HISTOPATHOLOGICAL ASSESSMENT OF SJOGREN'S DISEASE WITH HISTOMIL

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1. BACKGROUND

Primary Sjögren's (pSS) is a systemic autoimmune disease characterized by impaired function of the exocrine glands, pain and fatigue, greatly affecting patients' quality of life [1].

Histopathological assessment of labial salivary gland (LSG) biopsies is a key part of the diagnostic process, however their interpretation requires expert analysis, limiting access. Moreover, studies have shown there exists high inter-observer classification variability [2].

Deep learning can help automate and benchmark analysis to improve diagnostic capabilities and inter-observer concordance, ultimately leading to improved patient care.

AIM: To design a deep learning tool classifying LSG biopsies into pSS− (sicca) and + (sjögren), providing support to the diagnostic process.

2. METHODS

117 LSG biopsies were sampled, stained with H&E, digitized as Whole Slide Images (WSIs) and classified following 2016 ACR-EULAR Classification Criteria[1], 36 as pSS− and 81 as pSS+.

A gated-attention, deep multiple instance learning pipeline was implemented, modified from AttMIL/CLAM [3, 4] with a previously finetuned VGG16 backbone and attention score heatmap overlays[2]. Training was conducted using a 70/30% train/test split, with strict separation of patients between splits.

3. RESULTS

The model correctly classifies 89% of WSIs (Fig. 1A) and shows high diagnostic potential, correctly ranking patients (AUC = 88%) with a low rate of false negatives (Sensitivity = 90%).

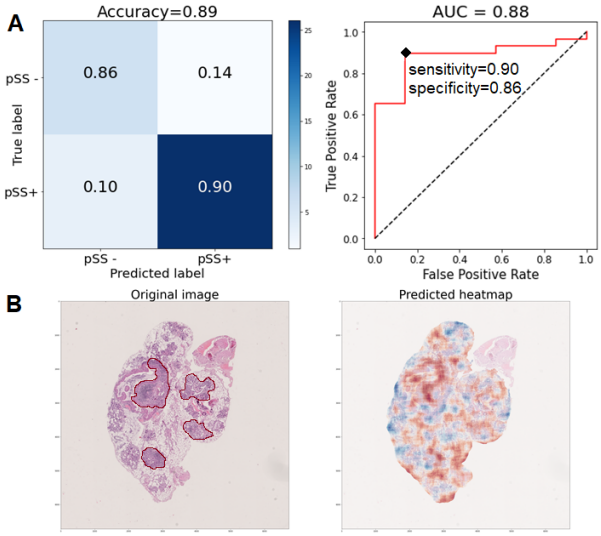

Fig. 1. **A**. Confusion matrix and Area Under the ROC Curve plot. **B**. Left: original WSI with areas of diagnostic relevance demarcated in red; Right: predicted heatmap overlay, with higher/lower attention scores in red/blue.

The attention heatmap (Fig. 1B) successfully highlights areas of diagnostic importance, corresponding to aggregates of lymphocytic infiltration. An in depth study of predicted heatmaps and incorrect predictions with pathologists/immunologists will help pinpoint where the model can be improved.

NEXT STEPS: Integrating further clinical data part of diagnostic criteria, such as presence of circulating auto-antibodies and salivary gland transcriptomics, to improve patient diagnosis and stratification.

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[1]Ethics approval: sample collection was approved by ethics committees (REC 05/Q0702/1, REC 17WS0172) for Rheumatology/Oral medicine clinic, Queen Mary University London.

[2]All code, implementation details and training schedule available at: https://github.com/AmayaGS/HistoMIL

4. REFERENCES

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