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	Efficient Processing of Hyperspectral Imaging using AI

Detailed description: Hyperspectral imaging (HSI) captures information across hundreds of spectral bands, enabling fine-grained material and tissues identification and analysis in domains such as precision agriculture, environmental monitoring, cultural heritage diagnostics, and medical/biomedical imaging. However, HSI data is high-dimensional and computationally expensive to store, preprocess, and analyze, which often prevents real-time or resource-efficient deployment. This internship focuses on designing and validating AI-driven pipelines that reduce computational cost while preserving (or improving) analytical performance.

The internship activities will cover the end-to-end workflow: (1) dataset selection and inspection (public HSI benchmarks and/or research datasets provided by the host), (2) preprocessing (radiometric normalization, denoising, bad band removal, dimensionality reduction), (3) model development for classification/segmentation/anomaly detection using efficient deep learning architectures, and (4) optimization for practical execution (latency, memory footprint, and throughput). Techniques may include spectral–spatial neural networks, lightweight CNNs/Transformers, autoencoders, pruning/quantization, knowledge distillation, and classical baselines such as PCA + SVM for comparison. Where applicable, the work will also address robust evaluation (cross-scene generalization, limited labels, class imbalance) and reproducibility (clean code, versioning, experiment tracking).

Deliver a reproducible pipeline with documented preprocessing, training, and evaluation scripts, plus a final technical report and presentation

Tools and technologies used during the internship will include Python, NumPy/SciPy, scikit-learn, PyTorch (or TensorFlow), common HSI libraries (e.g., Spectral Python), and experiment utilities (e.g., MLflow/Weights & Biases if available). Development will be done with Git for version control, and execution may leverage GPU acceleration when

available. The final output will include trained models, evaluation results, and an efficient inference-ready implementation.

Duration (month – max 12)	3-6
Duration (hours)	75
Open positions	2

Internship Skills

Technical requirements: Good Python programming skills Basic machine learning knowledge (training/validation, metrics, overfitting) Familiarity with deep learning frameworks (preferably PyTorch) Ability to run experiments on Linux/Windows, manage environments (conda/pip) Basic understanding of image processing; interest in high-dimensional data is a plus

Other skills	Scientific writing and documentation Team communication and regular progress reporting Problem-solving mindset; ability to read research papers and implement methods