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## Exploring Bubble Flow with Deep Learning: A Preliminary Study

In a bubble flow study, the bubble size measurement requires identifying every instance in each image frame in the first place. However, their tininess and highly overlapped instances hindered not only human-level manipulation but also any deep learning-based detectors. In addition, their dense presentation in the observation zone made manually measuring phase time-consuming and laborious. Annotation pipelines, adopted foundation models, and human intervention were proposed; those accelerate this process and help to build a real-world bubble detection dataset ready to fine-tune a deep learning model faster. Experimental results yield YOLO as the best balancing detector when coupled with upscaling during training for tiny bubble detection and its application in bubble size distribution.

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