Breast Cancer Analysis in DCE-MRI

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Abstract:
Dynamic Contrast Enhanced-Magnetic Resonance Imaging (DCE-MRI) has demonstrated a great potential in screening of high-risk women for breast cancer, in staging newly diagnosed patients and in assessing therapy effects.

In this talk we present a fully automated Computer Aided Detection (CAD) system for suspicious lesion detection and classification in DCE-MRI, to support radiologists during patient image analysis.

Breast DCE-MRI computer aided study needs a pre-processing stage to identify breast parenchyma. With this aim, we developed an automatic procedure for accurate segmentation of breast tissues from foreign tissues and background, relying on fuzzy binary clustering, breast anatomical priors and morphological refinements.

Breast imaging analysis is made harder by the dynamical characteristics of soft tissues since any patient movements (such as involuntary due to breathing) may affect the voxel-by-voxel dynamical analysis. To remove (or at least reduce) such motion artefacts, many different motion correction techniques (MCTs) were so far proposed. However, the problem of choosing the most suitable MCT for a given patient is still an open problem. To overcome this issue, we proposed a novel model-based quality index (QI) for quantitative evaluation of MCTs in DCE-MRI by means of a well-known compartmental model of blood plasma and of the extracellular space (EES) for tumour tissue (the so-called Tofts-Kermode model).

The proposed lesion detection approach is based on a Support Vector Machine trained with dynamic features, extracted from a suitably pre-selected area by using a pixel-based approach. The lesion classification is instead carried out by means of 3D textural characterization with Local Binary Patterns on Three Orthogonal Planes (LBP-TOP).

Finally, to improve the usability of the proposed work, we developed a framework for telemedicine that allows advanced medical image remote analysis in a secure and versatile client-server environment, at a low cost. The benefits of using the proposed framework will be presented in a real-case scenario where OsiriX, a wide-spread medical image analysis software, is allowed to perform advanced remote image processing in a simple manner over a secure channel.