Multi-domain semi supervised learning for instance segmentation of neuromuscular junctions

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α-Bungarotoxin labels the neuromuscular junction in mice. Counting these labels in microscopy scans manually is not feasible. We try to employ a **semi supervised learning** approach utilizing the wide range of existing data to solve this problem efficiently.

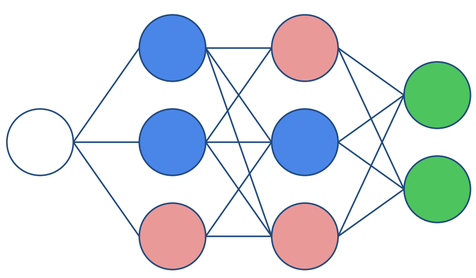
Objectives

- Segment and count instances of neuromuscular junctions
- Reduce the amount of manually annotated data by using self supervised learning

Semi supervised learning

Pretraining a network on a *proxy task* that
- implicitly learns the main task
- does not require annotated data

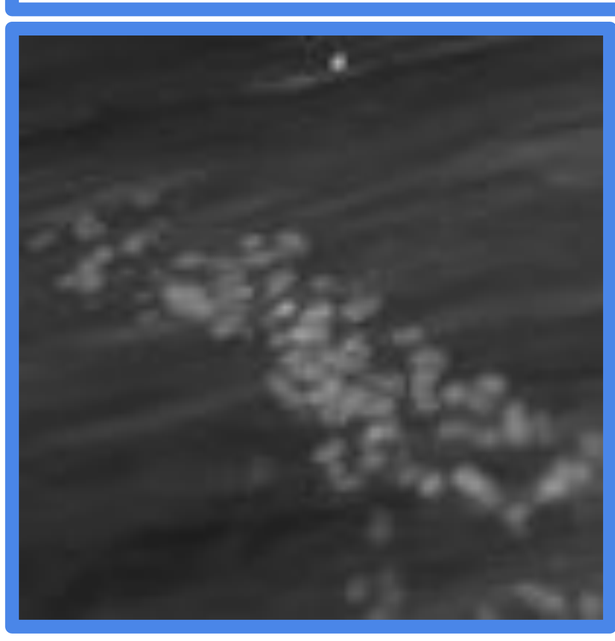
before fine tuning it on the *primary task*



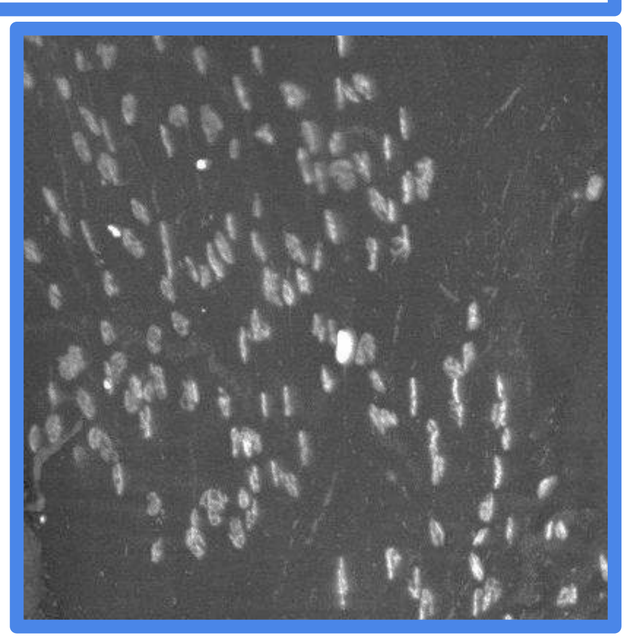
A sketch of a self supervised network: both blue and green parts are already pre trained on the proxy tasks while the last layers are fine tuned on the primary task

Proxy Task Magnification detection
Identify different levels of magnification

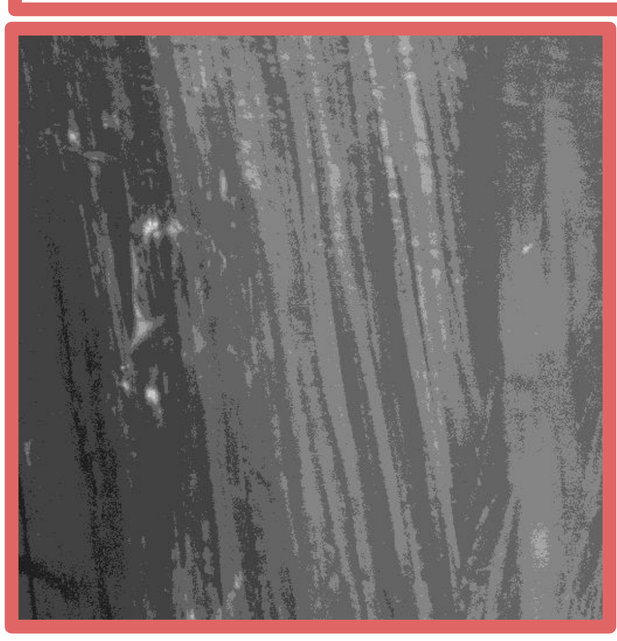
Proxy Task Channel detection
Identify different channels of the input data



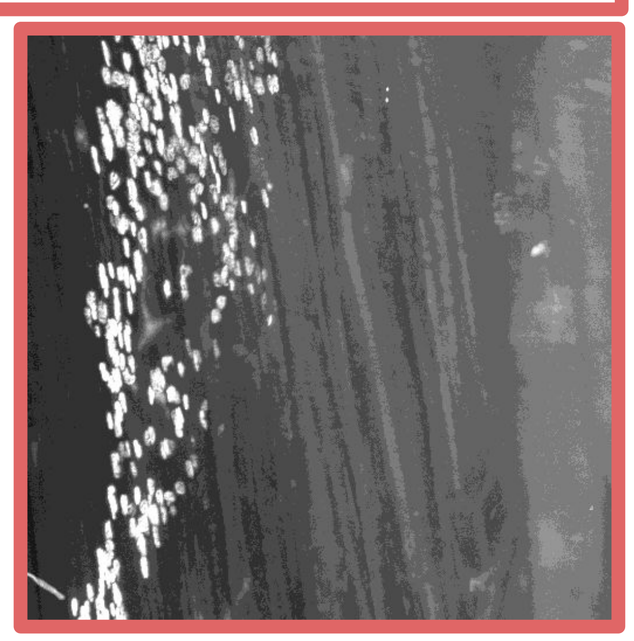
1x magnification



4x magnification

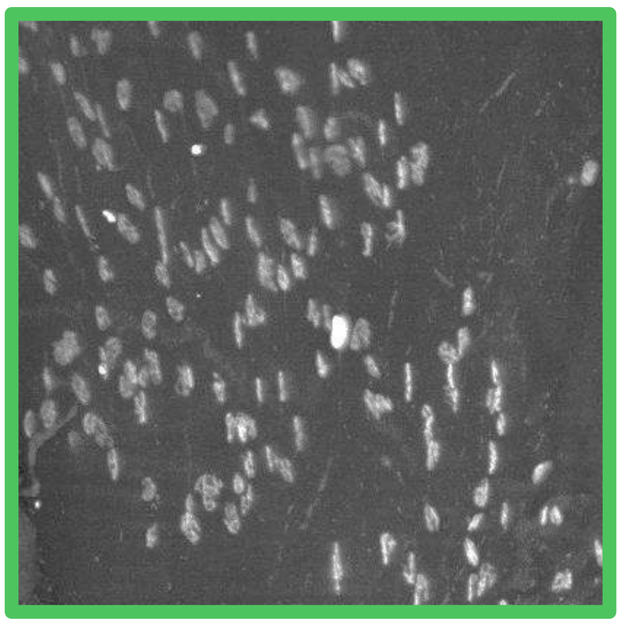


Background channel

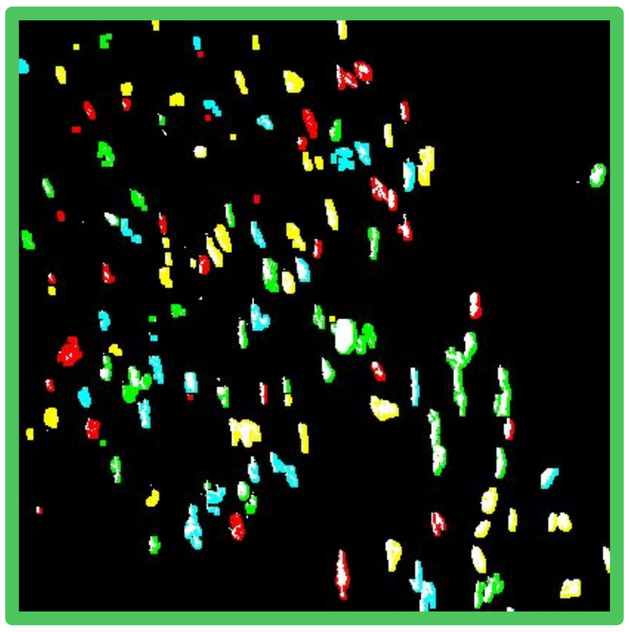


Foreground channel

Primary Task Instance segmentation
Identify and count individual instances of neuromuscular junctions
using the pre trained network components and annotated data



Raw Input



Instance segmentation