CRUNCH Seminars at Brown, Division of Applied Mathematics

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Paper Review: Deep Fluids: A Generative Network for Parameterized Fluid Simulations by Byungsoo Kim et al.

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This paper presents a novel generative model to synthesize fluid simulations from a set of reduced parameters. A convolutional neural network is trained on a collection of discrete, parameterizable fluid simulation velocity fields. Due to the capability of deep learning architectures to learn representative features of the data, our generative model is able to accurately approximate the training data set, while providing plausible interpolated in-betweens. The proposed generative model is optimized for fluids by a novel loss function that guarantees divergence-free velocity fields at all times. In addition, we demonstrate that we can handle complex parameterizations in reduced spaces, and advance simulations in time by integrating in the latent space with a second network. Our method models a wide variety of fluid behaviors, thus enabling applications such as fast construction of simulations, interpolation of fluids with different parameters, time re-sampling, latent space simulations, and compression of fluid simulation data. Reconstructed velocity fields are generated up to 700× faster than re-simulating the data with the underlying CPU solver, while achieving compression rates of up to 1300×.
arXiv Link: https://arxiv.org/abs/1806.02071