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Graph Neural Network for Lagrangian Fluid Simulation ZIJIE LI, AMIR BARATI FARIMANI, Carnegie Mellon University — Despite the advances in computing power, computing high-quality fluid simulation is still computationally expensive. Meanwhile, data-driven model serves as an attractive alternative. In this work, we use graph to describe fluid field under Lagrangian system and build a neural network model upon graph representation, where physical quantities are encoded as node and edge features. Instead of directly predicting the acceleration or position correction given current state, we decompose the simulation scheme into separate parts-advection, collision and pressure projection. With different sub-networks each responsible for a specific reasoning task, the learned model is able to give reasonable prediction and remain stable in long-term simulation. The network is build upon simple graph aggregation and standard multi-layer perceptron, but we show that it can accurately learn and simulate the underlying complex fluid dynamics based on observations. Our tests demonstrates that, first, it can remain stable and be extrapolated to situation with different geometries and conditions. Second, the simplicity of the model enables its fast inference during simulation. Third, the learned model is able to maintain low velocity divergence and generate reasonable pressure distribution.

zijie li
Carnegie Mellon University

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