

# Medical Image Segmentation

CV Project mid-evaluation

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Team: Autobots

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# Overview

- Medical Image Segmentation using Vision Transformer based U-Nets
- Modalities used : X-Ray, Ultrasound Images
- Tasks: Lung segmentation, Fetal Head Measurement
- Reference Paper: [1] [Chen, Jieneng, et al. "TransUNet: Transformers Make Strong Encoders for Medical Image Segmentation." \*arXiv preprint arXiv:2102.04306\* \(2021\).](#)
- Progress:
  - Result using vanilla U-Net on ultrasound dataset
  - Results using TransUNet on our XRay & Ultrasound datasets

Interactive version of this presentation can be viewed [here](#)

# Model

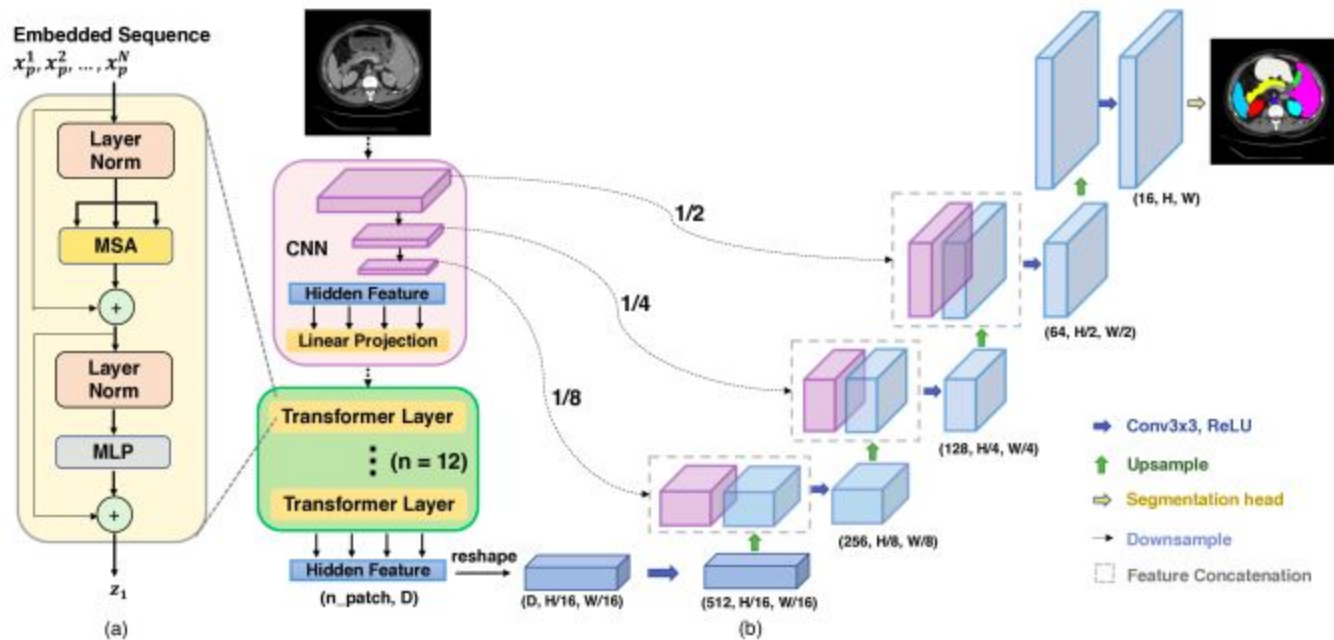
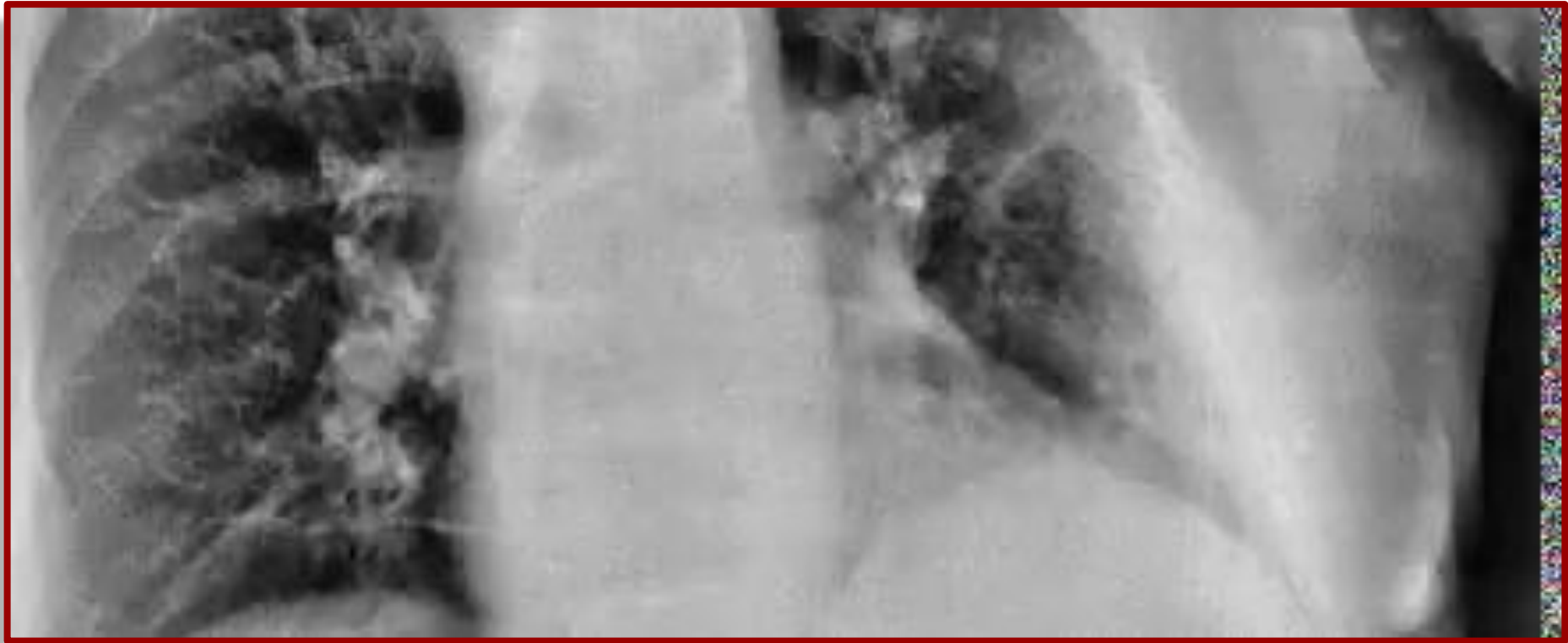


Figure 1: Overview of the framework. (a) schematic of the Transformer layer; (b) architecture of the proposed TransUNet.

# Modality 1: X-Ray Images



# Dataset Description

- Covid19-Xray Dataset by V7 Labs
- 6395 usable images of chest x-rays
- pixel-level polygonal lung segmentation labels
- Image resolutions, sources, and orientations vary across the dataset,
  - Max Size: 5600 x 4700 px
  - Min Size: 156 x 156 px
- Some Xrays are acquired using portable scanners, and have low quality
- License: CC4.0

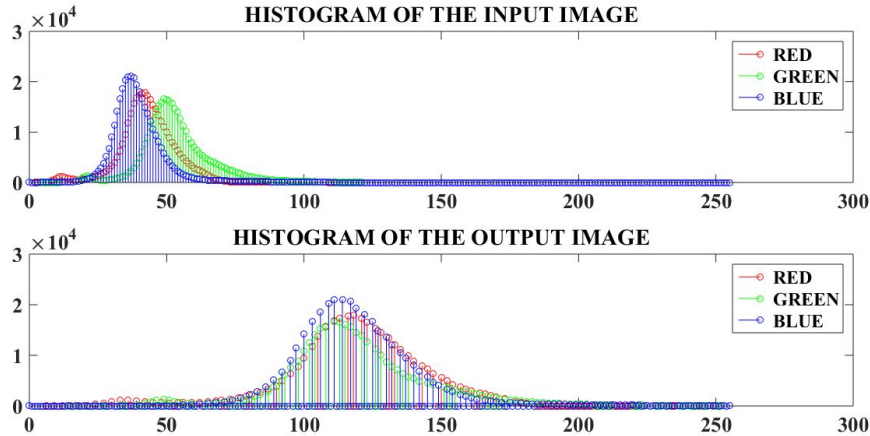
*Kermany, Daniel; Zhang, Kang; Goldbaum, Michael (2018), "Labeled Optical Coherence Tomography (OCT) and Chest X-Ray Images for Classification", Mendeley Data, v2<http://dx.doi.org/10.17632/rscbjbr9sj.2>*

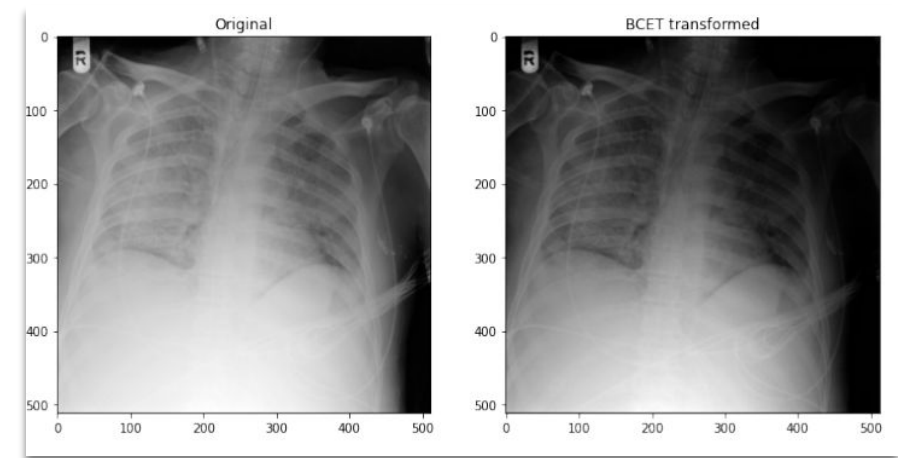
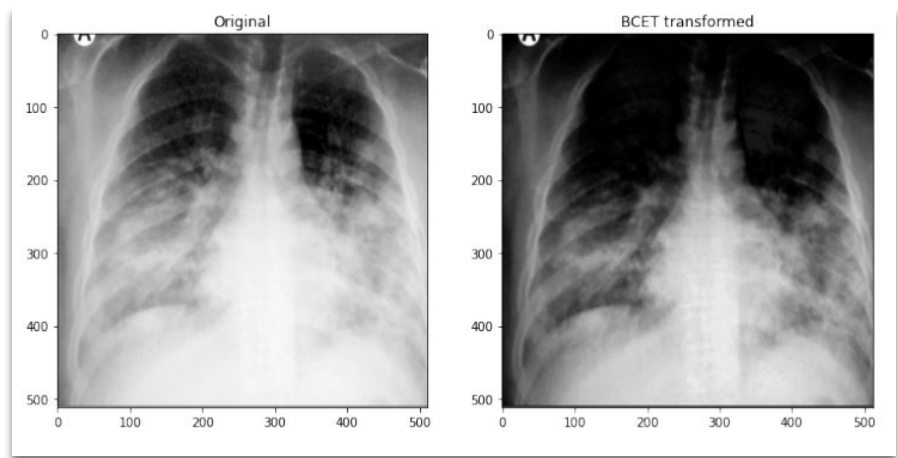
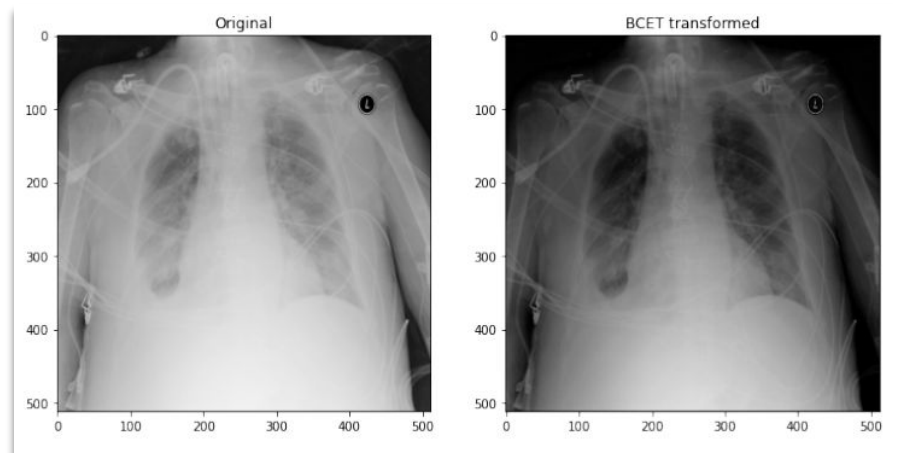
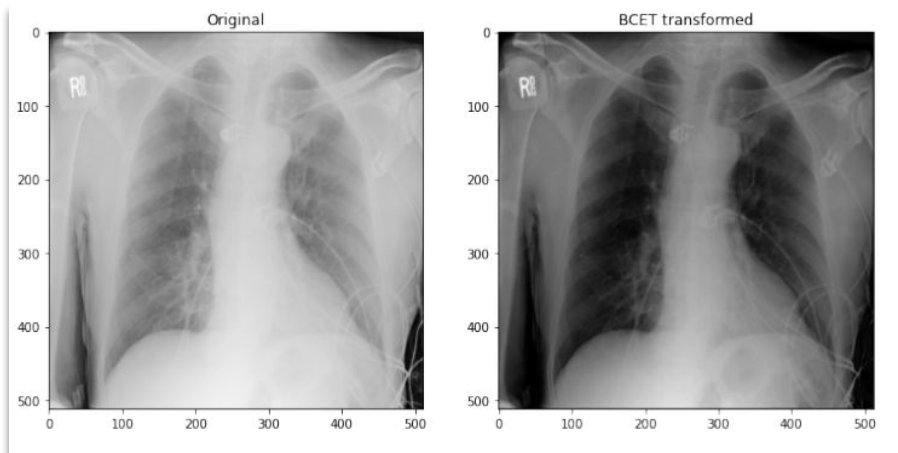
*Joseph Paul Cohen and Paul Morrison and Lan Dao COVID-19 image data collection, arXiv:2003.11597, 2020*

# Preprocessing

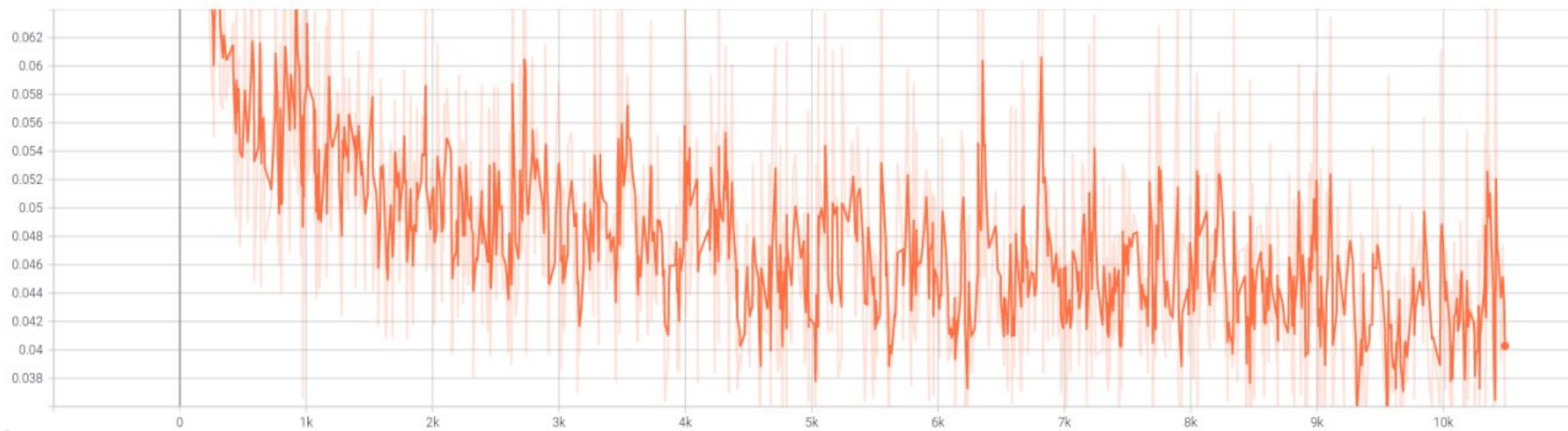
- Balance Contrast Enhancement Technique

The contrast of the image stretched or compressed without changing the histogram pattern of the input image.









## LUNG SEGMENTATION

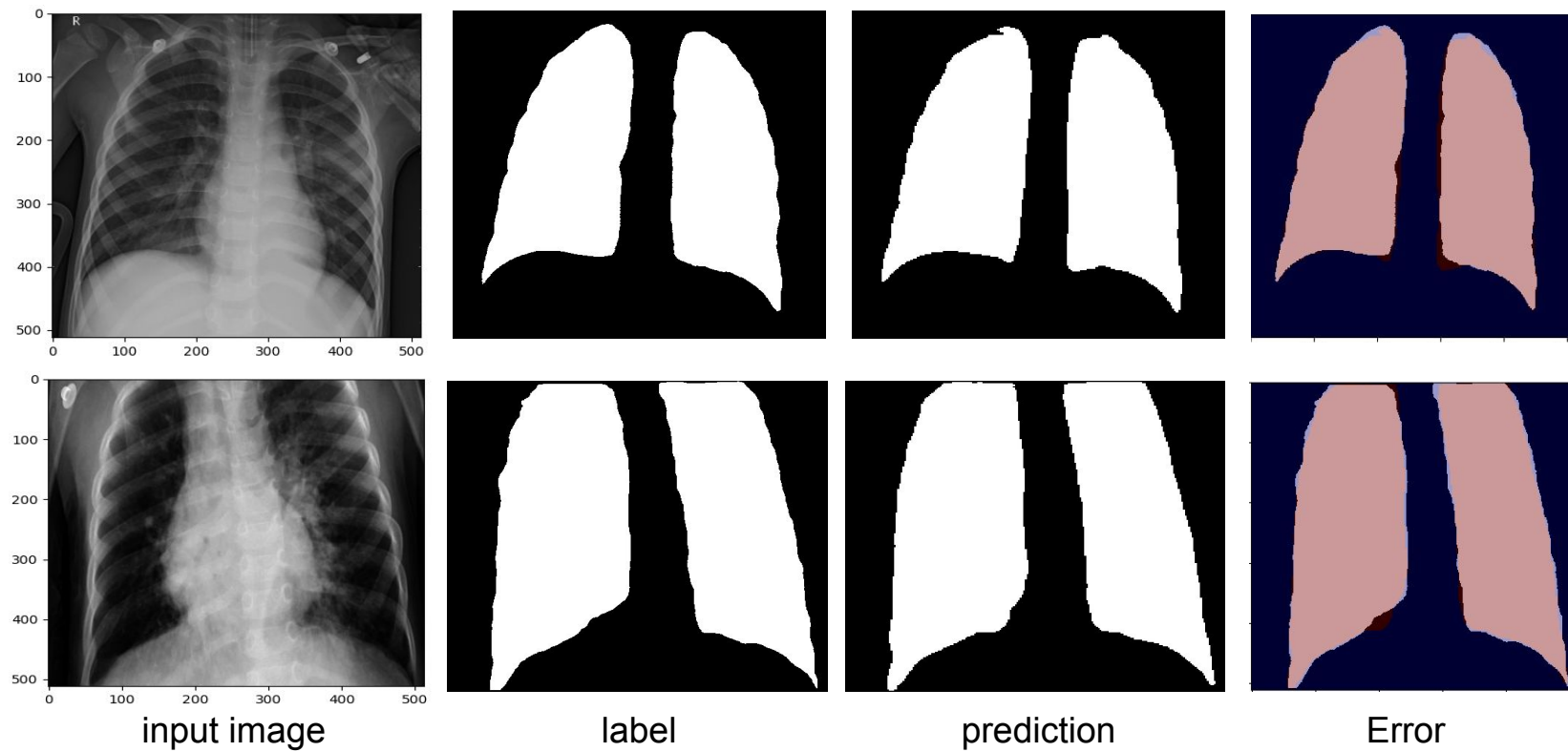
mean DICE

TransUNet

95.5384



# Qualitative Results

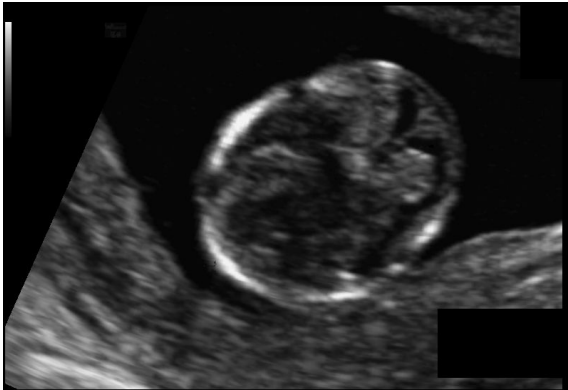


## Modality 2: Ultrasound Images

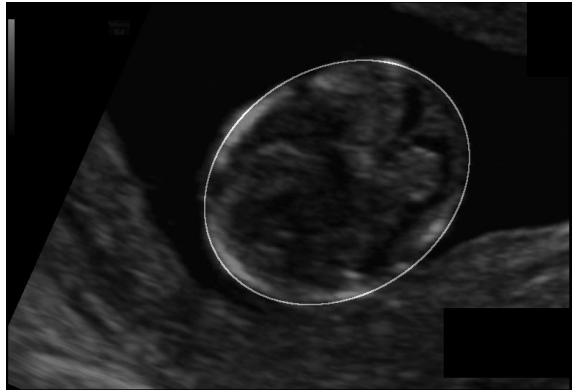


# Preprocessing

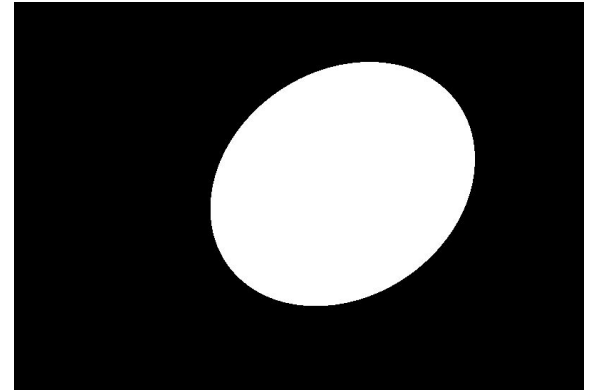
- The delineated outline of the fetal head creates extreme class imbalance calling for methods like dilated convolutions etc. To keep things simple, one neat trick is to convert the labels in the mask format



IMAGE

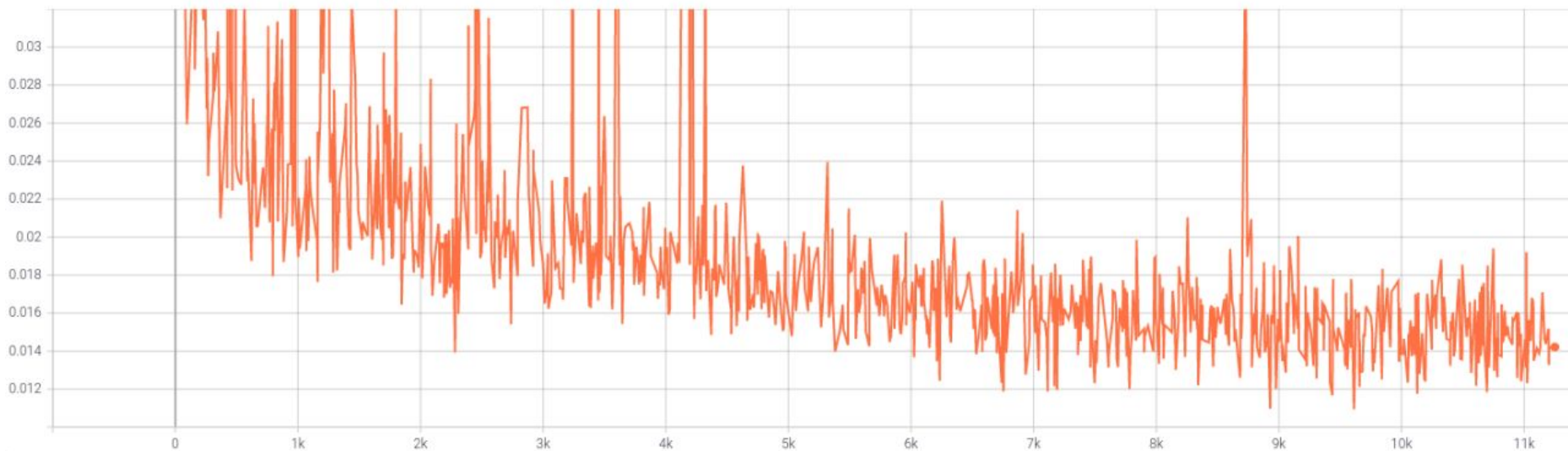


LABEL (OVERLAYED)



MASK

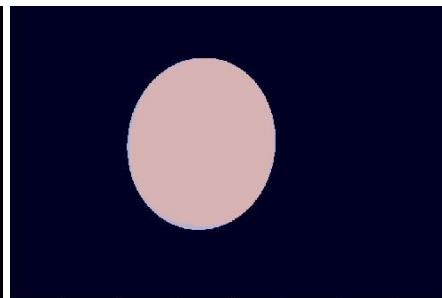
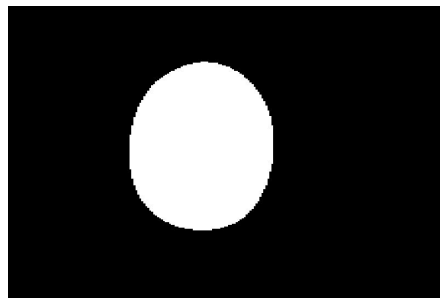
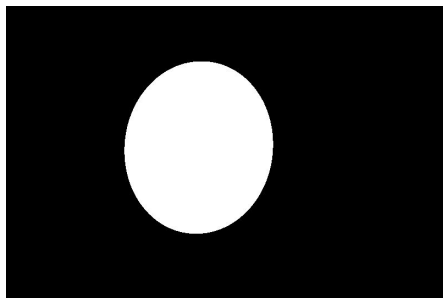
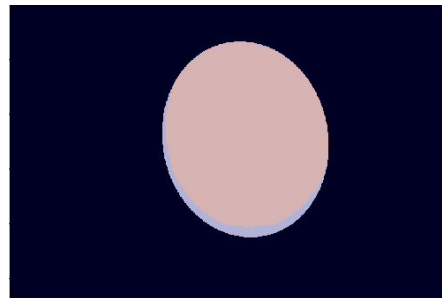
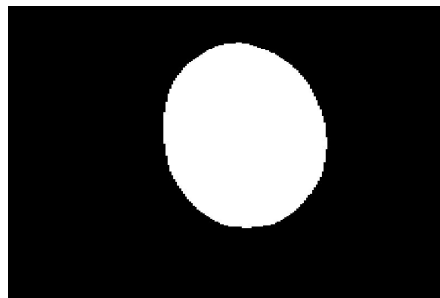
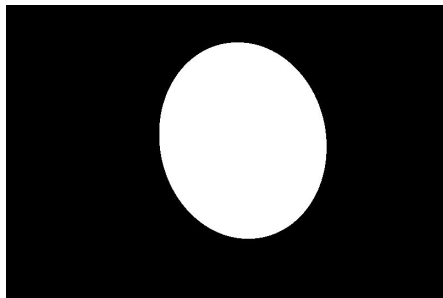
- Postprocessing would involve ellipse fitting over the mask & circumference measurement



## FETAL HEAD SEGMENTATION

	mean DICE
U-Net	94.64
TransUNet	97.7352
SOTA	98.1

# Qualitative Results



Input Image

label

prediction

Error

## Next Steps - subjected to the available time

- Experiment with TransUnet architecture based on other upcoming works
- Experiment with scattering coefficients as additional inputs to improve performance
- Use the lung segmentation model as the first stage classifier for [pneumothorax segmentation](#)
- Extend the architecture for videos