Advanced MRI imaging techniques for quantitative characterization of cancer

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At the dept. of Radiology of the University of Trieste, two state-of-art MRI systems are used for both clinical practice and research. The magnetic fields are 1.5 T and 3T.
A number of innovative techniques are under development in advanced MRI units, exploiting difference in water diffusion, in oxygenation and in magnetic susceptibly between normal tissues and lesions.
The aim of this research is to develop innovative MRI techniques in order to characterise cancer. Due to large clinical research experience in the field of abdomen imaging of the dept. of Radiology, the research project focuses to the pelvis and urogenital system.

The family of the diffusion imaging techniques (Diffusion Weighted Imaging, Diffusion Tensor Imaging, Diffusion Kurtosis Imaging and Intra Voxel Incoherent Motion) is to be evaluated in details. The evaluation of the magnetic susceptibly maps acquired at 3T is another goal of the project. There is increasing interest in the radiologic community to apply such sophisticated analytic approaches which allows quantitative parameters that reflect tissue microcapillary perfusion and tissue diffusivity to be derived.

The PhD student is going to work in an interdisciplinary environment, in close collaboration with medical physicists and radiologists and in direct contact with the technological team of the MRI manufactures and with the medical doctors.

In order to develop optimized MRI acquisition sequences, a deep knowledge of the physics of MRI will be acquired. Dedicated post-processing procedures are to be developed, mainly using MathLab. The techniques developed in the first year are to be applied in clinical studies, to evaluate their possible impact in the clinical practice in comparison to the conventional MRI images. Data acquired during the clinical studies will be evaluated during the third year of this PhD program using advanced radiomics approaches.

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