Advancing from Two to Three Dimensions in Digital Pathology

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Pathologists render a diagnosis by reading thin tissue sections mounted on glass slides. An ability to infer three-dimensional (3D) structure from two-dimensional (2D) tissue sections is crucial for diagnosis and for full characterization of many disease processes, but this depends on the skill and experience of the individual pathologist. With advances in digital methods, it is now feasible to have a new workflow in which pathologists are presented with aligned whole slide images (WSIs) of serial sections. The expectation is for faster evaluation, greater objectivity, and improved diagnostic accuracy. A limitation of current slide scanning systems is that they are designed primarily for acquiring and viewing 2D WSIs. Thus we have two major aims in this project: 1) validate the usefulness of the 3D approach, and 2) develop and deploy web-based tools for aligning and viewing the WSI datasets. Our application will be 3D analysis of needle core renal biopsies. Our current protocol already calls for serially sectioning through a renal needle core biopsy. Here we will generate multiple WSI image datasets that we can use for direct comparison with the current approach of viewing glass slides on conventional microscopes. Our web-based tools will be integrated into an open-source digital pathology platform that we have developed and use for routine teaching of residents. Ultimately our goal is to have tools that are automated and easy to use so that they can be used routinely in clinical work.