Conclusion: This retrospective study shows that the SUVmax50 pre-therapeutic signal correlates with the post-therapeutic recurrences in the majority of patients. Pre-therapeutic PET/CT or planning PET/CT is a useful tool to guide the future dose escalation studies.

EP-1224
An Australian radiotherapy decision support system with contextual justification
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Purpose or Objective: Background: There is great potential to utilise a large range of retrospective clinical data as an evidence base in decision support systems (DSS) for cancer prognosis and subsequent personalised treatment decisions. Recently, there were several DSSs built for this purpose using machine learning tools, mainly regression models, Bayesian Networks (BN) and Support Vector Machines (SVM). These machine learning tools provide only a prediction of a class (decision), based on input attributes that were used to build the model, without providing additional information to clinicians about how and why this prediction was made.

Objective: To investigate the performance of an alternative machine learning tool in building a lung cancer radiotherapy DSS that provides clinicians with an estimated prediction together with the influencing attributes and their values (evidence) in supporting the decision reached. This will provide contextual justification to clinicians regarding the decisions, which will further help them in deciding whether to adopt the machine prediction or not.

Material and Methods: A Non-Small Cell Lung Cancer 2 year survival prediction model was built, using data at Liverpool Cancer Therapy Centre in NSW, Australia. The attributes used to predict the survival were age, gender, ECOG, GTV and FEV1. The machine learning tool used is a Decision Tree which automatically extracts rules from the training data and formulates these as if-then-else patterns. A report of the used rules during the prediction process indicates the effective attributes used to reach the decision. SVM, Regression models and BN were built and tested using the same data set; however, BN possess less, and SVM/Regression models possess none, of this reporting capability as they are learned by analysing probabilities and numerical distances among data points associated with prediction class.

Results: The DSS was learnt within the Liverpool Clinic with an unfiltered cohort of 4650 4686 patients. After filtering out patient records with missing values for the used attributes the cohort was reduced to 97 patients treated radically. The area under curve of the Decision Tree, SVM, Regression Model and BN when tested using a rigorous 10 fold cross-validation method respectively was 0.62, 0.62, 0.63 and 0.6. There is no significant difference in the performance between the four tools examined, however, the decision tree also generates an understandable context with every prediction made as a list of supporting attributes like the example in Figure 1.

Figure 1. Part from the decision tree and the trace of example input patient and expected scenarios.

Conclusion: It is possible to build a DSS for NSCLC data that provides a prediction with additional information justifying the decision with similar performance as the commonly utilised SVM, BN and regression tools. To improve the performance and avoid over fitting, more diverse and complete training data is needed by incorporating data from other centres to the learning process using distributed learning.

EP-1225
MRI-defined GTV change during SBRT for unresectable or oligometastatic disease of the central thorax
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Purpose or Objective: Stereotactic body radiotherapy (SBRT) is an attractive modality for the definitive treatment of oligometastatic or unresectable primary lung malignancies. Proximity of the tumor to adjacent organs-at-risk (OAR) may limit delivery of a sufficiently ablative dose. The ability to adapt to tumor response during treatment may improve OAR sparing and/or allow dose escalation. This study aimed to evaluate the degree of daily inter-fractional variation in gross tumor volume (GTV) during SBRT for patients with oligometastatic or unresectable primary malignancy of the central thorax using a magnetic resonance image guided radiotherapy (MR-IGRT) treatment system.

Material and Methods: Eleven patients with unresectable primary or oligometastatic malignancy of the central thorax were treated at our institution with extended fractionation SBRT on a clinical MR-IGRT system. Treatment regimens consisted of 60 Gy in 12 fractions (n=8) or 62.5 Gy in 10 fractions (n=3). For each treatment fraction, low-field (0.35 Tesla) MR setup imaging was acquired as part of routine clinical practice. Daily GTV was retrospectively defined on MR image sets for all patients at each of 10 or 12 fractions, using initial GTVs from CT simulation as a template. Daily tumor volumes were then recorded and compared for each patient to evaluate for inter-fractional change in tumor volume.