlighting key challenges in model inference, latent space structure, and multiscale control, and discuss recent AI-driven advances that make this vision increasingly tractable.

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