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Deep learning-based shadowgraph: implementation of Mask R-CNN to bubble detection in complex two-phase[1] YEWON KIM, HYUNG-MIN PARK, Seoul Natl Univ — One of the tricky issues in experimentally investigating the gas-liquid two-phase flow is to measure the bubble statistics. This is more serious when the flows are measured optically, in which the bubbles are densely populated. Due to wide range of flow conditions and lighting system, it is impossible to apply a global threshold for processing the optically-obtained images. Recently, deep learning showed up as a promising tool for tackling complex fluid mechanics problems, including the two-phase flow experiments. However, the bubble detection still remains at the level of bounding box detection, which is not sufficient. In this study, we trained the Mask R-CNN, a popular model in the field of object detection, using optimized datasets (real experimental and synthetic images for bubbly flows) and parameters to develop an universal tool for detecting the actual bubble shapes (not a box). We also used a customized loss function to enhance the detection performance for small objects (bubbles). We found that the accuracy of detection on the validation data set is above 95%. Furthermore, the time taken for detection is reduced by up to 3 times compared to conventional digital image processing method, while providing comparable quality of detected bubble masks.

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