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Influence of Image Resolution and Extraction Software on the Stability of Radiomic Features

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Purpose

Before the extraction of radiomic features, images are usually interpolated to a common resolution. Furthermore, a number of different radiomic feature extraction software exist. Here, we investiage how choice of interpolation resolution and feature extraction software affects stability of radiomic features.

Methods

Following work quantifies this influence on the radiomic features by comparing pre-treatment CT and PET images of melanoma patients resized to 1 mm and 2 mm resolution and the two IBSI-compliant feature extraction platforms Z-Rad and PyRadiomics. The stability is assessed with the ICC(3,1) (intraclass correlation coefficient) according to the Shrout and Fleiss convention. The total set of 1413 (856) radiomic features extracted, included 25 (16) shape, 19 (21) intensity, 137 (75) texture and 1232 (744) wavelet features for Z-Rad (PyRadiomics). To compare PyRadiomics and Z-Rad, a set of 686 (470) features, consisting of 9 (9) shape, 17 (17) intensity, 60 (36) texture and 600 (408) wavelet features was defined for CT (PET) images.

Results

Both feature extraction platforms provide high stability ($\overline{ICC} > 0.95$, *first quartile*> 0.9) for shape and intensity features in both imaging modalities when comparing 1 mm with 2 mm scaling resolution. However, there are a few outliers with low intraclass correlation present. Texture features show good stability ($\overline{ICC} > 0.8$, *first quartile*> 0.5) while most wavelet features show poor intraclass correlation. Only the LLL wavelet features show good stability ($\overline{ICC} > 0.8$, *first quartile*> 0.55).
Comparing Z-Rad and PyRadiomics led to a high intraclass correlation for intensity and texture features with both resolutions ($\overline{ICC} > 0.95$, *first quartile*> 0.85) in CT images. Shape features showed good stability ($\overline{ICC} = 0.91$, *first quartile*$= 0.62$) while wavelet features overall showed a low ICC ($\overline{ICC} = 0.42$, *first quartile*$= 0.20$). The analysis with PET images showed worse intraclass correlation for all general types.

Conclusion

An overall good stability of shape, intensity and texture features has been shown in the comparisons of two different image resolutions and two different feature extraction platforms. However, there are several outliers in each of these general types, explainable by extraction parameters, image properties and feature definition.

Primary authors: WIDMER, Lars (Universität Zürich); GABRYS, Hubert (University Hospital of Zürich)

Co-authors: BURGERMEISTER, Simon; BASLER, Lucas; BOGOWICZ, Marta; DUMMER, Reinhard; FÖRSTER, Robert; GUCKENBERGER, Matthias (Universitätsspital Zürich); HOGAN, Sabrina; HUELLNER, Martin; LEVESQUE, Mitch; PAVIC, Matea; VUONG, Diem; TANADINI-LANG, Stephanie (Universitätsspital Zürich)

Presenter: WIDMER, Lars (Universität Zürich)

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