TECHNISCHE UNIVERSITÄT DARMSTADT

Transformation of the raw tissue sample to histopathological stained image

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In computational pathology, reliable analysis via a stained tissue sample digitized by a whole-slide image (WSI) scanner plays a vital role in pathological evaluation. Histological staining of the tissue sample provides precise information about the relationships between tissue components via chromatic distinction. The most commonly used stain is hematoxylin and eosin (H&E), which has become standard in almost every case and provides information about the morphological structure of the tissue sample [1]. Hematoxylin stains chromatin in the nucleus and nucleic acid in the cytoplasm purple-blue, while eosin mainly stains the components in the cytoplasm and extracellular matrix red, providing chromatic separation between tissue components [2]. By leveraging H&E staining, pathologists can distinguish between tissue types through the size and shape of cells and nuclei [3].

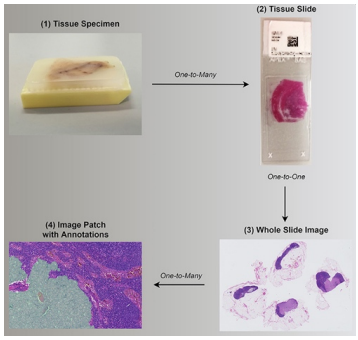

Figure 1: Histopathological staining of a tissue in a conventional laboratory flow [4].

The conventional laboratory staining workflow, which requires an expensive laboratory infrastructure, is time-consuming, complex, and tedious. In this method, tissue samples taken from the patient are sliced into approximately 5μ slices and fixed on a glass slide, followed by staining. The sample tissue is not 100% the same after the staining procedure because staining is a chemical process that needs to be heated up. The process might cause the tissue shrinks. Even if the tissue shrinks by half a millimetre, the cells around the area of interest will displace. This displacement can cause severe errors in routine diagnosis as to whether cells belong to this site or not.

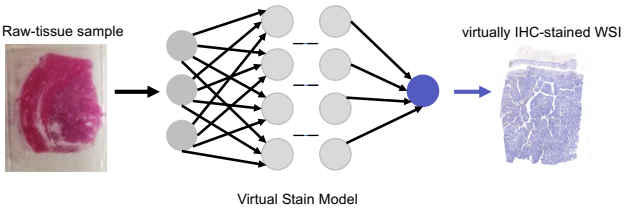

Figure 2: Virtual histopathological staining of a tissue.

In this thesis study, a deep learning-based virtual staining method [5] for raw tissue WSIs will be developed. Hence, we aim to minimize time loss and eliminate tissue deterioration caused by conventional staining.

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