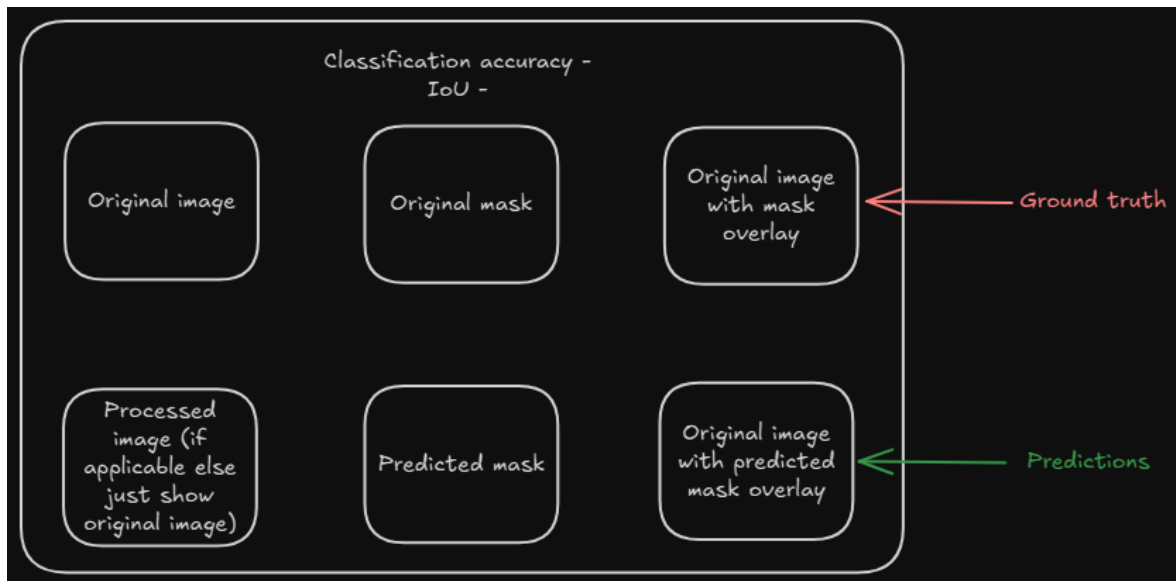


Dataset link - <https://www.kaggle.com/datasets/briscdataset/brisc2025?resource=download>

Minimum expectations -

1. Prepare a **U-Net** architecture (<https://arxiv.org/abs/1505.04597>) to segment the data.
2. Attach a classifier head to the encoder output and classify the data.
3. Prepare a code that takes any image as an input and displays the image in the form -



4. Update the **U-Net** architecture to **Attention U-Net** (<https://arxiv.org/abs/1804.03999>) and run the segmentation training again.

Open-ended design choices -

- You can train the segmentation and classification heads separately or together. If you opt to do both and show and analyze differences of training separately and training together, you will get some bonus marks.
- You do not have to separately preprocess each image, you can find a common pattern and apply a preprocessing pipeline. It's your duty to ensure you are getting the best possible results with or without preprocessing.
- You can use any classifier architecture. There are no restrictions on which one to use. Whatever you do, try to maximize your accuracy.

Presentation requirements -

Please note that you do not have to make a presentation slide if you opt not to. But in that case, you have to prepare the notebook carefully so that you can present your work through the notebook. At the very least we hope to see some data exploration, training statistics (metric update per epoch and loss curves), and result summaries. For the result summaries, we want to

see the values of mean Intersection over union (mIoU), dice coefficient and pixel accuracies for the segmentation task, and accuracy, precision, recall and F1 scores for classification task. The result summaries should be presented for all sets - training, validation and test.

PS - If you have prepared the code in VSCode or other IDEs in a modular pattern, you must prepare a presentation slide compiling the results.

Marks distribution -

1. Attendance (1%)
2. Presentation (2%)
3. Demonstration (6%)
4. Viva (6%)

The attendance and presentation part of the assessment is self-explanatory.

For the demonstration part, we will provide you with some random images on which you have to run your model and get the predictions. Follow the instructions given in minimum expectations to code this part up. Do note that we might ask you to execute any block of code or simply ask you the function of the code block. Failure to do so will result in mark deduction from this segment under the GPT penalty.

Finally in the viva, we will ask you questions about your understanding of the project. Even if you haven't worked on one part of the project, you may still be asked from that part. So it's your responsibility to understand the project properly.

Bonus tasks -

Bonus marks will only be awarded at the discretion of the lab faculties. We are providing a list of possible cases where bonus marks may be provided. But remember, if you do not complete the bonus tasks properly, you will not receive any additional marks. Incomplete tasks are worth 0. With that being said, the list of bonus tasks that you may attempt (you can go for multiple bonus tasks) (the tasks are arranged in ascending order of value) -

1. From the section "Open-ended design choices", analyze how the performance changes when the segmentation head and the classifier head are trained separately compared to when they are trained together. (Difficulty: Easy)
2. Test out different well-established classifier architectures (like MobileNet, EfficientNet, DenseNet etc.) and see how the performance changes. Show comparison between at least 3. (Difficulty: Easy)
3. Test how your model performance changes with change in hyperparameters. For example, you can test for the most optimal optimizer under a wide range of learning rates. Remember, you have to compile your results properly for your work to be considered complete. (Difficulty: Medium)

4. Implementing EfficientDet (<https://arxiv.org/abs/1911.09070>) architecture on the decoder side of the original U-Net architecture. (Difficulty: High)

If you want to do anything different for the bonus segment, do let your lab faculties know and get it approved before working on it.