Wales
Data Nation
Accelerator

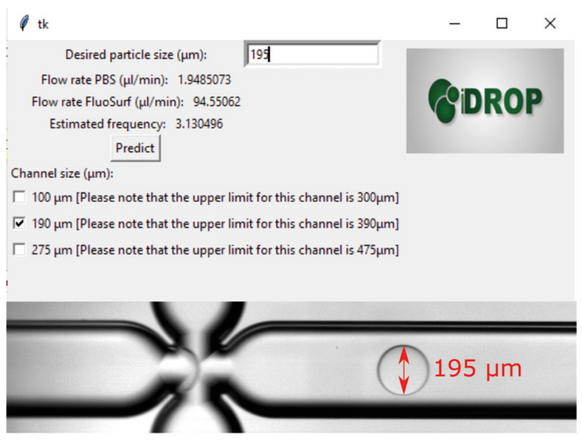
Intelligent Microfluidic Droplet Generator

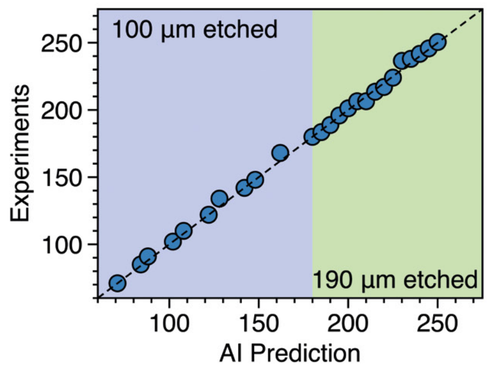
Summary

Droplets generated using microfluidic devices are widely employed for a myriad of applications, including synthesis of micro/nano particles, drug delivery, and single cell-analysis.

The current challenge in microfluidic droplet generation is the lack of a unified model that can suggest a priori the relevant parameters required for a desired output.

We here employed machine learning algorithm to develop a model to predict the required experimental conditions to generate a droplet of a given size, in different microfluidic configurations.





Benefits

The use of AI streamlined the process of identifying the best experimental conditions to achieve a certain droplet size. This is acutely aligned with the strategic needs of Dolomite Microfluidics. The company commented, verbatim, “Due to the complex nature of the fluidic and physical properties of the droplet generation process, there presently are no usable methods available to predict the size of droplets that will be generated at given fluid flow rates. This means that protocol development work is an empirical experiment-based process which can be time consuming and expensive in consumption of materials and reagents.

If the initial success achieved with the recent research can be developed further into a generally applicable tool, the work would be extremely valuable and important to many of the sectors Dolomite is active in, including Particle Generation for drug delivery, foods and cosmetics, encapsulation of cells for scRNA-Seq, and many applications in Diagnostics and research”

Further exploitation/next steps

Future exploration includes the improvement of the Deep Learning algorithm to expand the range of accurate predictions for droplets larger that 150 microns and smaller than 50 microns: this will require around 2-3 months.

Additional work will be required to expand the methodology to account for a number of different parameters including different channel geometries (e.g., T-junction devices) and different channel sizes: this will require 3-6 months and specialized staff working on the project. Similarly, different combinations of fluids required to produce the droplets will need to be investigated: this will require 3-6 months and specialized staff working on the project.

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Project group

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