Assignment II [EE604]

Submission Instructions:

- The submitted PDF should include only your code snippets and sample images/results.
- Upload your datasets to a shared drive folder, and include only the link to that folder in your PDF.

Q1) Dataset Creation using the MNIST Dataset [2.5 Marks]

Perform the following steps to build three new datasets:

(a) Obtain foreground segmentation masks for the images in the MNIST dataset using Otsu's thresholding. Using these rough binary masks as ground truth, build a new foreground segmentation dataset. *(0.5 Mark)*

Note: The goal of this dataset is only to extract the foreground, so the original class labels are not required.

(b) For each ground truth segmentation mask obtained in part (a), generate a tight enclosing circle around the mask. Build a new dataset with 10 classes, where each sample contains the image and its corresponding circular ground truth mask, for performing classification with circlization (circular localization). You may use existing libraries to generate the tight enclosing circles. *(1 Mark)*

(c) Randomly concatenate four images and their corresponding ground truths (from part a) in a 2×2 grid to create new images containing four digits. In this way, build a new dataset with 10 classes for performing semantic segmentation. *(1 Mark)*

Note: Ensure that no two generated images are identical, and that the final dataset contains at least 0.25 million (250,000) images.

Q2) Foreground Extraction [2.5 Marks]

Train a deep learning network from scratch to perform foreground extraction on the dataset created in Q1(a). Report your test performance using the Intersection over Union (IoU) metric.

Q3) Classification with Circlization [2.5 Marks]

Train a deep learning network from scratch to perform classification with circlization on the dataset created in Q1(b). Report your test performance using the IoU metric.

Note: If the classification prediction is incorrect, assign an IoU score of zero for that sample.

Q4) Semantic Segmentation [2.5 Marks]

Train a deep learning network from scratch to perform semantic segmentation on the dataset created in Q1(c). Report your test performance using the Dice Coefficient.