University of Messina, Italy
Department of Mathematical and Computer Sciences,
Physical Sciences and Earth Sciences

Subject: Internship Proposal

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Project details

Title	Synthetic MRI Generation Using Latent Diffusion Models

Detailed description: Simulating brain changes over time is vital for understanding neurodegenerative diseases. Recent progress in generative models allows realistic synthetic MRI image generation, supporting virtual clinical trials and personalized medicine.

Internship Objectives:
- Deep dive into generative models (GANs, Diffusion Models) for medical imaging.
- Preparation and preprocessing of longitudinal MRI datasets (e.g., ADNI, OASIS-3).
- Development, training, and validation of latent diffusion models conditioned on clinical or demographic data.
- Evaluation of generated images using structural (SSIM, PSNR) and biological plausibility metrics, plus comparison against actual disease progression.

Expected Outcomes:
- Trained generative model for synthetic brain MRI.
- Dataset of synthetic MRI sequences and demo scripts.
- Summary report comparing model performance against real disease progression.

Duration (month – max 12)	6
Duration (hours)	150
Open positions	2

Internship Skills

Technical requirements: • Strong Python and PyTorch/TensorFlow expertise. • Understanding of generative models. • Data augmentation and image similarity evaluation techniques.	
Other skills	