Deep learning segmentation of glomeruli on kidney frozen sections

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Value Proposition

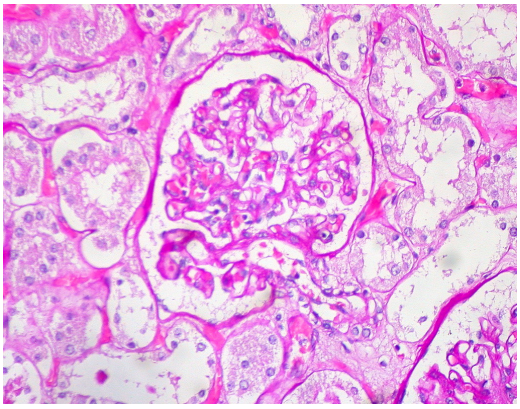
The conventional assessment of cadaveric donor kidneys by light microscopy is known to include several limitations. First, pathologists are required to travel to the site of explant at all times of the day or night, which has the potential to delay organ allocation. Second, the evaluation of donor kidney biopsies generally relies on the surgical pathologist on call, who often does not have formal training in renal pathology. These pathology reviews have high inter-reader variability relative to a trained nephropathologist. Rapid, reproducible, and accurate assessment of frozen tissue from donor kidney biopsies is critical to successful renal allograft transplantation. Such pathological assessment carries major clinical impact, including (a) reducing the number of discarded organs otherwise suitable for transplantation, (b) preventing the use of non-viable kidneys or kidneys with an already limited nephron reserve, and (c) predicting the allograft function and longevity in the transplant recipient. The ability to predict implant function and longevity across a widening pool of donor organs is thus becoming an essential component to precision kidney transplant medicine.

Technology

Duke inventors have developed an algorithm to assess frozen kidney donors to assist pathologists in properly predicting a successful implant. A deep convolutional neural network is used to automatically detect and segment normal glomeruli on whole slide image from donor frozen sections stained with hematoxylin and eosin. Over 250 renal biopsies harvested and processed (frozen, cut, and stained) have been manually segmented from Duke hospital and others institutions, providing thousands of glomeruli for training the CNN.

Advantages

- Can help standardize and improve the clinical process of assessing frozen tissues from donor kidney biopsies
- Has been trained using thousands of glomeruli
- Proof-of-concept has been demonstrated in the lab and hospital validation is planned



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Links

- From the lab of Dr. Laura Barisoni

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