

A Radiomics Approach to Predict the Evolution of Prostate Imaging Reporting and Data System Score 3/5 Prostate Areas in Multiparametric Magnetic Resonance

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Abstract : Purpose: To characterize, through a radiomic approach, the nature of areas classified PI-RADS (Prostate Imaging Reporting and Data System) 3/5, recognized in multiparametric prostate magnetic resonance with T2-weighted (T2w), diffusion and perfusion sequences with paramagnetic contrast. Methods and Materials: 24 cases undergoing multiparametric prostate MR and biopsy were admitted to this pilot study. Clinical outcome of the PI-RADS 3/5 was found through biopsy, finding 8 malignant tumours. The analysed images were acquired with a Philips Achieva 1.5T machine with a CE- T2-weighted sequence in the axial plane. Semi-automatic tumour segmentation was carried out on MR images using 3DSlicer image analysis software. 45 shape-based, intensity-based and texture-based features were extracted and represented the input for preprocessing. An evolutionary algorithm (a TWIST system based on KNN algorithm) was used to subdivide the dataset into training and testing set and select features yielding the maximal amount of information. After this pre-processing 20 input variables were selected and different machine learning systems were used to develop a predictive model based on a training testing crossover procedure. Results: The best machine learning system (three-layers feed-forward neural network) obtained a global accuracy of 90% (80 % sensitivity and 100% specificity) with a ROC of 0.82. Conclusion: Machine learning systems coupled with radiomics show a promising potential in distinguishing benign from malignant tumours in PI-RADS 3/5 areas.

Keywords : machine learning, MR prostate, PI-RADS 3, radiomics

Conference Title : ICHMMIRS 2018 : International Conference on Health Monitoring, Medical Imaging and Radiologic Sciences

Conference Location : Venice, Italy

Conference Dates : April 12-13, 2018