CT-based Radiomics Analysis for Prediction of Liver Progression Intrahepatic Risk in Hepatocellular Carcinoma Patients Treated with Stereotactic Body Radiation Therapy

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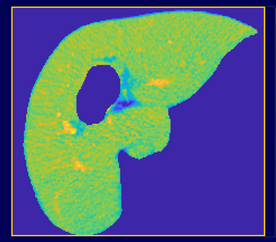
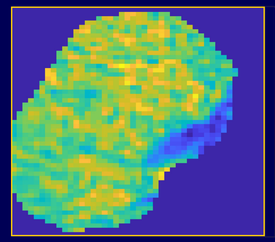
7/31/2018, 7:30-9:30am
Quantitative Imaging:
Translation to Practice

CT contrast-enhanced images

Liver-GTV

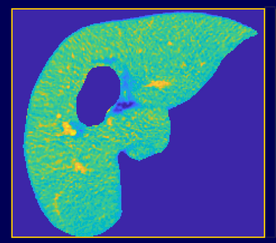


GTV

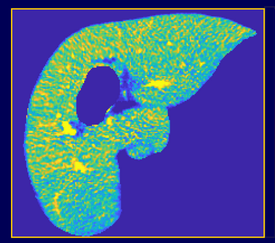


Pre-processing

Lloyd quantization

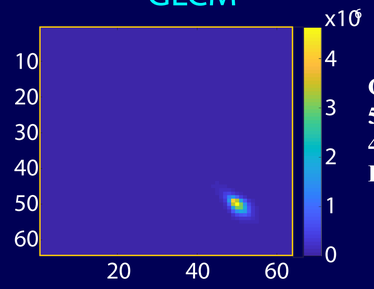


Equal quantization



Feature extraction

GLCM



GLRLM, GLSZM, NGTDM, Global
5 resolutions: 1 mm~5 mm
4 grey levels: 8,16,32,64
In total 3441 features/sample

Graph-based feature ranking

$$\text{Fisher criterion}_i = \frac{|\mu_{i,1} - \mu_{i,2}|^2}{\sigma^2_{i,1} + \sigma^2_{i,2}}$$

$$\text{mutual information}_i = \sum_{y \in Y} \sum_{f \in x^{(i)}} p(f,y) \log\left(\frac{p(f,y)}{p(f)p(y)}\right)$$

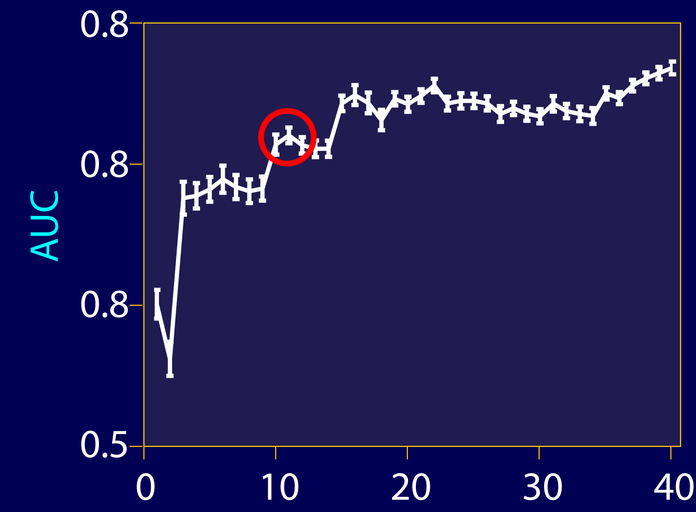
$$\text{Relevance}_i = (F \cdot m^T)$$

$$\text{Variance } \sigma_{i,j} - \max(\sigma^{(i)}, \sigma^{(j)})$$

$$A = \alpha \cdot \text{Relevance} + (1 - \alpha) \cdot \text{Variance}$$

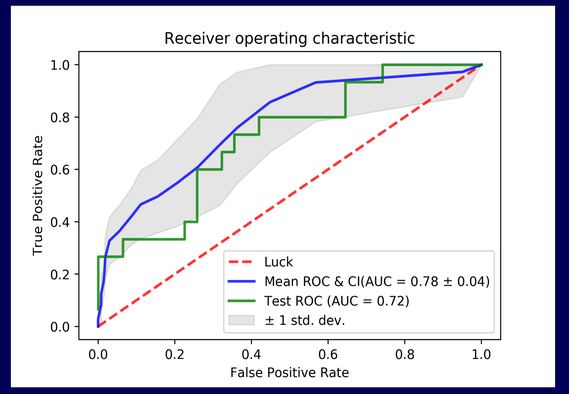
Get the ranking basd on Eigenvalues of matrix A

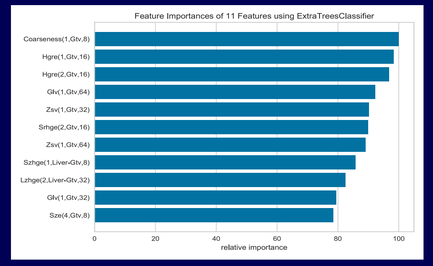
Model order and construction



Grid search hyper-parameters for Gaussian kernel SVM on the train to build model

Independent test result





Texture Matrix	Feature (resolution/mm, grey level)	Region	Feature relative importance
GLRLM	HGRE (2,16)	Gtv	0.97
	HGRE (1,16)	Gtv	0.98
	SRHGE (2,16)	Gtv	0.90
	GLV (1,32)	Gtv	0.79
	GLV (1,64)	Gtv	0.92
GLSZM	SZE (4,8)	Gtv	0.78
	ZSV (1,32)	Gtv	0.90
	ZSV (1,64)	Gtv	0.89
	LZHGE (2,32)	Liver-gtv	0.83
	SZHGE (1,8)	Liver-gtv	0.86
NGTDM	Coarseness (1,8)	Gtv	1