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Optimization of Deep Learning Model for Aerofoil Flow Analysis

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Abstract. Computational fluid dynamics spends much time and computational resources to simulate the aerodynamic behaviour of complex systems, such as drug delivery problems inside human body. This study suggests a method for solving these problems by using deep learning, one kind of artificial intelligence. This study analyzed the incompressible fluid dynamics around 2D airfoils by using U-net architecture based on convolutional neural network (CNN), and estimate the pressure and velocity fields. This study used University of Illinois at Urbana-Champaign (UIUC) airfoil database and analyzed 1404 types of airfoils as both training data and test data. Angle of attack (AOA) and inlet velocity were conditioned as calculation parameters. As a result of the deep learning, this study obtained good agreement with the result of Reynolds Averaged Navier-Stokes simulation, a mean relative pressure and velocity errors between them under 1.4%.

Keywords: deep learning, U-net, RANS, CFD