

SPATIALLY DIFFERENTIATED MEASUREMENT OF INFLAMMATORY CELLS WITH DEEP LEARNING REVEALS THE HETEROGENEITY OF CHANGES IN ULCERATIVE COLITIS

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An ensemble of convolutional neural networks was developed and validated to quantify key histological features in ulcerative colitis biopsies, including inflammatory cell counts, mucin depletion, and architectural changes, to support pathologist decision-making and provide sensitive metrics for clinical trials.

KEY POINTS

- The AI model was trained on 34,289 expert-labelled image-annotation pairs and validated on 6,464 held-out image-annotation pairs from 26 whole slide images spanning all large intestine sites commonly sampled during endoscopic investigation.
- The model spatially segments tissue compartments (crypts, lamina propria, muscularis mucosae) and identifies inflammatory cell types (neutrophils, eosinophils, lymphocytes, plasma cells) to produce density metrics for each region of interest.
- Goblet cell segmentation within crypts enables quantitative measurement of mucin depletion, and the model detects architectural changes, erosions, and ulceration to measure histological healing.
- Automated quantification in 66 confirmed UC patients revealed large intra- and inter-patient variability in inflammatory cell distribution across AI-identified tissue domains.
- The model is intended as a decision support tool to improve pathologist scoring alignment and provide visual overlays and quantitative metrics for clinical trial settings, not to replace pathologists.

- All model developers (DW, AM, RL, PA, PW, CL) are employees of Perspectum Ltd, and EF and RG are consultants for Perspectum Ltd.

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