A new high-throughput auto-annotation method to detect and outline cancer areas in prostate biopsies

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Prostate cancer is one of the most diagnosed cancer forms and a leading cause of cancer-related death in males. The manual examination and Gleason scoring of prostate biopsies is however a major bottleneck in the pathology workflow, and studies have shown that the inter-observer variability in scoring is high. In order to reduce the risk of therapeutic decision errors, there is a high demand for implementation of an automated image analysis algorithm to serve as a decision support tool for pathologists. The aim of the present investigation was to develop a strategy for highly specific detection and outlining of cancer areas in clinical biopsy whole slide images (WSIs), which will serve as training material for machine-learning algorithms.

Prostate sections were triple-stained towards Cytokeratin 5/6, Cytokeratin 8/18 and AMACR, followed by DAPI counterstaining and immunofluorescence whole slide scanning. After detachment of coverslip, the same slides we stained with hematoxylin and eosin (HE) and scanned in brightfield. The immunofluorescent stainings generated high-resolution multiplex images marking specific structures in the prostate biopsies, accurately outlining the cancer containing areas. By overlaying the multiplex antibody stainings with HE in the computer, the cancer areas could be exactly marked in the corresponding HE images. This provides the basis for further qualitative and quantitative image analysis of prostate sections.

In summary, we have generated a robust and powerful method for specific and objective visualization of cancer areas in prostate biopsy WSIs, which will be used for machine-learning to generate a highly accurate decision support tool for pathologists.