Previous studies have shown that Quantitative Ultrasound (QUS) methods can provide tissue-microstructure information and are able to successfully detect metastases in human lymph nodes (LNs) harvested from cancer patients. Nevertheless, the gold standard for diagnosis remains pathological evaluation of histology photomicrographs.

The goal of the present study is to compare QUS-based and histology-based features which proved to be most valuable for metastatic classification in lymph nodes.

2 – ACQUISITION OF COLORECTAL LYMPH NODES IN HAWAII

- Home made 3D ultrasound system
- 25.6 MHz center frequency transducer
- Resolution: Axial 85 μm, Lateral 116 μm.

3 – QUANTITATIVE ULTRASOUND PARAMETERS

- Effective Scattere Size (ESS) + Acoustic Concentration (AC) were chosen for this study, as were two of the most important QUS features to classify cancerous/non-cancerous lymph nodes (AUC>0.95 on >100 LN of similar patients).
- For each lymph node, ESS and AC were estimated in cylindrical regions (diameter 1 mm, length along axis of transducer 1mm) within the lymph node tissue and then average over the whole lymph node.

4 – SELECTION OF TEXTURE PARAMETERS FROM HISTOLOGIC IMAGES

- On the lymph node training set, HPF were divided in 10 subsets for cross-validation.
- Sequential Forward Selection SFS) and cross-validation were used on those 10 subsets to choose the most important features to include in a SVM classifier that classifies HPF as non-metastatic or metastatic.
- SFS exhibited 5 Laws’ features. The two first were derived from the Hematoxylin sub-images. They are:
  - Mean after L7E7 filtering
  - Skewness after L5E5 filtering
- The final classifier retains those two features and was evaluated on the lymph node test set.
  - AUC = 0.986 on the lymph node classification task on the test set.

5 – COMPARISON RESULTS, CONCLUSION AND PERSPECTIVES

- At the considered scale and HPF size, the SFS selected five features and the two first were Laws features computed from the hematoxylin channel after H&E separation.
- The histologic features successfully classified the LN.
- L5E5_Skewness and ESS exhibited the strongest linear relationship ($R^2 = 0.56$) between any pair of QUS and histologic features (Right Figure).
- Only moderate information was shared between most performant QUS and histology features.
- Investigate other QUS parameters and other scales on histologic images.

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