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Visualization of internal procedure in neural networks for fluid flows[1] MASAKI MORIMOTO, Keio University, KAI FUKAMI, University of California, Los Angeles, KOJI FUKAGATA, Keio University — In recent years, many researchers have explored the use of neural networks for various problems in fluid dynamics. For more practical uses of them, we aim here to increase the interpretability of the machine learning models, i.e., to provide understandable explanation on the results. Generally, the internal structure of deep networks is complicated, and we often encounter difficulty in its interpretation due to a massive number of parameters and nonlinear activation functions. In the present talk, we introduce two ways of visualizing the internal procedure of neural networks following our previous studies, i.e., (1) CD prediction of a cylinder wake (Fukami et al., Theor. Comput. Fluid Dyn., 2020) and (2) experimental velocity estimation from PIV images (Morimoto et al., arXiv:2005.00756). The visualization of each layer for the trained network is demonstrated first. We find that the upstream layer has higher interest on the alignment of bodies while the downstream layer is more related to the velocity fluctuations. We also use a gradient-weighted class activation mapping (Grad-CAM), which can map the influential regions. We anticipate that both methods would serve as a powerful tool for the interpretation of various neural networks with fluid flow problems.

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