UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Thesis Project Form

Title (tentative): Classification of MRI Images Acquired on a Phantom Based on Artifact Intensity Using Deep Learning and Machine Learning Techniques

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Description

Motivation and application domain

Magnetic Resonance Imaging (MRI) has traditionally evolved toward higher magnetic field strengths to achieve superior Signal-to-Noise Ratio (SNR) and enhanced diagnostic detail. Recently, however, low- and mid-field MRI systems have gained momentum due to their accessibility, patient comfort, and clinical versatility.
One standout example of mid-field innovation is MROPEN, an MRI scanner entirely designed and manufactured in Genova by ASG Superconductors. MROPEN redefines patient accessibility by offering the largest gantry opening available on the market, making it particularly suitable for obese and claustrophobic patients. Its open architecture not only improves patient comfort but also expands the clinical applicability of MRI in scenarios where traditional closed-bore systems fall short.
To guarantee consistent performance, quality assurance tests are performed using â€œphantomsâ€•â€”standardized containers filled with MRI-visible solutions.
MRIâ€™s sensitivity means even micrometer-scale displacements can degrade image quality, requiring exhaustive checks across all acquisition parameters. This generates large datasets that demand automated evaluation.
The goal of this thesis is to develop methods for automatically assessing image quality and classifying artifacts, enabling scalable, reliable quality control and reducing manual inspection.

General objectives and main activities

The thesis aims to design and implement image analysis techniques combined with DL/ML algorithms to automatically classify MRI phantom images based on artifact presence and intensity.
Key activities include:
â€¢ Building and preprocessing a labeled dataset for supervised learning.
â€¢ Developing and training classification models using DL/ML frameworks.
â€¢ Validating the pipeline against manually annotated ground truth.
The candidate will also contribute to the manual labeling process to ensure robust model training and evaluation.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will acquire skills in advanced image processing, machine learning, and deep learning applied to medical imaging. They will gain hands-on experience with Python-based frameworks (e.g., TensorFlow, PyTorch), data annotation, and quality assurance workflows in MRI. These competencies are highly relevant for careers in medical imaging, AI, and healthcare technology

Place(s) where the thesis work will be carried out: ASG Superconductors, Corso F.M. Perrone 73r, 16152 Genova and UNIGE

Additional information

Pre-requisite abilities/skills: Background in image processing, machine learning, and preferably deep learning.

Proficiency in Python (or MATLAB) is required.

Curriculum: The assignment of the thesis requires a preliminary interview with company managers.

Maximum number of students: 2

Financial support/scholarship: Not available