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Fig. 1: Results for RNLU (training). TOP: (left) feature calculated at each voxel dimension against patient rank. (right) Feature normalised by voxel number in ROI. BOTTOM: (left) Surface model to calculate feature change. (right) Surface model shifted result.

Fig. 2: CCC heatmap for each feature (validation dataset)

Conclusion
We developed, tested and validated a novel normalisation technique for voxel size dependent radiomic features. Ongoing work aims at validating the proposed approach on other imaging modalities.

References

PO-0964 Stability and prognostic significance of CT radiomic features from oesophageal cancer patients

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Purpose or Objective
Radiomics aims at extracting quantitative features from medical images. Several studies focussed on the potential value of radiomic analysis in predicting tumour response for oesophageal cancer (OC) patients using contrast enhanced CT images. However, in clinical practice contrast agents are not always administrable, making the development of a new radiomic model necessary. In this work, we investigated the usefulness of radiomic features extracted from contrast and non-contrast enhanced CT scans in the development of a prognostic model in OC.

Material and Methods
CT images and radiotherapy volumes of 213 patients from a clinical trial in OC were processed with the CERR package. Patients were divided into 3 groups: mixed group (MG) with contrast and non-contrast enhanced CT images (n=213), contrast group (CG) with contrast enhanced CT scans (n=138) and non-contrast group (nCG) with non-contrast enhanced CT data (n=75). Radiomic features were automatically extracted in 2D and 3D in compliance with the IBSI, using in-house developed data analytics software. Stable features were selected as the ones with similar intra-groups distributions (Kruskal-Wallis test). Corresponding 2D and 3D stable features within each group were evaluated for differences (Wilcoxon signed rank test). Remaining stable features and clinical characteristics were used to develop a prognostic model with the Cox regression method.

Results
A total of 119 2D and 3D features were computed from each group. The Kruskal-Wallis test excluded 82, 3 and 6 unstable features obtained from MG, from CG and from nCG, respectively (Fig. 1). Some stable features (6 for MG, 15 for CG and 17 for nCG) did not show a significant difference if extracted considering 1 tumour layer at a time or considering the whole tumour volume. Among stable features, 4 features showed no difference if obtained from 3D or 2D data and were stable in all the 3 groups. The Cox regression model, constructed with 8 clinical and radiomic variables, identified 1 feature (GLDZM zone distance variance) associated with survival (Table 1).

Conclusion
The prognostic model has identified 1 texture significantly and independently correlated with overall survival. This
feature can add value over and above currently known prognostic factors if computed in 2D or 3D and independently from administration of CT contrast agents.

<table>
<thead>
<tr>
<th>Prognostic variable</th>
<th>p-value</th>
<th>Parameter estimate</th>
<th>Hazard Ratio</th>
<th>95% Confidence Intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLDVM core distance variance</td>
<td>0.005</td>
<td>0.274</td>
<td>1.315</td>
<td>1.085 - 1.593</td>
</tr>
</tbody>
</table>

Table 1: Results of the Cox regression model

References:

PO-0965 How to find the best radiomics features for prediction of overall survival in SBRT for HCC?

P. Fontaine¹, O. Acosta¹, F. Riet², J. Castelli³, K. Gnep³, A. Simon⁴, A. Depeursinge⁴, R. De Crevoisier²
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Purpose or Objective
One of the major issues in radiomics is the very large amount of tested extracted features, compared to the often-reduced sample size and the low number of events. Reduction of dimensionality may be therefore an important preliminary step to improve the prediction capability of the predictive models. The aims of the study were:
- to propose methods for reducing redundancy by selecting the more informative features from multimodal images;
- to evaluate and compare the prediction capability of the models when using these methods.

The considered example was MRI based radiomics to predict overall survival after SBRT for hepatocellular carcinoma (HCC).

Material and Methods
Eighty-one patients underwent SBRT for inoperable HCC. For each patient, 7 modalities of MR images were acquired. A total of 273 features were extracted from manually delineated tumours belonging to 4 radiomics categories (geometrical, first order, gradient-based and second order) in each modality. As we follow the workflow [Figure 1]

Results
The table displays the selected predictive feature depending on the selection methods. Unsupervised clustering algorithms allowed to select a non-redundant set of features able to significantly better predict HCC overall survival [Exemplars from AP: Precision= 0.76 ± 0.01, (p-value ≤ 0.001)], in comparison to the other methods [All features: Precision = 0.73 ± 0.01; RS from all features : Precision = 0.71 ± 0.3 ; RS from K-means clustering : Precision = 0.715 ± 0.02; RS from AP clustering: Precision = 0.735 ± 0.01 and exemplars from mRMR: Precision = 0.735 ± 0.01] .

Conclusion
A framework for feature selection in a radiomics workflow is presented. Unsupervised methods allow to cluster together groups of features increasing the prediction capabilities and reducing redundancy. AP outperforms the other features selection method suggesting the use of the exemplars as representative feature of each cluster.

PO-0966 Prediction of Locoregional Control in Hepatocellular Carcinoma After SBRT with Deep Learning

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