New closure for Vlasov-Poisson equation using Machine Learning

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Abstract

In this work we are interested in the modeling of plasmas, which are charged-particle fluids. Thanks to machine leaning, we construct a closure for 1d fluid equations. This closure, based on a fully convolutional neural network called V-net, takes as input the whole spatial density, mean velocity and temperature and predicts as output the whole heat flux. Data generation and preprocessings are designed to ensure an almost uniform accuracy over the chosen range of Knudsen numbers (which parametrise collision regimes). Finally, several numerical tests are carried out to assess validity and flexibility of the whole pipeline.