

## **OBJECT DETECTION: NEURAL ANNOTATIONS**

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When it comes to real-time neural decoding object detection is a pertinent tool. In order to perform object detection for neurons on a large dataset, a few images from the dataset must first be annotated. The annotations use ground truth data as a comparison to indicate the specific location of each fired neuron in each image analyzed. The annotations are then used to train an object detection algorithm, before the algorithm can detect neurons in real-time.

The question now stands: How to compute neural annotations given a dataset of calcium images and their corresponding ground truth data? Well, two environments were researched: ImageJ and MATLAB. ImageJ offered the ability to create masks and analyze images without programming, however MATLAB allowed for programming precise calculations creating more accurate results. Therefore, a program was created using MATLAB to annotate the few images necessary. The program first calculates the background average of each image. It then compares the average to the neuron locations, from the ground truth, in the images to determine if a neuron is fired. If a neuron is confirmed to be fired it's information is formatted according to a specific object detection algorithm and then written to a .txt file.

The next step is to train an object detection algorithm using the neural annotations computed. The chosen algorithm to be researched is named YOLOv3. YOLOv3 is known for its speed and accuracy. After YOLOv3 is trained using neural annotations, it will be run to show real-time neural detection.

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