Abstract: FR-PO019

Interactive Visualization of Kidney Structural Segmentations and Associated Pathomic Features on Whole Slide Images

Session Information

- AI, Digital Health, Data Science - II
  November 03, 2023 | Location: Exhibit Hall, Pennsylvania Convention Center
  Abstract Time: 10:00 AM - 12:00 PM

Category: Augmented Intelligence, Digital Health, and Data Science

- 300 Augmented Intelligence, Digital Health, and Data Science

Authors

- Keller, Mark, Harvard Medical School Department of Biomedical Informatics, Boston, Massachusetts, United States
- Lucarelli, Nicholas, University of Florida Department of Biomedical Engineering, Gainesville, Florida, United States
- Chen, Yijiang, Case Western Reserve University Center for Computational Imaging and Personalized Diagnostics, Cleveland, Ohio, United States
- Wang, Bangchen, Duke University Department of Pathology - Division of AI and Computational Pathology, Duhram, North Carolina, United States
- Alpers, Charles E., University of Washington Department of Laboratory Medicine & Pathology, Seattle, Washington, United States
- Janowczyk, Andrew, Emory University Department of Biomedical Engineering, Atlanta, Georgia, United States
- Hodgin, Jeffrey B., University of Michigan Department of Pathology, Ann Arbor, Michigan, United States
- Border, Samuel, University of Florida Department of Biomedical Engineering, Gainesville, Florida, United States
- Mimar, Sayat, University of Florida Department of Medicine - Quantitative Health, Gainesville, Florida, United States
- Naglah, Ahmed, University of Florida Department of Medicine - Quantitative Health, Gainesville, Florida, United States
- Bonevich, Nikki, University of Michigan Department of Medicine - Division of Nephrology, Ann Arbor, Michigan, United States
- Balis, Ulysses G. J., University of Michigan Department of Pathology, Ann Arbor, Michigan, United States
- Himmelfarb, Jonathan, University of Washington Kidney Research Institute, Seattle, Washington, United States

- Kretzler, Matthias, University of Michigan Department of Medicine - Division of Nephrology, Ann Arbor, Michigan, United States
- Barisoni, Laura, Duke University Department of Pathology - Division of AI and Computational Pathology, Duhram, North Carolina, United States
- Gehlenborg, Nils, Harvard Medical School Department of Biomedical Informatics, Boston, Massachusetts, United States
- Sarder, Pinaki, University of Florida Department of Medicine - Quantitative Health, Gainesville, Florida, United States

Group or Team Name

- The Kidney Precision Medicine Project (KPMP).

Background

The Kidney Precision Medicine Project (KPMP) is a collaborative study generating histology images and spatial molecular data from patient biopsies. To enable seamless study of whole slide images (WSI) and derived data, it is important to integrate solutions for navigation and visualization into computational pipelines.

Methods

We built a pipeline to (a) apply previously developed segmentation models of kidney structures on KPMP PAS-stained WSIs, including for globally/non-sclerotic glomeruli, arteries/arterioles, tubules, peritubular capillaries (PTC), interstitial fibrosis and tubular atrophy (IFTA), and the cortical interstitial fractional space (Ginley et al., bioRxiv 2023); (b) extract quantitative features from these structures; and (c) load these data in Vitessce (http://vitessce.io), a web-based framework for visualization and analysis of bioimaging data.

Results

Segmented KPMP WSIs linked to corresponding extracted features are visualized using quantitative colormaps and statistical plots such as histograms, violin plots, and bar charts. As a use case, we explore the spatial relationship between different structures and associated features (i.e., aspect ratio of PTCs in IFTA and non-IFTA regions).

Conclusion

Image analysis methodologies paired with web-based visualization tools allow for the interactive examination of renal morphometry. These tools enable KPMP investigators and a broader public to exploit WSI-extracted data for integration with other omics data and hypothesis generation and testing.

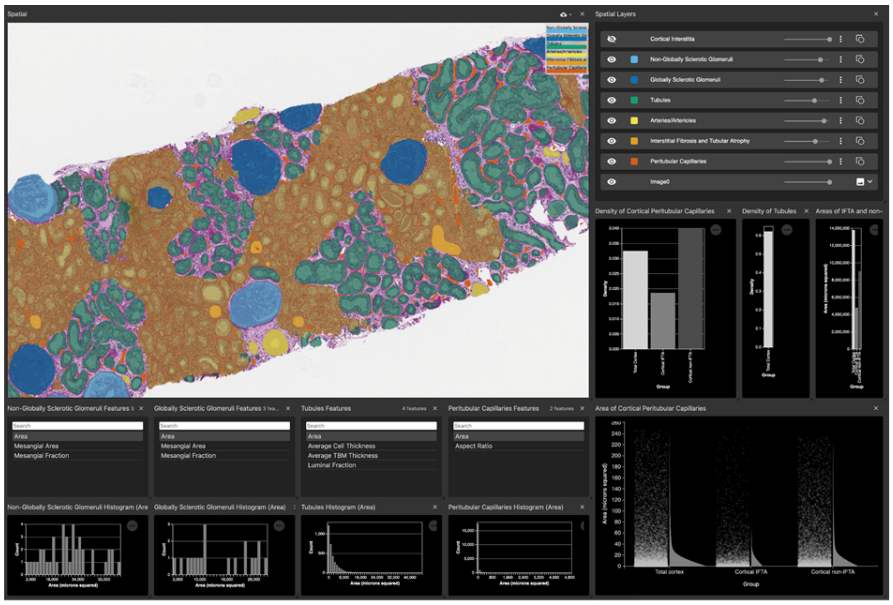

Figure caption: Vitessce showing whole slide image (WSI) data overlaid with segmentations of multiple kidney structures and statistical plots of quantified features such as area, cell thickness, or luminal fraction (of tubules) associated with those structures.

Vitessce showing WSI data overlaid with segmentations of multiple kidney structures and statistical plots of quantified features such as area, cell thickness, or luminal fraction (of tubules) associated with those structures.

Funding

- NIDDK Support