Facial Weakness Identification for Stroke Detection

Agenda

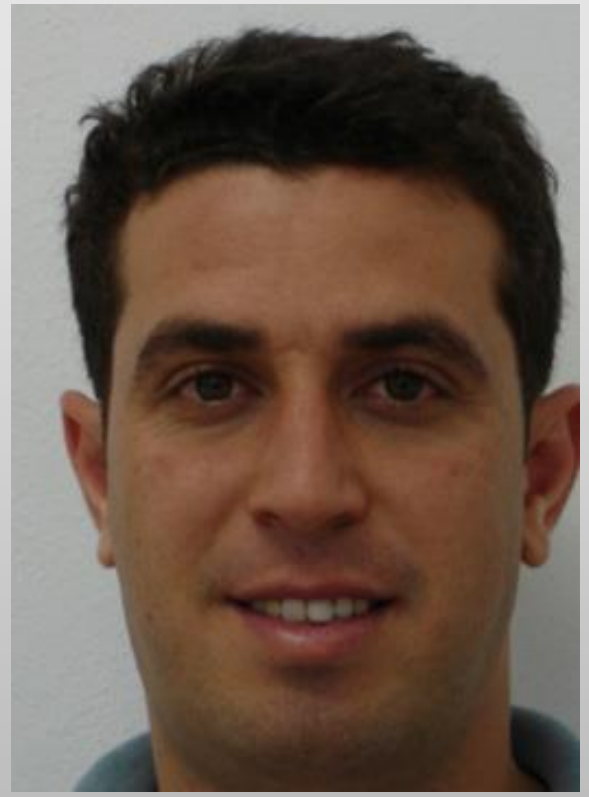
- The Aim of Facial Weakness Detection
- An Introduction to Mask-RCNN
- Image Labelling
- Image Augmentation
- Analysing the Results
- What’s Next?

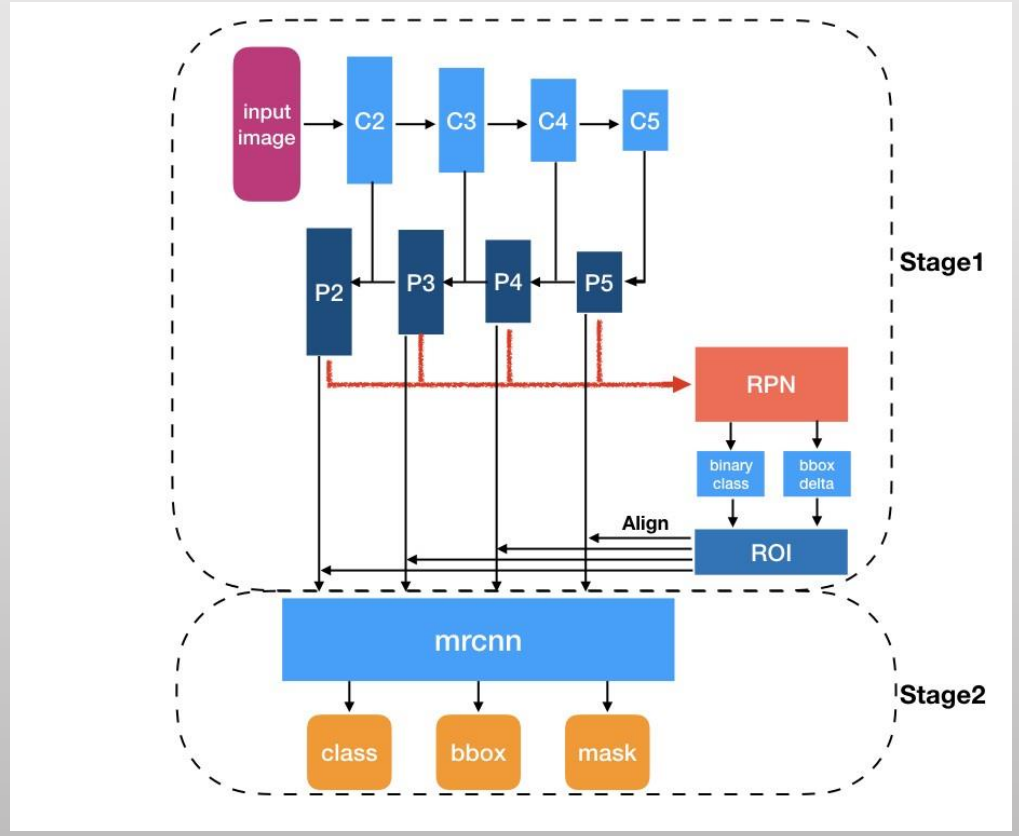
The Aim…

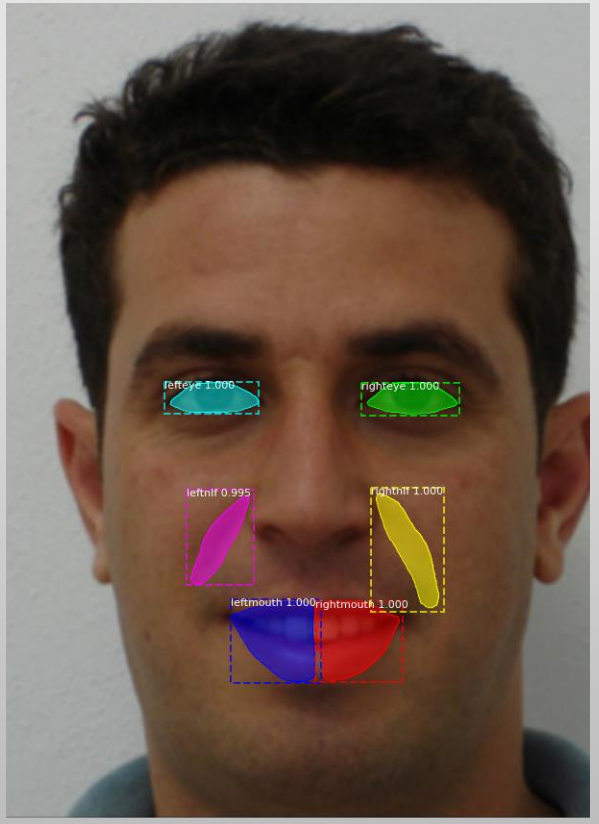
- To encode the decision-making expertise of neurologists.
- To create a computational tool to support paramedics in accurately detecting stroke to enable the early onset of treatment and consequently improve the person's quality of life.

Introducing Mask-RCNN

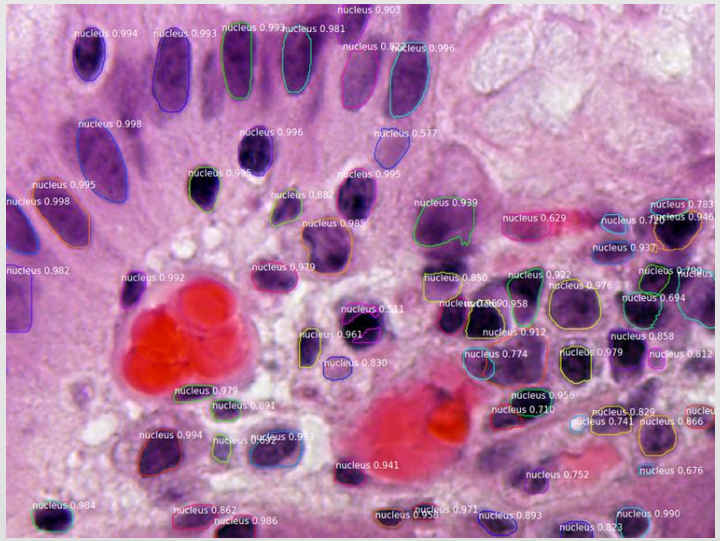
- Mask RCNN is a **deep neural network** intended to solve instance segmentation problems.
- **Instance segmentation** is the automatic representation of different objects appearing in an image or video.

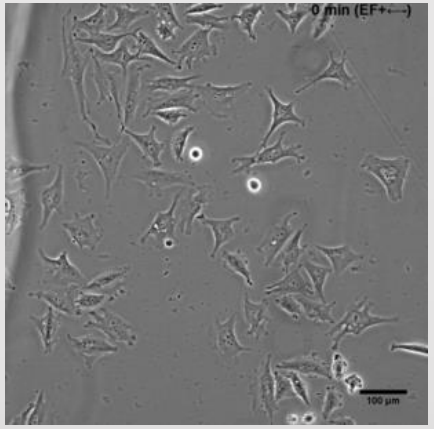






Uses of Mask-RCNN





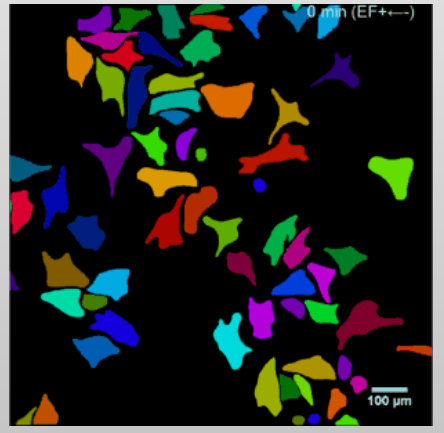
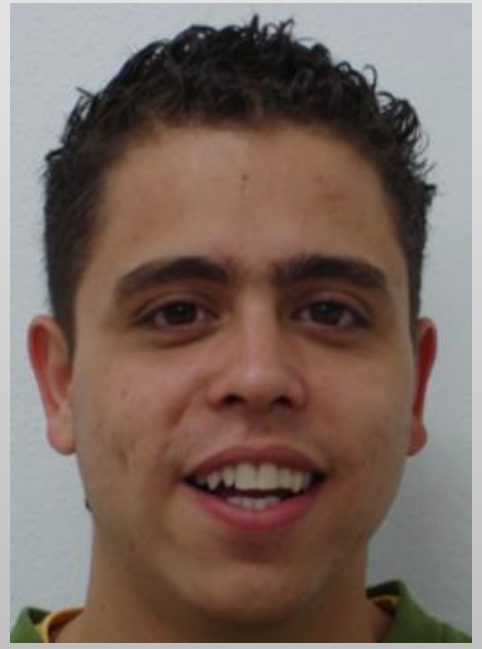


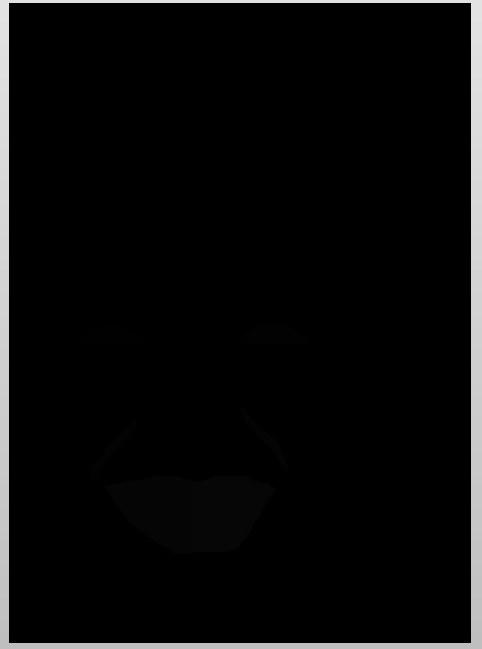
Image Labelling

- The dataset consists of 200 frontal images of healthy people smiling.
- I initially used MATLAB's **Image Labeller** tool to label the regions.

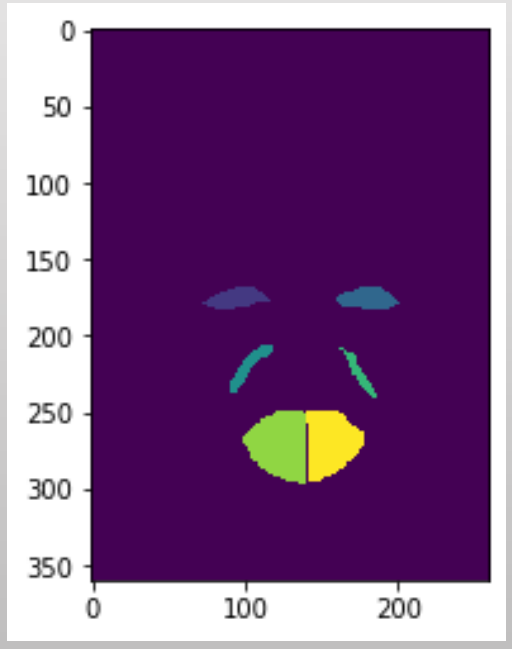
Original Image



MATLAB Image Labeller



Python Visualisation



Ex. Inference Test Result – Model A

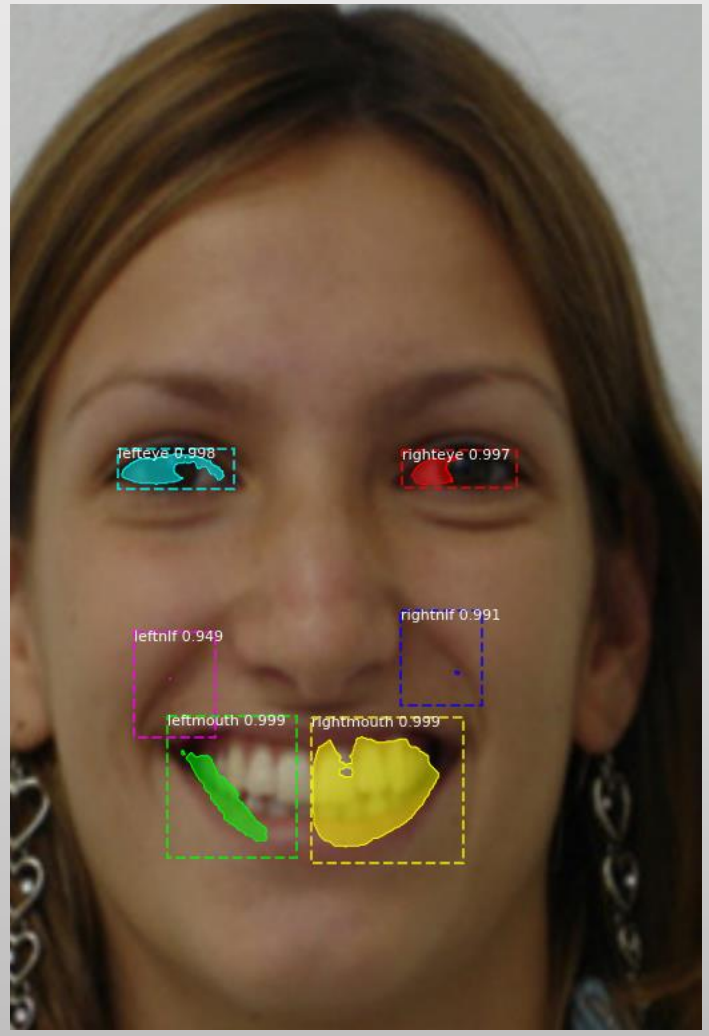
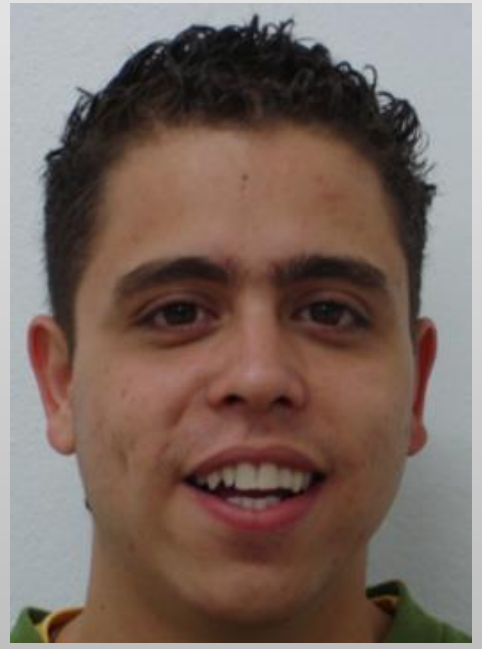


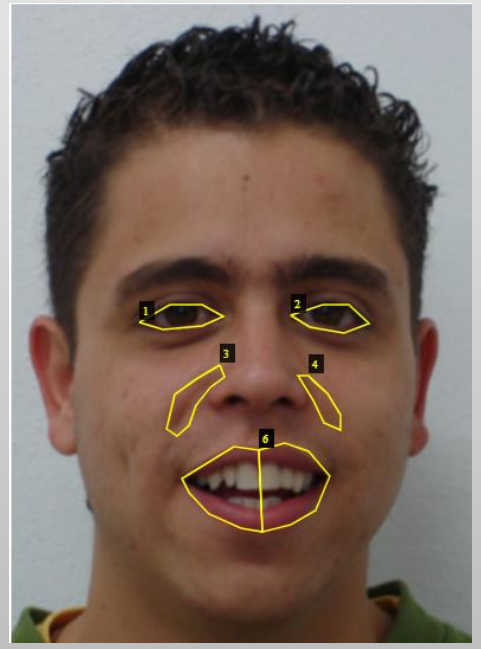
Image Labelling

- Second image labelling session - I used the **VGG Image Annotation** tool.
- Dramatic improvement in the performance.

Original Image



VGG Image Annotator



Ex. Inference Test Result – Model C

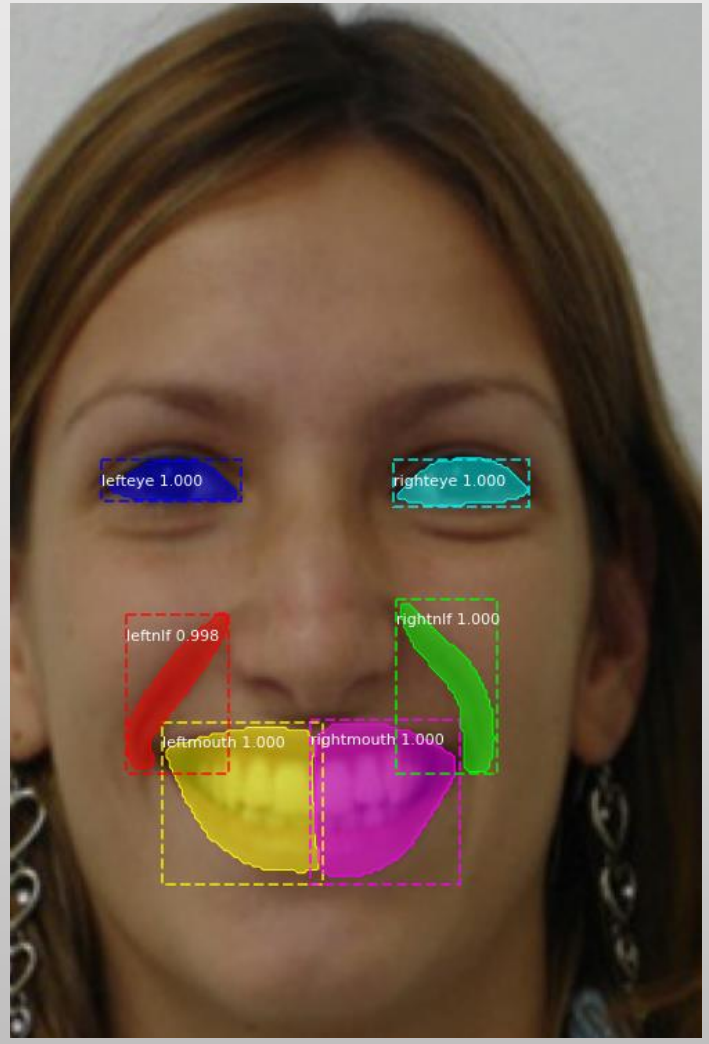


Image Augmentation

- 200 images wasn't enough to create a "good" model.
- Augmentations allow us to artificially increase the size of the dataset.

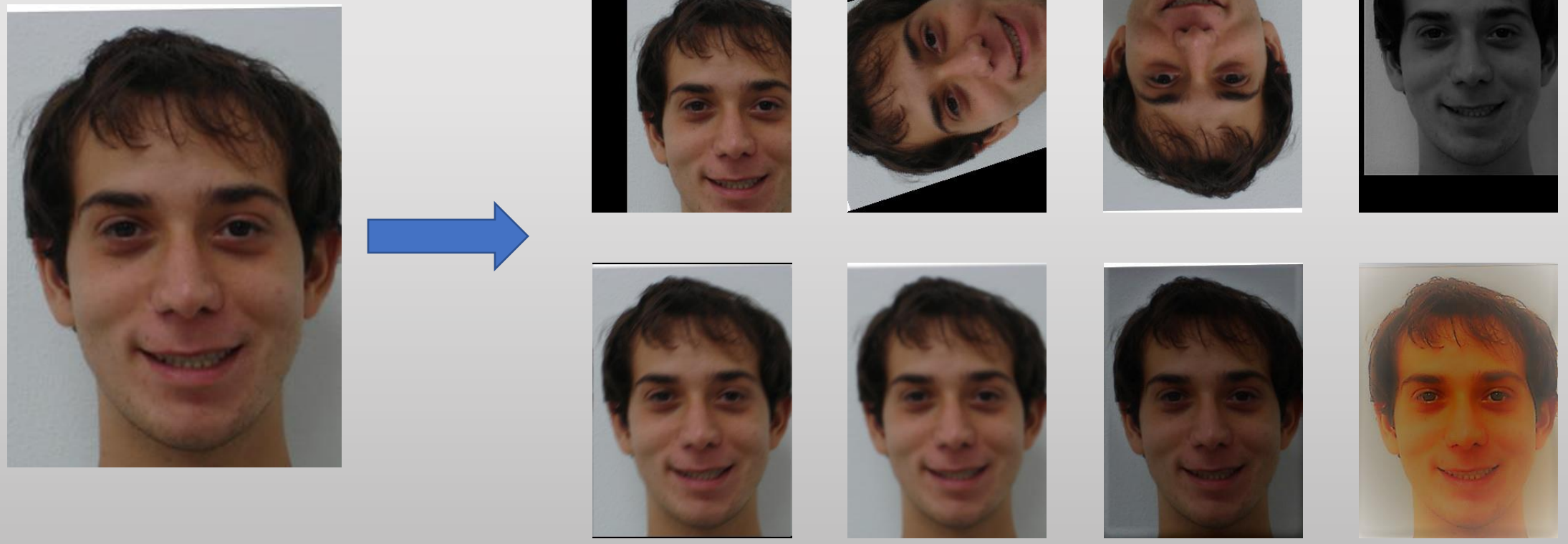


Image Augmentation

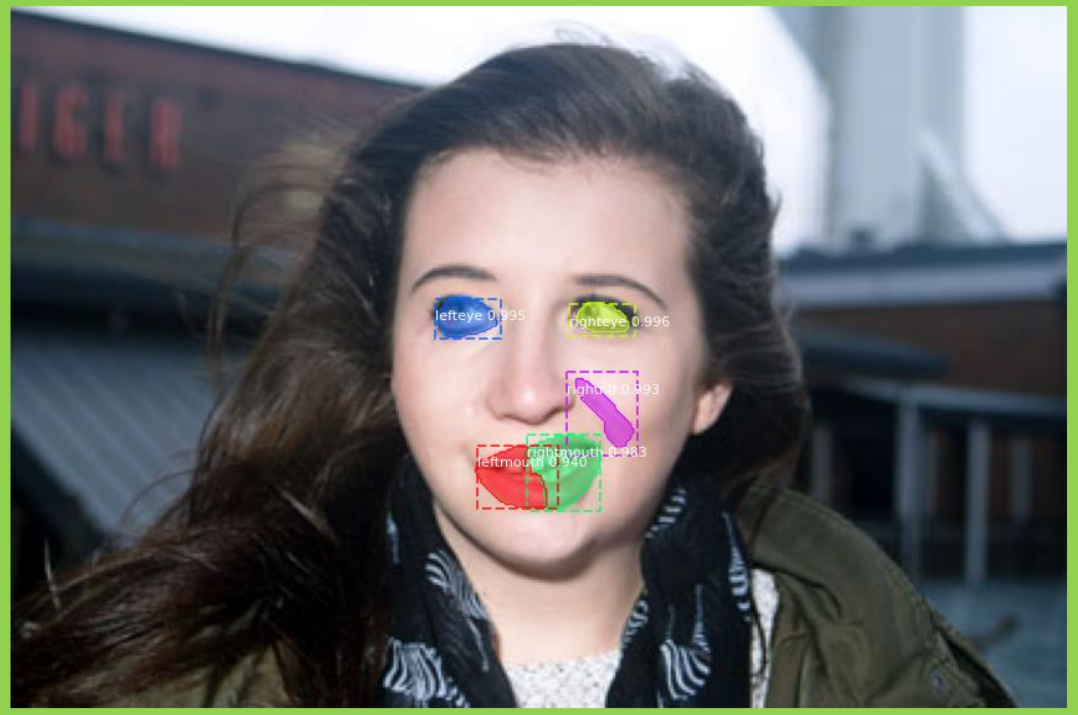
Approach	No. of raw training images	Manual augmentations?	Automatic augmentations?
1	1800	Yes - geometric	Yes – colour space and blurring
2	180	No	Yes – geometric, colour space and blurring

- 180 images for training, 20 images for testing.
- 150 epochs used in training.
- Random automatic augmentation applied 90% of the time.
- 24,300 augmented + 180 original = 24,480 “unique” images total.

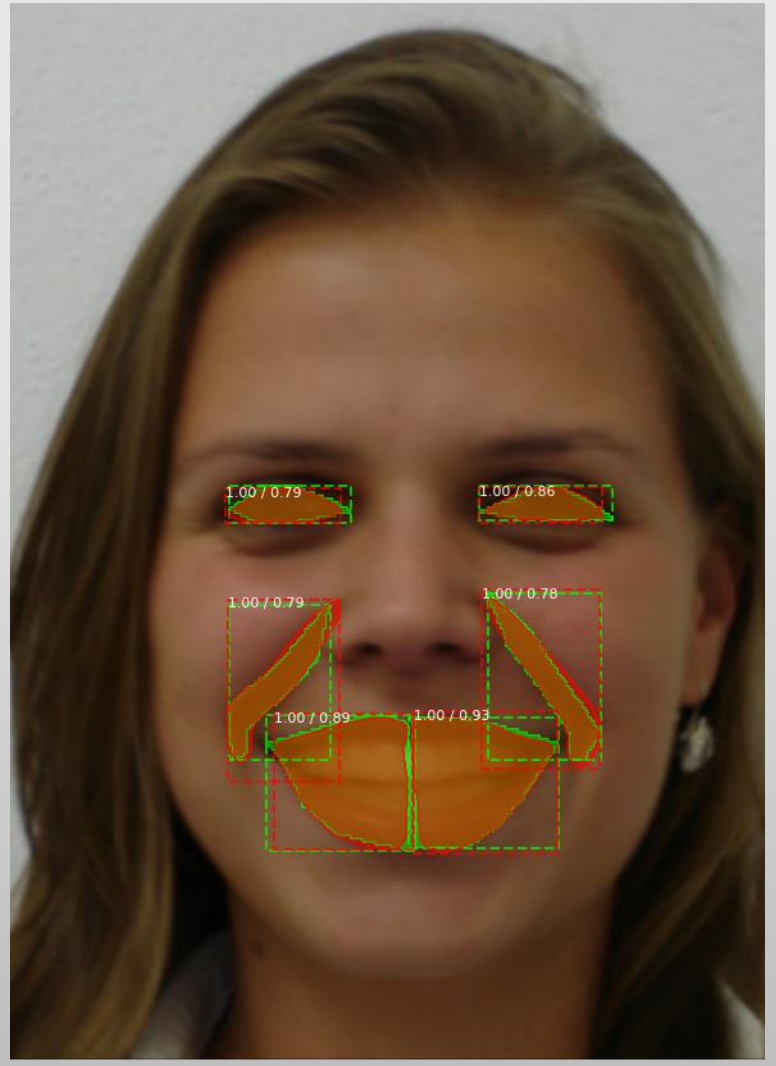
The Effect of Augmentations

No augmentations applied

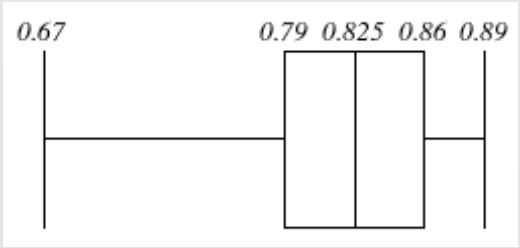
Augmentations applied



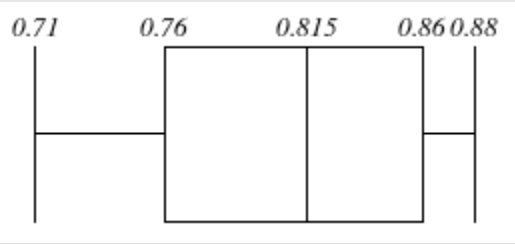
Analysing the Results



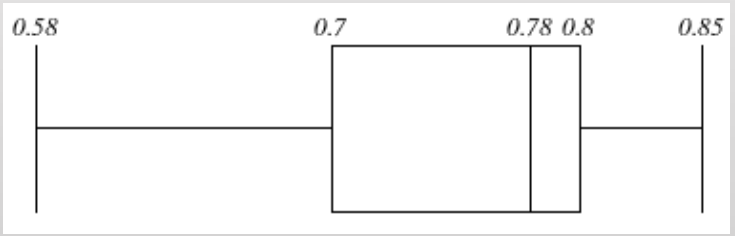
Left Eye



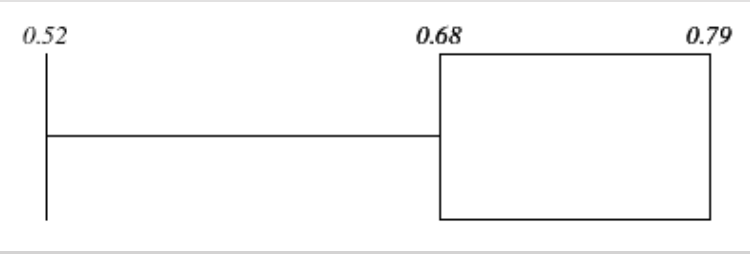
Right Eye



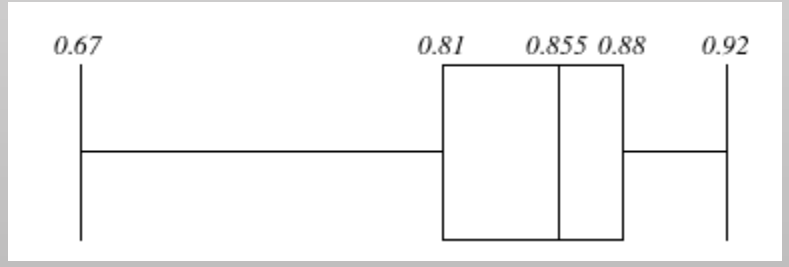
Left NLF



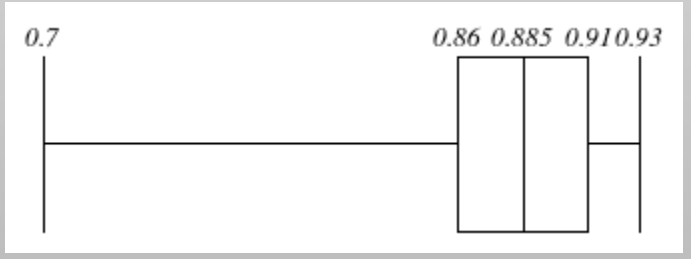
Right NLF



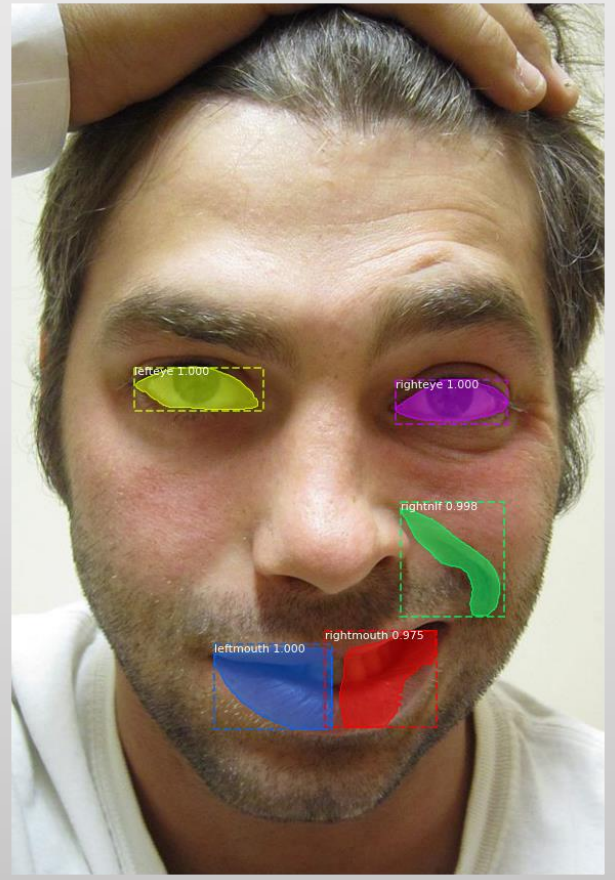
Left Mouth

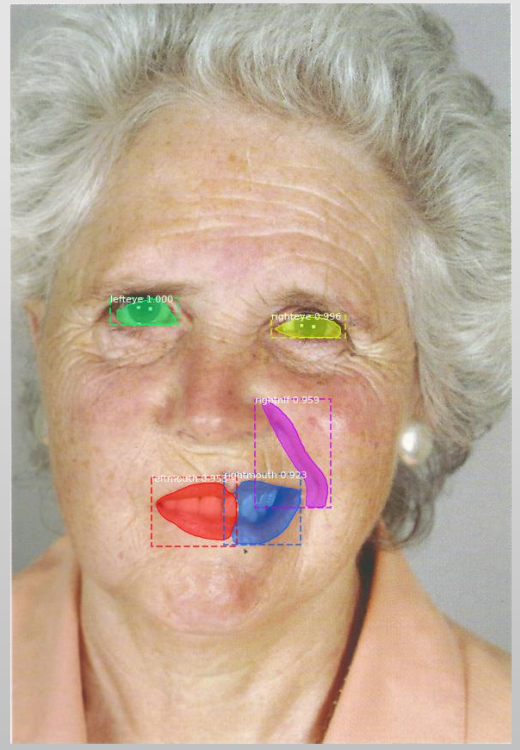


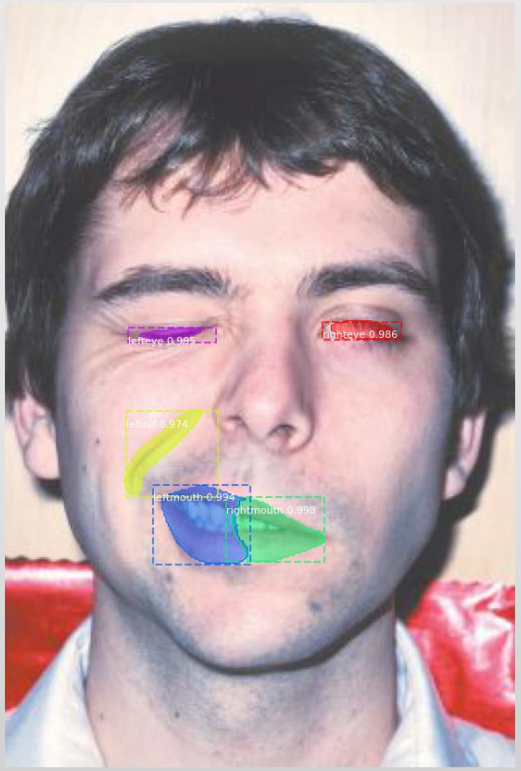
Right Mouth



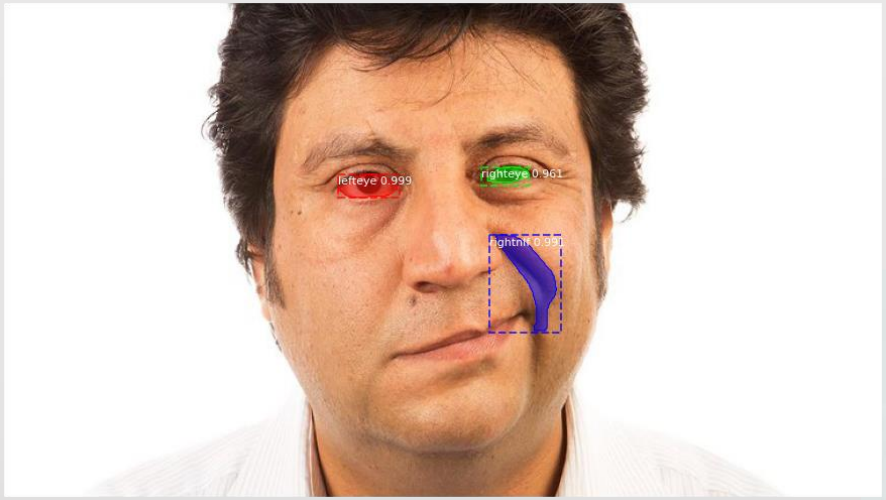
Analysing the Results

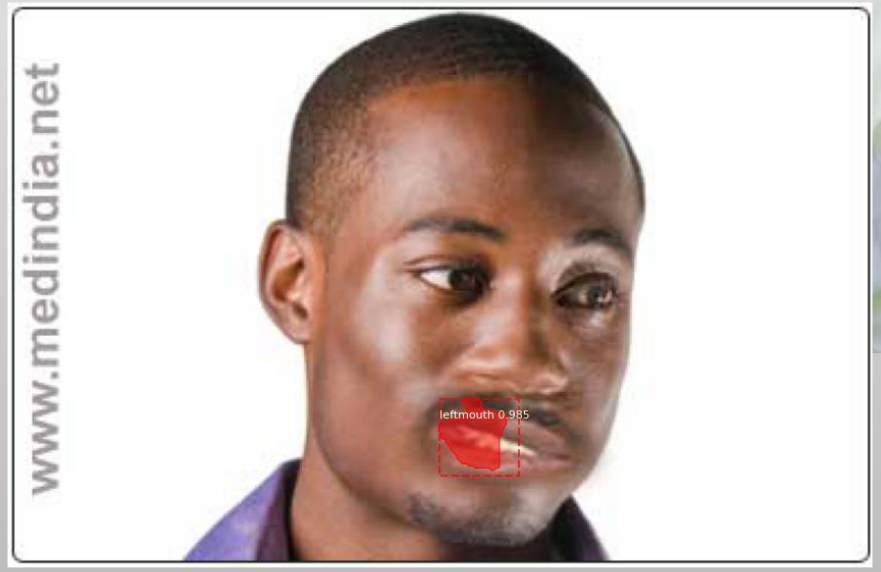


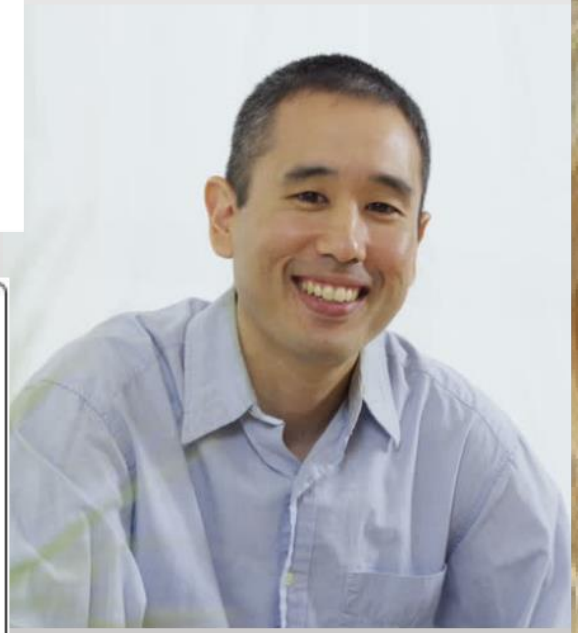


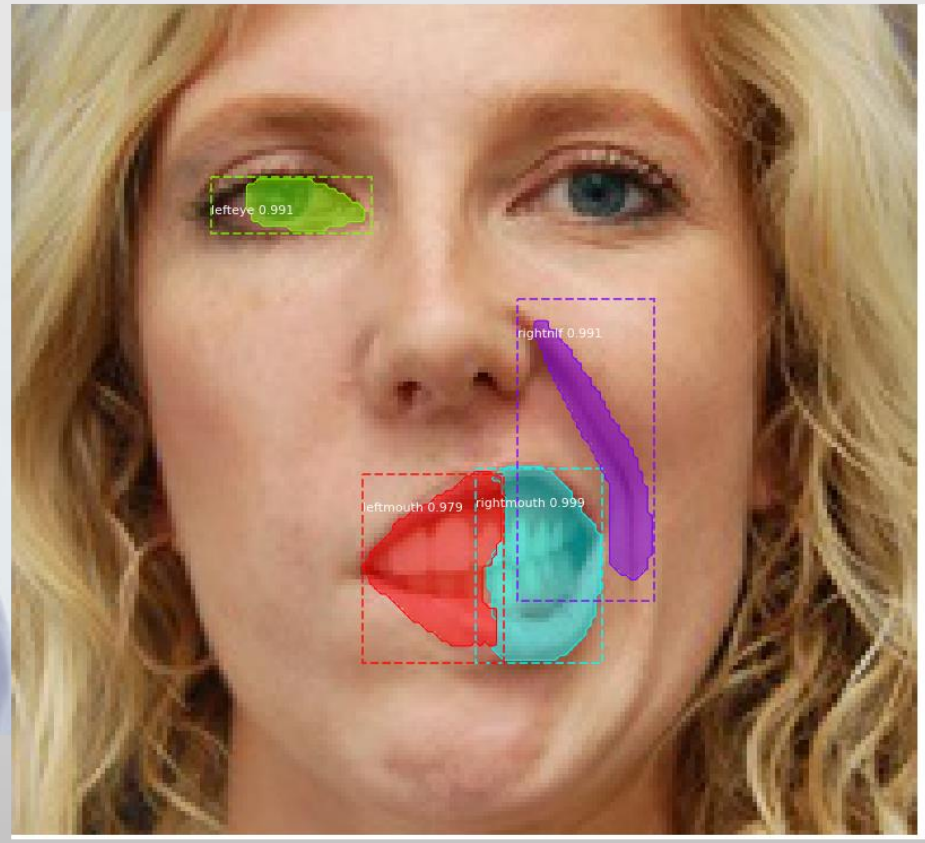


Analysing the Results









Future Plans

- Refine model by adding more specific augmentations.
- Calculate symmetry using mask ratios for facial weakness dataset.
- Determine fuzzy rules to remove uncertainty.

Questions?