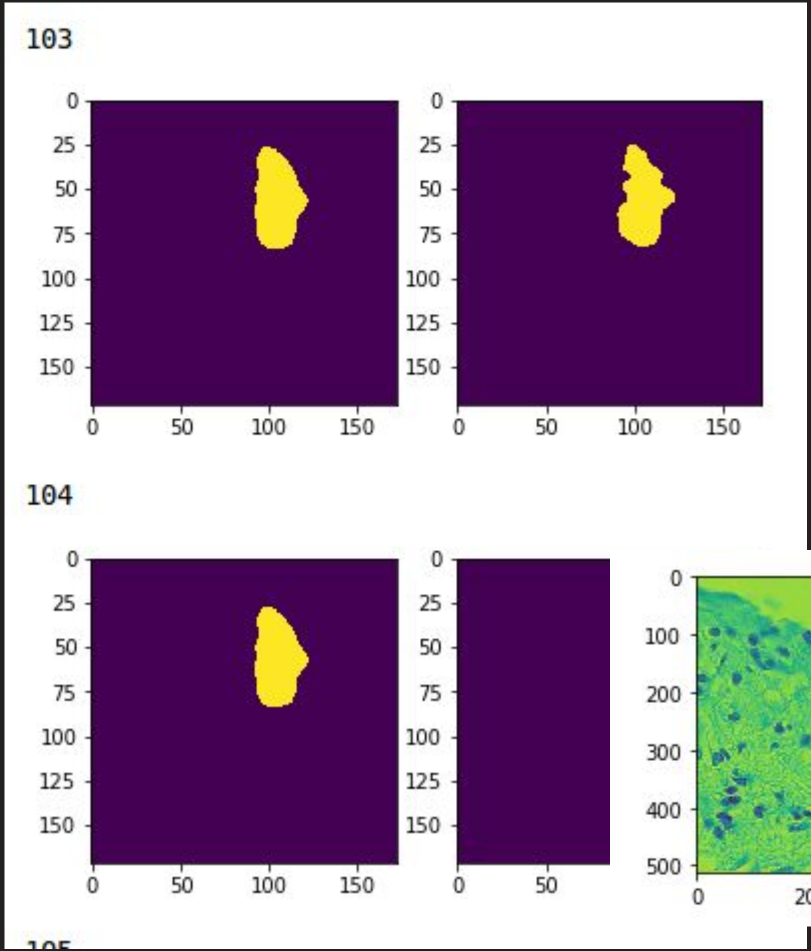
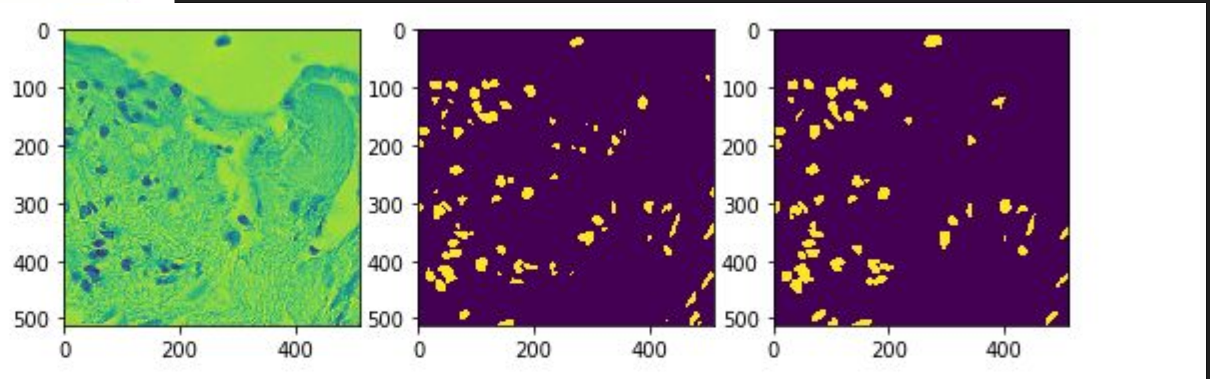
Improving Segmentation of fine structures





CNNS prefer smooth predictions when edges are very uneven with sudden shifts

There is imbalance in outputs where certain parts of image did better than others. Gradient is drowned out due to better performing region.

Patch-Wise Loss

Using a trained model:

Break the output mask into N patches

Take exponential dice of each patch and add them in the loss function.

Exponential dice will weigh each patch according to the error made there. So all areas are well represented. Or use hinge loss type approach.

L= D^k

dL/dw = k*D^k-1 * dD/dw

Benefit of training on patches with the speed of full image convolution

(Based on patch statistics we can use Tversky Focal loss in some of the patches to balance False positives and false negatives)

Refining Output Boundaries

Uneven edges are not captured due to fitler looking in local regions where local features indicate presence of other class

Steps:

Break up output into many small patches or use mask to select out boundry region

Pass only these portions through a smaller refinement network that has small receptive field size and then merge back with original output

Morphology Filters

Hard Negative Mining

Observe network does bad on few hard samples but good on others

Use exponential dice loss formulation to train multiple networks

Observe that previously bad samples are compensated for but easier samples are a bit less accurate

Come up with a ensembling procedure to incorporate both these learnings to raise the minimum error which is critical in medical conditions