An AI-based tool to identify cancer in lung biopsies

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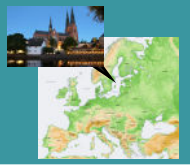


Background & objective

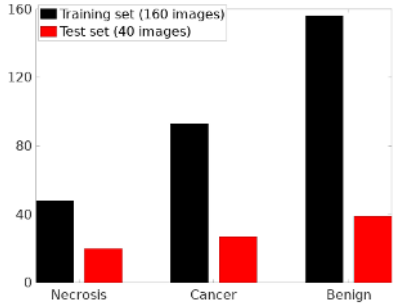
The microscopic evaluation of biopsies to diagnose lung cancer forms the backbone of clinical diagnostics and it is highly dependent on the experience of the pathologist. Even for a skilled pathologist, it is challenging to correctly identify cancer in the usually small biopsy specimen (taken transthoracic or endobronchial). To facilitate the diagnostic process, we trained a deep segmentation U-Net neural network [1] to identify cancer in lung biopsies.

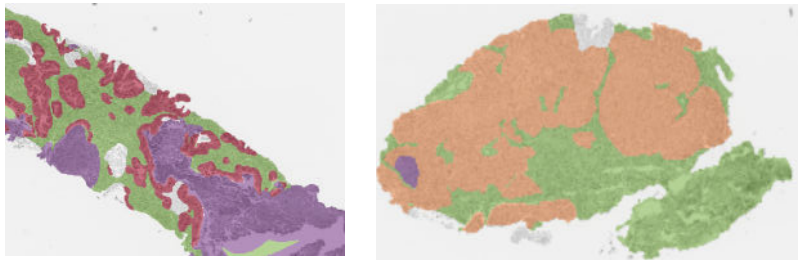
Cancer Suspicion → **Microscopic diagnosis** → **Therapy**

Methodology

We retrieved 90 retrospective cases of lung cancer, containing 200 whole slide images (WSIs) of H&E stained biopsies including clinical metadata from Uppsala University Hospital. The slides were scanned and pixel-level multiclass annotations were made by two pathologists, one reviewing the other, using Contextvision´s INIFY viewer and annotation tool. A U-Net was trained on 160 of the WSIs and was evaluated on the remaining 40.

No. Images in each class

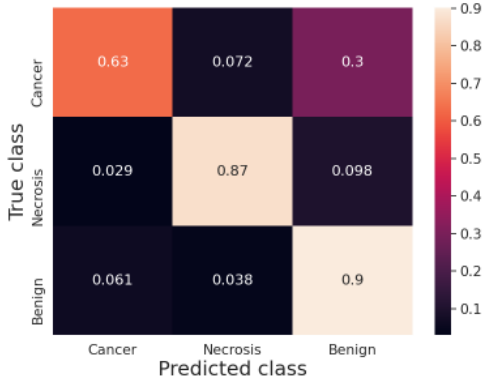


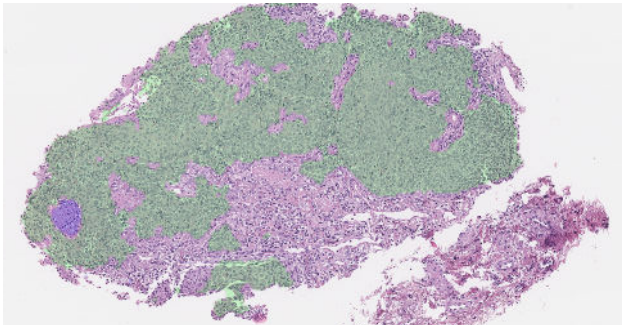


Examples of pixel-wise annotations for adenocarcinoma (red), squamous (orange), and necrosis (purple)

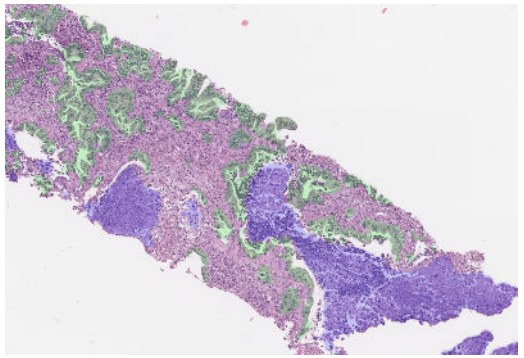
Results

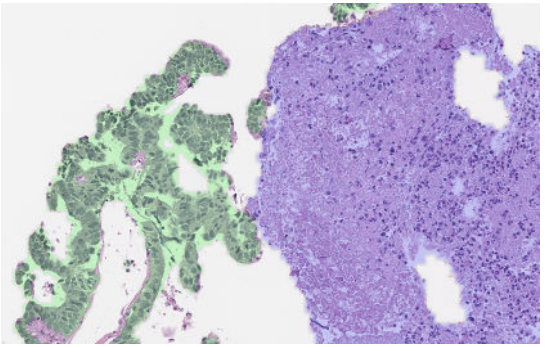
Pixel-level performance on all tissue pixels in the 40 evaluation images





Pixel-level predictions of cancer (green) and necrosis (blue) overlaid on evaluation H&E images





Conclusion

We present a deep learning network that can identify and outline necrosis and and cancer areas in lung biopsies with high accuracy. This network could be further developed into a decision support tool for pathologists in their routine diagnostic process.

References [1] Ronneberger, O. *et. al.* (2015), . arXiv:1505.04597