ACCELERATING CANCER HISTOPATHOLOGY WORKFLOWS WITH STIMULATED RAMAN SCATTERING MICROSCOPY

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Histopathology serves as the bedrock of cancer diagnoses and grading with a resource-intensive workflow involving biopsy, tissue processing, and manual examination. Stimulated Raman Scattering microscopy (SRSM) is an emergent method that enables direct measurement of inherent molecular composition in tissue and consequently dispensing with the need for tissue processing and staining. The optical sectioning capability of SRSM enables thick tissue imaging at various depths thereby obviating the need for thin sectioning. In this work we leverage these capabilities to develop an alternate workflow, combining SRSM and deep learning to rapidly generate archival-quality virtual hematoxylin and eosin stains from excised tissue. We demonstrate our workflow with Prostate Cancer which is the leading form of carcinoma in males. The virtual stains we generate are in excellent visual agreement with stained images and on blinded evaluation by five expert urological pathologists were found to be non-inferior from real stains for diagnosis and grading. Since SRSM imaging involves no sample processing, the native lipid composition of the tissues is retained and reveals significant differences between cancer and benign patients. Collectively, we demonstrate a noise-tolerant, clinically translatable method of SRSM-based histopathology.