The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5 – 9 June 2022, Oslo, Norway

A COMPARISON OF MACHINE LEARNING METHODS FOR PRESSURE COEFFICIENT PREDICTION OF AN AERONAUTICAL CONFIGURATION

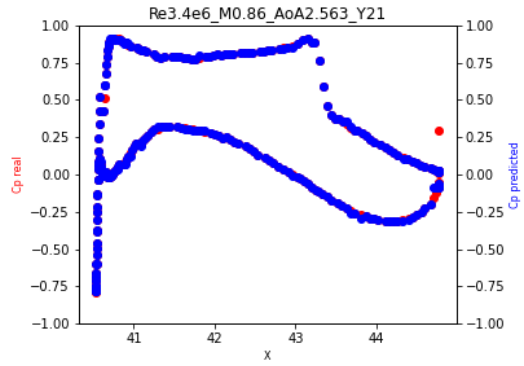
Alejandro Gorgues, Rodrigo Castellanos, Jaime Bowen, Esther Andrés,

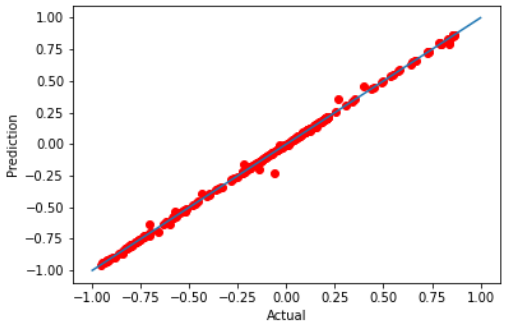
Theoretical and Computational Aerodynamics Branch, Flight Physics Department
Spanish National Institute for Aerospace Technology (INTA)
Ctra. Ajalvir, km. 4. 28850 Torrejón de Ardoz, Spain
eandper@inta.es

Key Words: *machine learning, data-mining, aerodynamic analysis, computational fluid dynamics, surrogate modelling.*

Machine learning entails powerful information processing algorithms that are relevant for modelling, optimization, and control of fluids. Currently, machine learning capabilities are advancing at an incredible rate, and fluid mechanics is beginning to tap into the full potential of these powerful methods. Many tasks in fluid mechanics, such as reduced-order modelling, shape optimization and uncertainty quantification, may be posed as optimization and regression tasks. Machine learning can dramatically improve optimization performance and reduce convergence time.

In this paper, the potential of machine learning techniques for the aerodynamics prediction of an industrial-relevant aircraft configuration has been assessed. Different machine learning algorithms have been evaluated showing that the DecisionTree regression model performs the best in this case. In addition, a deep learning model, a deep neural network, has been also tested and the results were compared to other traditional regression methods. The following pictures show some of the results obtained in the work:





REFERENCES

[1] Dupuis, Romain, Jean-Christophe Jouhaud, and Pierre Sagaut. "Improved Surrogate Modeling using Machine Learning for Industrial Civil Aircraft Aerodynamics." arXiv preprint arXiv:1912.04706 (2019).

[2] Li, Kai, Jiaqing Kou, and Weiwei Zhang. "Unsteady aerodynamic reduced-order modeling based on machine learning across multiple airfoils." Aerospace Science and Technology (2021): 107173.

[3] Andrés-Pérez, Esther. "Data Mining and Machine Learning Techniques for Aerodynamic Databases: Introduction, Methodology and Potential Benefits." Energies 13.21 (2020): 5807.