Convolutional Neural Networks for Bubble Flow Reconstruction

Keywords: Convolutional Neural Networks (CNN)

Two-phase bubbly flows occur in nature and in many industrial applications. For example, bubble columns are used in chemical, biochemical and petrochemical reactors. In many industrial settings the velocity field and gas distribution are required, but the only available information is 2D images.

This project aims at improving the methods for extracting information from those 2D images. To achieve this goal we propose to train a convolutional neural network (CNN) on the labeled simulation outcomes and then apply it to the experimental measurements. CNNs have already proven their efficiency in determining overlapping, blurred, and non-spherical bubble images [2].

This project involves setting up simulations using Paris, or Paris Simulator (PArallel Robust Interface Simulator) [3] which combines the Volume-Of-Fluid (VOF) and Front-Tracking methods, building a CNN using tensorflow [4], interpretation of the results. This project can be adapted to BSc or MSc level. A student job (HiWi) is also possible. Collaboration with a group providing experimental data is possible.

PREREQUISITES

Basic programming skills
Basic knowledge of python
Basic knowledge of neural networks

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LITERATURE


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In the CSE lab, we combine computational methods, computer science tools and domain specific knowledge to solve scientific and engineering problems in areas such as Fluid Mechanics, Nanotechnology and Life Sciences. Motivated by challenges in application fields, we focus on identifying the common elements among computational techniques and on formulating common methodological, algorithmic and software structures that facilitate their further development.