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Machine Learning for Plaque Assays

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The evaluation of plaque assays is a crucial step when studying viruses, as they are used to determine viral reproduction. This is done via a dilution series of the virus, which is applied to gel plates containing a confluent layer of host cells. Infected cells are killed by the virus and the number of empty patches ("plaques") will therefore indicate the viral load of the original sample.

Counting these plaques however is not trivial, and today evaluating these assays often remains a manual task. To speed up this task, we develop an approach combining semantic and instance segmentation, to classify plaques which have merged, and thus can not be reliably counted, and plaques arising from a single virus. Merged plaques are identified via a class segmentation, whereas single plaques get separated by an instance segmentation. We are additionally establishing an iterative annotation strategy, where preliminary predictions corrected by the lab experts are used to re-train new models, to quickly increase the train set size in order to achieve a broadly applicable model in the end.

By combining instance and class segmentation, we were able to better reflect the reality of the dataset, and this approach might be also applicable to other real world datasets. In summary, generating a feedback loop with preliminary manually corrected annotations enables a quick increase in training data.

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