CRUNCH Seminars at Brown, Division of Applied Mathematics

Friday – August 23, 2019

Deep-PIV: particle image velocimetry via deep learning techniques

Shengze Cai

Particle image velocimetry (PIV), as a common technology for analysing the global flow motion from images, plays a significant role in experimental fluid mechanics. In this work, we investigate the deep learning-based techniques for such a fluid motion estimation problem. The aim of this novel technique is to extract two-dimensional velocity fields from fluid images efficiently and accurately. First, we introduce the convolutional neural network (CNN) called LiteFlowNet, which is proposed for end-to-end optical flow estimation. Enhanced configurations of LiteFlowNet are adopted for PIV estimation in order to refine the small-scale vortex structures. Furthermore, as the supervised learning strategy is considered, a dataset including particle images and the ground-truth fluid motions is generated to train the parameters of the networks. A number of fluidic images, from synthetic turbulent flow to laboratory boundary layer flow, are investigated to validate the performance.