

ALMA MATER STUDIORUM · UNIVERSITÀ DI BOLOGNA

DIPARTIMENTO DI FISICA E ASTRONOMIA - DIFA

AIM Live Meeting

ML classification of Prostate Tumours from NMR Image Texture Analysis

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Task and data available

Tumor classification on prostate MR images

- 46 Patients (+ healthy tissue) recruited at the Polyclinic University Hospital of Palermo
- T₂-weighted and ADC images
- Table of the features extracted through Mazda software from the T₂-weighted and ADC images
- Histological results of biopsy

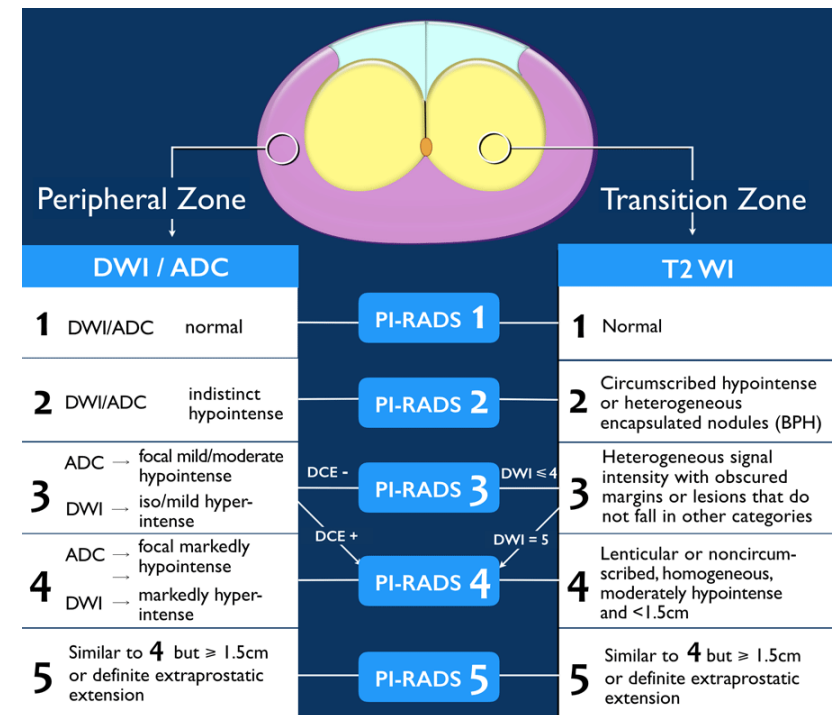


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PI-RADS

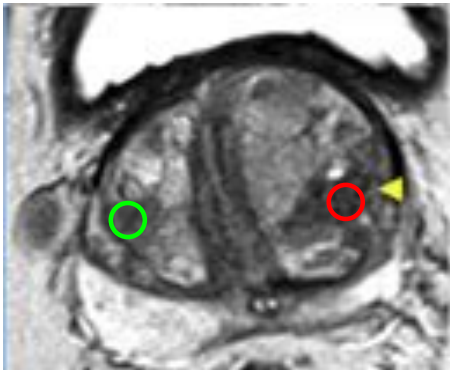
- PI-RADS 1 = Very low (clinically significant cancer highly unlikely)
- PI-RADS 2 = Low (clinically significant cancer unlikely)
- PI-RADS 3 = Intermediate (clinically significant cancer equivocal)
- PI-RADS 4 = High (clinically significant cancer likely)
- PI-RADS 5 = Very high (clinically significant cancer highly likely)



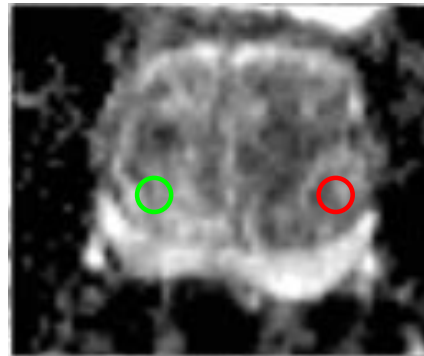
Feature extraction



T2w



ADC



Identification of a ROI in the lesion region
and another ROI in healthy tissue as control



Radiomics feature extraction



Dataset

92 samples, T2 data:

- **Control Tissues:** 46
- **Lesion Tissues:** 26
- **Lesion with Tumor Tissues:** 20

Objective: evaluate predictive power of the 290 features common amongst patients (**MazDa** software).



Method

- Elastic-net Logistic Regression
- Cross Validated predictive performance: ~ 0.72 average accuracy

Leave-One-Out crossvalidation confusion matrix:

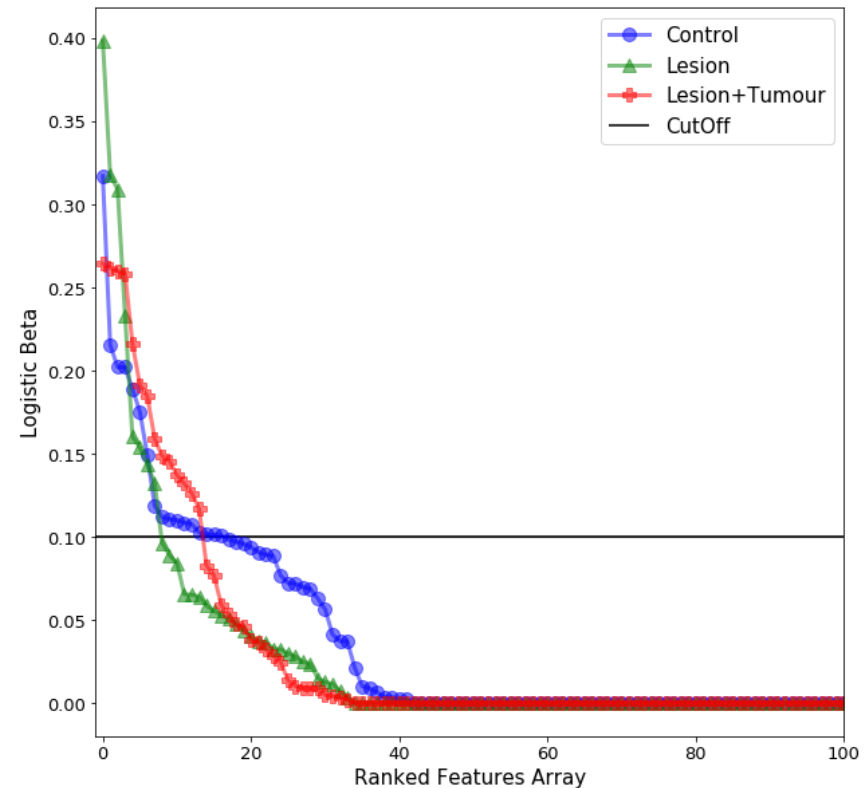
	Control	Lesion	Lesion+Tumor
Control	39	4	3
Lesion	6	8	12
Lesion+Tumor	2	8	10

Controls vs Lesion/Lesion+Tumour classes: very good performance
More errors between Lesion and Lesion+Tumour classes



Most relevant features

- **Controls:** Mean, Skewness, Perc.01%, Perc.10%, S(1,0)AngScMom, S(1,0)SumAverg, S(0,1)SumAverg, S(1,1)SumAverg, S(1,-1)SumAverg, S(2,0)SumAverg, S(0,2)SumAverg, S(2,-2)SumAverg, S(3,0)SumAverg, S(3,-3)SumVarnc, S(5,0)InvDfMom, S(5,0)SumAverg, 135drLngREmph
- **Lesions:** Skewness, S(4,-4)SumVarnc, S(5,0)AngScMom, S(0,5)InvDfMom, S(5,-5)Contrast, Tetra4, WavEnLLs-1, WavEnLLs-2
- **Lesion + Tumour:** Perc.01%, Perc.10%, S(3,-3)SumVarnc, S(4,-4)AngScMom, S(4,-4)Contrast, S(5,5)AngScMom, S(5,5)DifVarnc, S(5,-5)Contrast, S(5,-5)SumVarnc, S(5,-5)DifVarnc, GrSkewness, WavEnLLs-1, WavEnHHs-1, WavEnLLs-2





Conclusions and Future Developments

- promising results, more images needed to improve/validate performance
- other features to be added to MazDa features

Future analyses



- Analyses on T2w-MRI data extracted from patients classified as cases with PIRADS 4 and 5 (at least 60 patients)
- Analyses on ADC data