ID5030: Machine Learning for Engineering for Science Application Programming Homework (Online submission)

To be submitted by April 7th, 2023 11:59 pm

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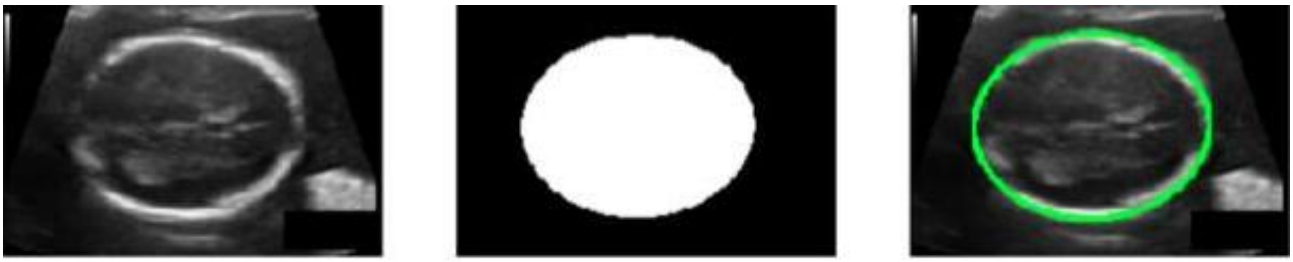
1 CNN in PyTorch

1. This entire assignment must be completed in a jupyter notebook. Please submit the ipynb notebook for evaluation.
2. In this assignment, we are going to implement a CNN in Pytorch and use the same to segment out the fetal head.
3. This assignment is on developing a deep-learning model to perform single-object segmentation.In single-object segmentation, we are interested in automatically outlining the boundary of one target object in an image. The object boundary is usually defined by a binary mask. From the binary mask, we can overlay a contour on the image to outline the object boundary. For example, the following screenshot depicts an ultrasound image of a fetus, a binary mask corresponding to the fetal head, and the segmentation of the fetal head overlaid on the ultrasound image:



4. You have to use some encoder-decoder algorithm to automatically segment a fetal head in ultrasound images.
5. To download the dataset, visit the website and download the dataset using the-link
6. **Go through the following steps**
   (a) Download the training_set.zip and test_test.zip files.
   (b) Extract them as training_set and test_set, respectively.

The training_set folder should contain 1,998 ṗng files, including 999 images and 999 annotations. In addition, the test_set folder should contain 335 ṗng images. There are no annotation files in the test_set folder

1. Create the custom dataset(Split the training_set into 799 images for training and validate with 200 images).
2. Use a custom encoder-decoder model and experiment(you are allowed any set of combinations like any number of layers in the encoder-decoder, any activation function,any optimizer,any lr, etc.) to segment out the fetal head. Dice score is the metrics to be used.
3. Now use a plain UNet model and calculate the Dice score. Compare the Dice score of the models and comment which one performs better.
4. Plot the training and validation losses with the number of epochs and also plot the train-val metrics plot.
5. Deploy the model on the test_set. Also display the images and the predicted output of the model on test_set.