Fluid Dynamic Models in Machine Learning

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Fluid dynamic models play an important role in understanding the dynamics of recent machine learning models including reverse diffusion models and feature learning via stochastic gradient descent. I will describe connections between incompressible fluid models and probabilistic models, highlighting the role of conservation laws in both contexts. Specifically, the Fokker-Planck equation provides a framework to describe how velocity flow fields and diffusive processes influence the spatial and temporal evolution of the probability distribution. I will also discuss how these concepts apply to modeling the weights and kernel integral operators in neural networks during feature learning.