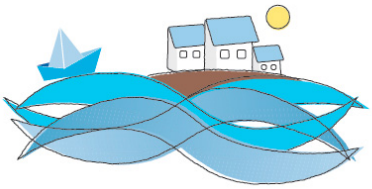

Mediterranean Thematic Workshops in Advanced Molecular Imaging

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# Prostate-Checker: Prostate cancer assessment by multi-parametric MRI studies

*Monday 2 May 2016 10:30 (20 minutes)*

Prostate cancer (PC) is the second most diagnosed type of cancer and the fifth leading cause of cancer-related death in men worldwide (most frequent cause of cancer death in men in developed countries).
Guidelines about prostate magnetic resonance (MR) imaging published by the European Society of Urogenital Radiology (ESUR) in 2012 recommended a multi-parametric approach for a better characterization of PC. Available sequences that allow the acquisition of anatomical and functional studies have led MRI to be the modality of choice in PC evaluation and during follow-up studies.
Anatomic T2-weighted (T2W) images, diffusion-weighted (DW) images and dynamic contrast enhanced (DCE) series allow the assessment of interstitial edema, cellularity and micro-vascularity of the gland respectively. MR imaging derived biomarkers provide quantitative information to objectively characterize a pathological process or a therapeutic action.
A software prototype (Prostate Checker Ltd, UK http://prostatechecker.co.uk) is presented (Figure 1). The tool is capable of performing voxelwise multi-parametric analysis from T2W, DW and DCE MR images to extract several imaging biomarkers related to PC detection and grading. Imaging biomarkers and their multi-variate combination are displayed in the form of parametric maps (Figure 2).
As images have different spatial resolutions and space orientation, and the prostate may slightly change in position, the software performs a re-slicing and elastic co-registration, driving all images to a common reference space and resolution.
Once the spatial coherence is achieved, the user manually segments the prostate or any PI-RADS region, launching the complementary multi-parametric analyses based on T2W, DW and DCE images.
First module of the prototype applies advanced TexRAD texture analysis (licenced by TexRAD Ltd www.texrad.com, part of Feedback Plc) to T2W images to quantify tissue heterogeneity through a filtration-histogram technique. First step uses a band-pass Laplacian of Gaussian (Mexican hat shaped filter similar to a non-orthogonal Wavelet approach) to extracts and enhances texture features of different sizes corresponding to spatial scale filter (SSF). Second step performs histogram-analysis to describe the shape of the histogram e.g. mean intensity/mean of positive pixels, standard-deviation, entropy, kurtosis and skewness. Diverse published literature states the use of filtration-histogram texture analysis technique to assist in risk-stratification.
A second module applies pharmacokinetic models to the DCE series to characterize tissue micro-capillarity. This module extracts and displays parameters such as the transfer constant (Ktrans), the reverse transfer constant (κep) and the extracellular space fractional volume (e), widely reported in literature to have a high sensitivity in cancer detection. The third module exploits DW images computing and displaying apparent diffusion (ADC) maps and intra-voxel incoherent motion (IVIM) parameters when several b-values are acquired. PC shows a lower ADC and D properties, with higher D* and f properties.
Nosologic images from the combination of the different extracted biomarkers are created by their combination through the application of multivariate analysis, providing closer information to the clinical endpoints.

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