Smart mesh generation for a two-dimensional computational fluid dynamics using machine learning

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A method of smart mesh generation for computational fluid dynamics (CFD) of a simple two-dimensional (2D) rectangular shape geometry was proposed using a machine learning approach. The training and test sets of two million meshing data were generated by the rule-based expert system that was applicable for a wide range of boundary conditions and fluid material properties. The machine learning model with ten input variables and six output variables was constructed by several schemes including linear regression, decision tree, neural network and supervised deep learning. In the deep learning model, the number of nodes and hidden layers was determined by the trial-error. To evaluate the prediction accuracy, the root mean square error (RMSE) and coefficient of determination (R-squared) of each scheme were compared. The supervised deep learning scheme with two hidden layers and 10 nodes for each layer showed the best accuracy for the mesh generation in the 2D rectangular shape geometry. The present smart mesh generation approach demonstrated the potential for integrating artificial intelligent into CFD modeling and simulation.