

MRI Texture Analysis of Cervical Cancer : Correlation of tumor heterogeneity with Stage and Histopathology

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Introduction

- Texture analysis refers to a variety of mathematical methods that can evaluate the gray-scale intensity and position of the pixels within an image.
- Texture analysis produces texture parameters that may help to predict tumor heterogeneity.

Objective

To study whether MRI Texture analysis can predict the tumor heterogeneity with respect to stage and histopathology in cervical cancer.

Methods

- Study site - Department of Radiology & Department of Gynae Oncology,Tata Medical Center, Kolkata.
- Prospective Observational study.
- 97 patients with cervical cancer recruited under the SyMec (Systems medicine cluster) project.
- MRI images were obtained at diagnosis prior to any treatment.
- TEXRAD Software (Cambridge Computed Imaging Ltd., version 3.9) was used for analysis of images.
- Region of interest(ROI) was drawn by the radiologist where the tumour was best delineated.
- Tumour regions were described in terms of small scale filtration(SSF) where SSF=0 refers no filter, SSF=2 refers fine texture, SSF=3-5 refers medium texture and SSF=6 refers course texture.
- After processing of images with some inbuild algorithms,TEXRAD produced six types of parameters namely mean, standard deviation, entropy, mpp,skewness and kurtosis with their respective values.
- Total number of pixels were also given by TEXRAD.

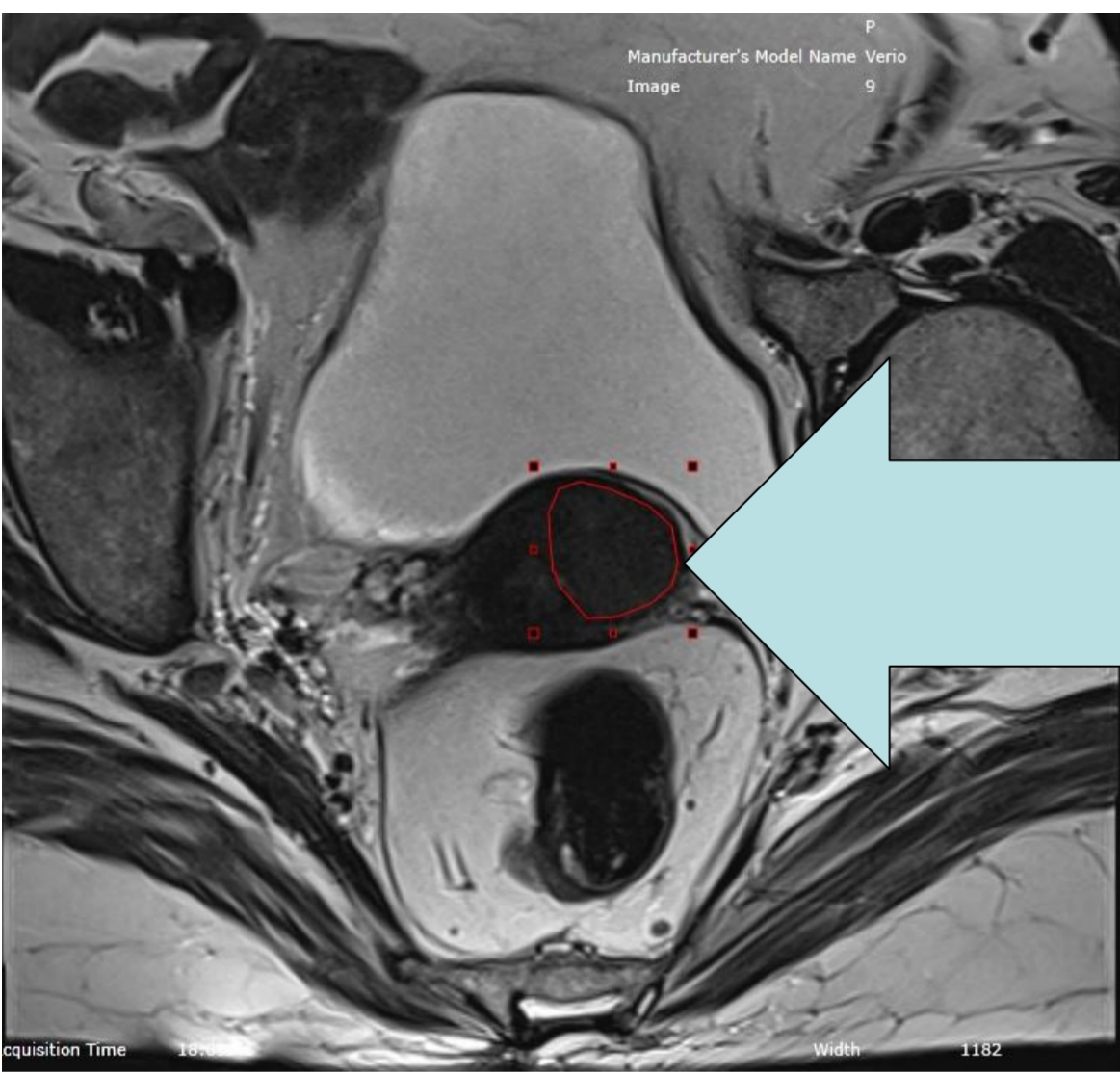


Figure: Region of interest(ROI) was drawn on Small FOV T2 transverse MRI image

Conclusions

- Texture parameters like entropy and skewness on MRI images correlate with stage of disease and histopathology.
- Larger studies with survival outcome are required to evaluate the role of MRI texture analysis as a predictive biomarker for disease outcome.

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Results

Demographic characteristics showed in the following table:

CHARACTERISTICS	NO. OF PATIENTS (%)
AGE (YEARS)	
Mean , Range	51.76 , 37 to 75
FIGO STAGE	
IB1	5(5.15%)
IB2	7(7.21%)
IIA1	2(2.06%)
IIA2	1(1.03%)
IIB	54(55.67%)
IIIA	1(1.03%)
IIIB	23(23.71%)
IVB	1(1.03%)
HISTOPATHOLOGY	
SCC	86 (88.66%)
NON SCC	11 (11.34%)
KERATINISING	14 (14.43%)
NON-KERATINISING	83 (85.57%)
POOR DIFFERENTIATED	15 (15.46%)
MODERATELY DIFFERENTIATED	55 (56.7%)
TREATMENT MODE	
CHEMORADIO THERAPY	72 (74.22%)
RADIO THERAPY	12 (12.37%)
SURGERY	9 (9.27%)
SURGERY + CHEMORADIO THERAPY	1 (1.03%)
NODAL STATUS	
POSITIVE	45 (46.39%)
NEGATIVE	42 (43.23%)
INDETERMINATE	7(7.22%)

The following parameters showed significant association between MRI texture and tumour stage/stroke and histology

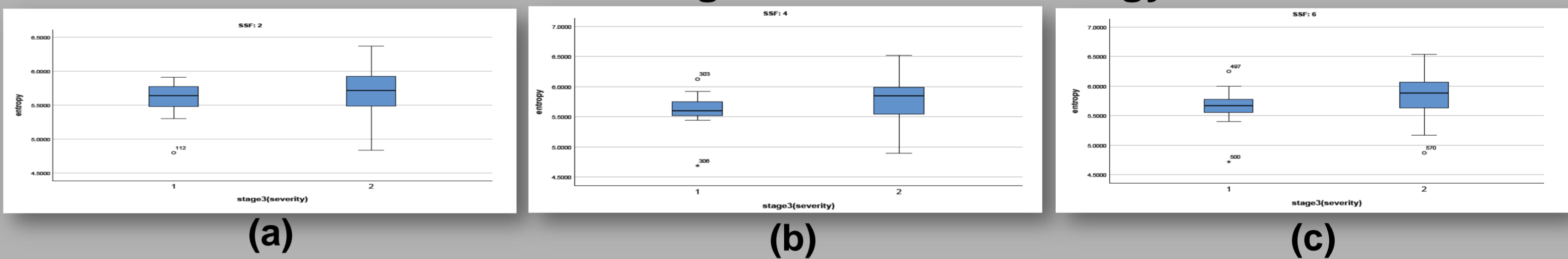


Figure1: Box-whisker plot shows differentiation of lower stage (0) from higher stage(1) according to entropy on small FOV T2 tse axial MRI images with use of (a) fine(SSF=2),(b) medium(SSF=4) and (c)course(SSF=6) filter settings with p=0.05, CI = 95%

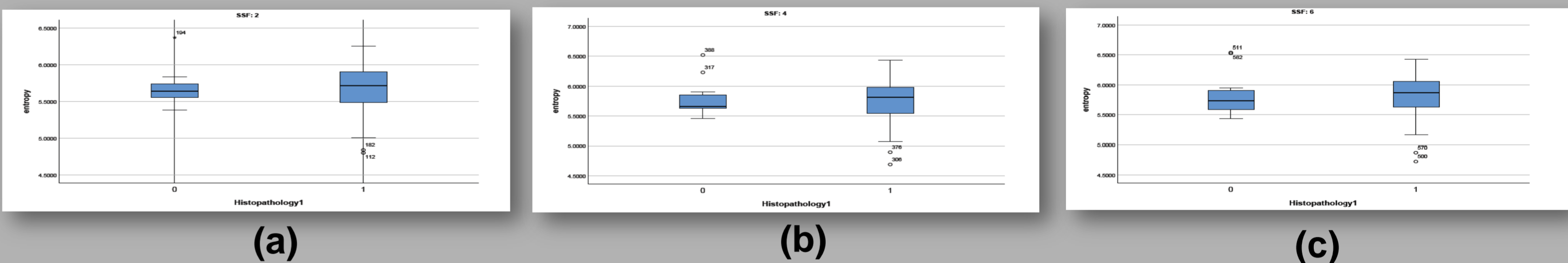


Figure2: Box-whisker plot shows differentiation of non-SCC(0) from SCC(1) according to entropy on small FOV T2 tse axial MRI images with use of (a) fine(SSF=2),(b) medium(SSF=4) and (c)course(SSF=6) filter settings with p=0.05, CI = 95%

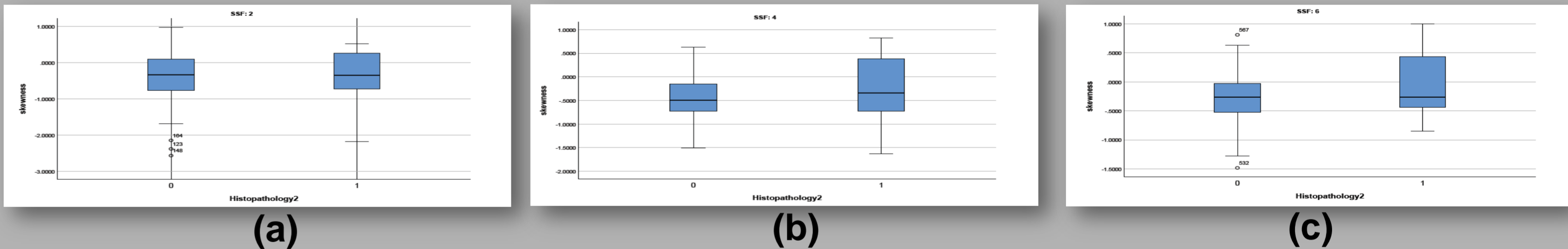


Figure3: Box-whisker plot shows differentiation of non-keratinizing(0) from keratinizing(1) according to skewness on small FOV T2 tse axial MRI images with use of (a) fine(SSF=2),(b) medium(SSF=4) and (c)course(SSF=6) filter settings with p=0.05, CI = 95%

Future Work:

- Study with more prospective as well as retrospective data.
- More correlations with different parameters.
- Kaplan-meier survival analysis.
- Correlation with genomic data.

References:

- Yankai Meng et.al. 2017. MRI texture analysis in predicting treatment response to neoadjuvant chemoradiotherapy in rectal cancer.
- Jie Meng et.al. 2018.Texture analysis as imaging biomarker for recurrence in advanced cervical cancer treated with CCRT.

