SSY340

Deep Machine Learning

Data Augmentation Using Generative Adversarial Networks

Project Planning Report
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1 Problem Statement and Motivation

One of the biggest bottlenecks in creating generalized deep learning models is a scarcity of labeled data. Labeled data is also costly to generate. Since large amounts of data are needed to achieve generalized deep learning models, standard data augmentation methods are routinely used to increase the dataset's generalizability. Generative Adversarial Networks, popularly known as GANs, offer a novel method for data augmentation. The generation of artificial training data can not only be instrumental in situations such as imbalanced data sets, but it can also be useful when the original dataset contains sensitive information, and it is desirable to avoid using the original data as much as possible (For example, Medical data). In this project, we propose different GAN architectures and evaluate its performance. We test on a benchmark dataset using the proposed architectures and evaluate the performance of different architectures. If time permits, we plan to test a simple classifier trained on the data generated by the GAN architectures and compare it against the classifier output from original data.

2 Dataset Planned to be Used

We plan to use one of the following benchmark datasets to avoid spending too much effort on data preparation:

- *Pancreas-CT from The Cancer Imaging Archive (TCIA) Public Access*

  The dataset contains 82 abdominal contrast-enhanced 3D CT scans from 53 male and 27 female subjects. Seventeen of the subjects are healthy kidney donors scanned before nephrectomy. A radiologist selected the remaining 65 patients from patients who neither had major abdominal pathologies nor pancreatic cancer lesions. The CT scans have resolutions of 512x512 pixels with varying pixel sizes. The link to the dataset is available **here**.

- *Cityscapes Dataset*

  The dataset contains a diverse set of stereo video sequences recorded in street scenes from 50 different cities, with high-quality pixel-level annotations of 5000 frames in addition to a more extensive set of 20000 weakly annotated frames. The link to the dataset is available **here**.

3 Available Implementation

Since we want to create our architectures, we do not use any available code.

4 Relevant Papers

The following list contains all the relevant papers:

1. *Data augmentation using generative adversarial networks (CycleGAN) to improve generalizability in CT segmentation tasks*

   This paper evaluates the use of CycleGAN for data augmentation in CT segmentation tasks. The paper is based on the "*Pancreas-CT*" dataset that we also plan to use. The link to the paper is available **here**.

2. *Data Augmentation Using GANs*

   This paper also uses GANs to generate artificial training data for machine learning tasks. Furthermore, the paper also discusses potential use cases in handling sensitive data and proposes that generating artificial training data would be more comfortable than acquiring data. The link to the paper is available **here**.

3. *Pros and Cons of GAN Evaluation Measures*

   This paper evaluates more than 24 quantitative and five qualitative measures for evaluating generative models, emphasizing on GAN-derived models. Our idea is to use one of the evaluation metrics discussed in the paper to evaluate our GAN architectures' performance. The link to the paper is available **here**.

5 Evaluation of Results

Our main idea is to use one of the evaluation metrics discussed in the paper "*Pros and Cons of GAN Evaluation Measures*" to evaluate our GAN architectures' performance. If time permits, we plan to test a simple classifier trained on the data generated by the GAN architectures and compare it against the classifier output from original data.

6 Time Plan

The detailed project plan is presented as a Gantt chart in figure 6.1.

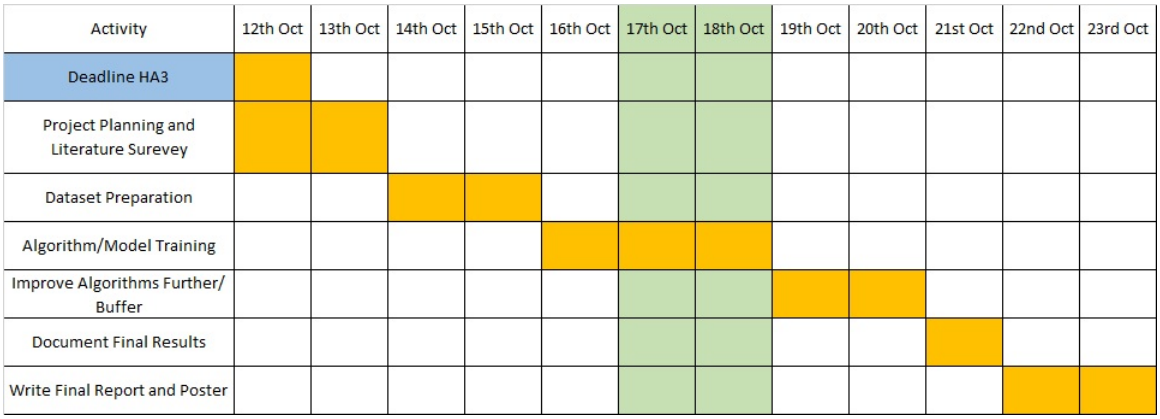

Figure 6.1: Detailed Project Plan