Deep Learning Models for Automated Unbiased Measurement of Podocyte Foot Process Width

The solution is an automated foot process width estimation software that uses deep learning to automatically calculate the average podocyte foot process width and reduce the time it takes to assess kidney disease progression.

What is the Problem?

Podocyte injury plays a key role in many kidney diseases and are often characterized by increased podocyte foot process width (FPW). Although FPW is an important measure of podocyte injury, there is currently no consensus method to measure podocyte FPW. The current gold standard, unbiased stereology, is time-consuming and not widely available. Other methods, such as measuring FPW using tools like Photoshop, takes technicians hours to quantify podocyte injury in kidney tissue. As a result, there is a need to streamline and automate the process of taking FPW measurements.

What is the Solution?

The solution is an automated FPW estimation software that uses deep learning to automatically calculate the average FPW. The software takes in images and labels the glomerular basement membrane to the filtration slit, an intercellular junction that connects adjacent foot processes, using a custom-made machine learning algorithm called ForkNET. Through traditional computer vision techniques, the filtration slits are mapped to their respective membranes and the distance between them is measured to quantify the FPW.

What is the Competitive Advantage?

The competitive advantage of this technology lies in its ability to quickly measure and quantify podocyte FPW from medical images of kidney tissue in an automated fashion. This deep learning technology will significantly reduce the time it takes to assess kidney disease progression. It is also accessible through a cloud-based application, making this technology widely available for research and clinical applications. As the global kidney function tests market was valued at $845.9 million in 2022 with an expected CAGR of 6.5%, there is a significant opportunity for this innovation to advance the field of kidney disease diagnostics.

References

Technology ID

BDP 8830

Category

Research Tools

Selection of Available Technologies

Diagnostic

Authors

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Learn more

1. Smerkous, D., Mauer, M., Tondel, C., Svarstad, E., Gubler, M.C., Nelson, R.G., Oliveira, J.P., Sargolzaeiaval, F., Najafian, B.(2024) , https://www.kidney-international.org/article/S0085-2538(23)00675-0/fulltext, https://www.kidney-international.org/, 105, 165-176