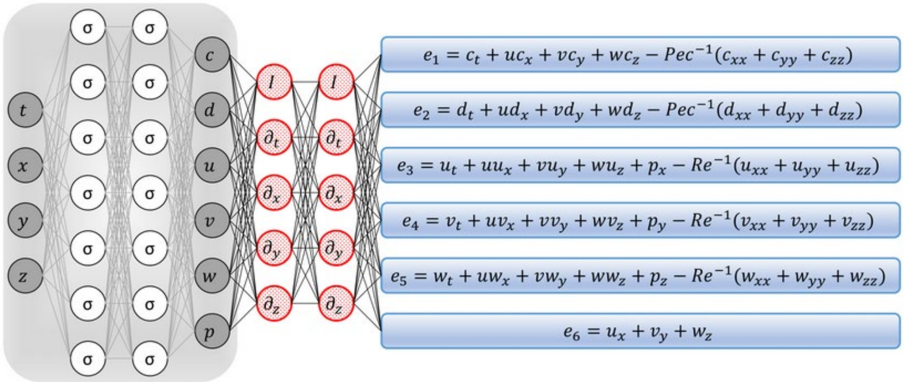
Student assistant

Physics-informed neural network for flow investigations

Deep learning and neural networks are applied in various fields these days. Some examples are object classification and language processing. However, even though the performance of neural networks is often impressive, neural networks still struggle to capture and represent the full dynamics and properties of turbulent fluid flows. An approach that recently obtained a lot of attention is the so-called physics-informed neural network (PINN). The advantage of PINNs with regard to conventional neural networks is that PINNs incorporate the underlying physics. The results obtained by the PINNS are promising [1].

Therefore, we are looking for a student who adapts the PINNS structure to allow predictions of additional physical quantities from experimental and simulation data of temperature-driven flows. The starting point is an available PINN model built in Tensorflow 1 that should be transferred into Tensorflow 2 and modified for temperature-driven flows [2].



Exemplary PINN that “knows” the Navier-Stokes equations [2]

Tasks:

- Transferring a given PINN from Tensorflow 1 to Tensorflow 2
- Modifying the PINN to our specific requirements
- Documentation of the code
- Training and testing of the PINN on available experimental and numerical data

Requirements:

- Good knowledge of Python and Tensorflow
- Interest and curiosity in the topic
- Independent way of working after some introduction
- Basic knowledge of fluid mechanics is a plus

References:

[1] Raissi et al., Science (2020), DOI: https://doi.org/10.1126/science.aaw4741
[2] https://maziarraissi.github.io/HFM/

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