Deep learning for solving complex fluid dynamics problem.

The ability to control a floating object on the surface of water remotely through surface waves has numerous applications ranging from collecting marine debris to organic cell manipulation. However, fluid interactions are extremely difficult to model. Their behavior is governed by a complex interplay of various external factors and internal interactions, which cannot reliably be mathematically predicted.

Our work uses the precision and repeatability of robotic devices coupled with real-world experimentation and deep learning to develop a control framework which can transport floating objects from one location to the other. Objects are moved from any starting location to a specified target location using a robotic manipulator to periodically excite the water remotely (like a dog paddling to get its tennis ball from the pool).

Recent developments in deep reinforcement learning are used to generate the best strategy to move the robotic manipulator. This is done by repeated trial and error experimentation by an intelligent agent that ‘figures’ out the best strategy through few days of controlled testing and real-world experiments in a laboratory setup.