

Enhancing Computational Fluid Dynamics with Machine Learning Integration

Quinn Green

PhD

Massachusetts Institute of Technology
77 Massachusetts Avenue, Cambridge, MA 02139, USA

Joseph Wilson

Dr.

University of Cambridge
The Old Schools, Trinity Ln, Cambridge CB2 1TN, United Kingdom

Jamie Anderson

Prof.

Technical University of Munich
Arcisstraße 21, 80333 München, Germany

Abstract. This study explores the integration of machine learning algorithms into computational fluid dynamics (CFD) simulations to enhance accuracy and efficiency. By leveraging neural networks and data-driven approaches, the research demonstrates improved prediction capabilities of turbulent flows and complex fluid interactions. The findings suggest significant potential for reducing computational costs while maintaining high fidelity in simulations, paving the way for more robust engineering designs.

Keywords: Computational Fluid Dynamics, Machine Learning, Turbulent Flows, Neural Networks, Data-Driven Models

Introduction

Computational Fluid Dynamics (CFD) has long been a staple in engineering and scientific research for simulating fluid flows. However, traditional methods often face challenges related to computational expense and the need for extensive domain knowledge. Recent advancements in machine learning offer promising avenues to address these issues. This article investigates the integration of machine learning techniques with CFD simulations to enhance their predictive capabilities and efficiency. By employing neural networks and data-driven models, the study aims to reduce computational costs while maintaining or improving accuracy. Initial results indicate a potential paradigm shift in how CFD simulations are conducted, offering more robust tools for engineers and scientists.

This is a preliminary version. To read the full version of the article, please purchase a subscription.

References

1. KUMAR, Nitin; KATARIA, Vipin. Enhanced Sentiment Classification using a Multi-layered Stacked Ensemble Architecture.

2. Рагимов, Э. Р. О. (2011). Метрология элементов безопасности программных комплексов, реализующих систему защиты информации корпоративных сетей. Вопросы защиты информации, (2), 36-41.