LEVERAGING RANDOM SURVIVAL FOREST (RSF) AND PET IMAGES FOR PROGNOSIS OF MULTIPLE MYELOMA AT DIAGNOSIS

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Aims
✓ Predict Progression-Free Survival (PPS).
✓ Provide predictive features (Clinics and Radiomics).

Context
Multiple myeloma (MM) is a bone marrow cancer that accounts for 10% of all haematological malignancies. It was reported that full-body FDG PET imaging provides prognostic information for both baseline and therapeutic follow-up of MM patients (MM).

Aims
There is yet much to discover in the survival analysis of MM. However, the Random Survival Forest (RSF) [2] has demonstrated robustness but is not studied in the PET imaging and MM context. We developed a two-stage computer-assisted method based on PET imaging features towards assisting current diagnosis and treatment decisions for MM patients, with RSF and "Variable importance" (VIMP) [2].

1) The data
✓ Prospective multi-centric french IMAJEM study [1], 66 patients
✓ 132 Clinical and imaging features (textural and conventional).

2) The textural features: Radiomics
Example of the GLCM (Gray-Level Co-Occurrence) Matrix [3];
Translate the joint probability \(P(i,j|\sigma,\theta)\) of the ROI. The position \((i,j)\) represents the number of times that the combination of the pixels with \(i\) and \(j\) levels appears in the image, separated by \(\sigma\) pixels distance and a \(\theta\) angle.

For a distance of 1 and an angle of 0° (plan horizontal):
\[
\text{Energy} = \frac{Np \times Np}{(Np \times Np)} \sum_{i,j} (P(i,j))^2
\]

with \(Np = Np\) the size of the GLCM matrix.

3) The method

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Definitions
Right censoring: When no event (death/relapse) has taken place at the end of the evaluation period.
C-index: The concordance probability is the frequency of concordant pairs among all pairs of subjects.
Error prediction = 1 - C-index
Survival curve: Survival rates of a specific population, over a period of time.

A. Material and method

1) The data

2) The textural features: Radiomics

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References


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