

## Bachelor's or master's thesis

### „Convolutional neural networks for instance segmentation in droplet images“

#### Topic:

In the production of functional nanomaterials in spray flame synthesis (Fig. 1a), the spray, i.e. droplet formation, evaporation and combustion, is of crucial importance. Rapid and complete evaporation of the droplets is desirable. A high-speed, high-resolution measurement technique is used to visualize regular and disrupting droplets in the spray flame. Droplets were sometimes found to burn disruptively, as “micro-explosions”. The essential goal of this work is to use a neural network to find and distinguish round and disrupting droplets. Existing droplet images (Fig. 1b and c) train a pretrained (trained with COCO dataset) convolutional neural network (Mask R-CNN). Annotations and labels need to be added to the training images which is done with commercial online tools (VGG image annotator). The programming will be done with Python. The trained network is then applied to validation datasets. The resulting segmented regions of droplets and their morphologic properties will be compared to the results from an existing explicit programming scheme.

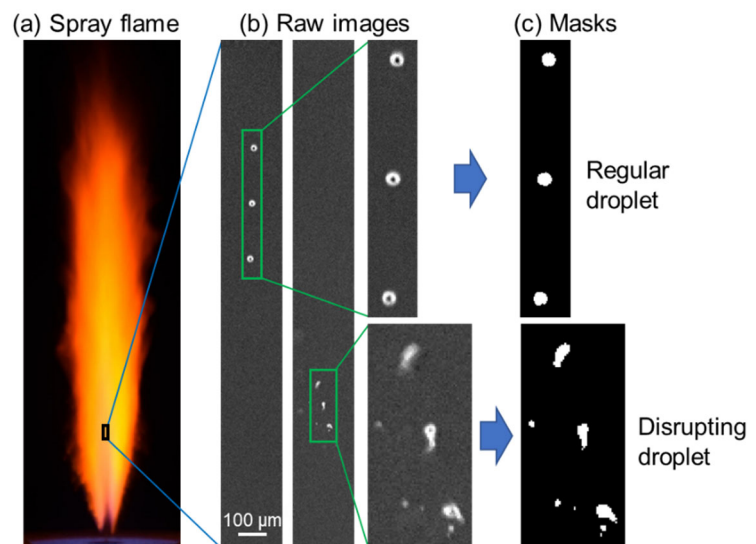


Figure 1: (a) Spray flame, (b) Raw images of droplets, (c) Mask images of droplets. Figure 1a from: Schneider et al., Rev. Sci. Instrum. 90 (085108).

#### Tasks:

- Preparation of training datasets
- Extension of existing convolutional neural network, then application of network

#### Requirements:

- Basic programming skills in Python
- Interest in image post-processing analysis

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