

AbstractID: 14263 Title: Normal Tissue Complication Probability (NTCP) Modeling using Self-Organizing Map (SOM)

Purpose: To investigate the possibility using Self-Organizing Map to predict Normal Tissue Complication Probability.

Materials and Methods: As an effective method to project and visual the high-dimensional data to low-dimensional data, the SOM is used to predict radiation pneumonitis (RP) risk according to similarity of patient's characteristics. 209 WUSTL lung cancer patients were available for SOM. The SOM models from lung dose volume metrics (SOM_{lung}), heart dose volume metrics (SOM_{heart}), GTV position ($SOM_{GTVposition}$) and clinical factors ($SOM_{clinical}$), separately or jointly were built and the model statistical significance was tested using Receiver Operating Characteristics (ROC) curve. The input feature selection is done by comparing difference of resulted ROC areas from including or excluding input feature.

Results: Initial input features are selected from hundred dose factors with correlation <0.85 to prevent selection of multiple highly correlated dose factors as features. Among the input features selected by SOM_{lung} , mean lung dose (MLD) has highest impact for increasing RP risk, area under curve (AUC) of ROC decrement resulted from its exclusion is from 0.8728 to .8539 ($p=0.7575$); for SOM_{heart} , $D10_{heart}$ has highest input impact for increasing RP risk, exclusion will result AUC drop from 0.9198 to 0.8771 ($p=0.0442$.); for $SOM_{clinical}$, $gtvVol$ has highest impact for increasing RP risk, AUC drop from 0.7810 to 0.7378 ($p=0.00001$); for $SOM_{GTVposition}$, COMSI (GTV inferior-superior position) has highest input impact for increasing RP risk, AUC drop resulted from its exclusion from 0.8942 to 0.8147 ($p=0.0402$.). By adding clinical factor into dose model, the AUC will drop from 0.9027 to 0.8438, implying non-dose factors don't add important information to predict RP risk.

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Conclusion: SOM appears to be a robust method to identify predictors of RP risk. Among selected input features, MLD, D10heart, and COMSI are three most important features contributing to increasing RP risk in our institutional dataset.