Final Projects -- Proposals

Team Members:

1. **Wentao Yao**
2. **Preetham Pareddy**
3. **Hualiang Qin**
4. **Bodhisatta Maiti**

Proposal Elements:

1. Task description (define task, motivation, why it's interesting)

Currently, we are living in a different world because of the Covid-19 pandemic. The effects of Covid-19 have been detrimental to the world and we are still reeling from it. Loss of innumerable lives, loss of livelihoods and damage to economies are some of the calamitous effects of the pandemic. So, our group has decided to work on a topic related to Covid-19. There are several research areas associated with Covid-19. Our work will be focused around Covid-19 detection in patients. This will be primarily a classification project. Our work will be split into 2 areas:

1. Using audio data for Covid-19 detection. For example, audio can be a cough sound or a respiratory sound of a patient.
2. Using image data for Covid-19 detection. For example, images can be the chest or lung X-Ray/CT scans of a patient.

2. Dataset (where will you acquire data? how will you create data?)

Audio Classification

1. Dataset url:
   https://www.kaggle.com/andrewmvd/covid19-cough-audio-classification
   research paper of the dataset:
   https://www.nature.com/articles/s41597-021-00937-4

2. Dataset url:
   https://github.com/iiscleap/Coswara-Data
   Research paper of the dataset:
   https://arxiv.org/abs/2005.10548

Image Classification

1. Dataset url:
   https://www.kaggle.com/andyczhao/covidx-cxr2
   research paper of the dataset:
   https://www.nature.com/articles/s41598-020-76550-z

2. Dataset url:
   https://www.kaggle.com/mehradaria/covid19-lung-ct-scans
   research paper of the dataset:
   https://www.jmir.org/2021/4/e27468/

3. Features/attributes (how will you select and construct your features?)

For the audio classification task, we will have 2 pathways:

1. We will extract features from audio data using a python package such as librosa and then use these features as input to ML techniques such as logistic regression, SVM, etc for classification.
2. We will convert the audios to spectrogram and chromagram images using python packages. Once we have these images from audio recordings, then this will be similar to any other image classification task.

For image classification, we will ensure that all the images are of the same size and scale and have the same number of color channels before modeling.

4. Project execution (what steps will you take to complete the project?)

• Data preprocessing and handling

For audio classification problems, we will be extracting features from the audio using python packages such as librosa.
For image classification problems, we will be resizing and rescaling the images before passing it as an input to the model. We will ensure that all the images have the same number of color channels.

• Machine learning techniques (two preferred, and a neural network preferred)

For the audio classification, we intend to extract features from the audio data using python packages such as librosa, and use these features as input to ML techniques such as logistic regression, SVM, etc. Another path we will be exploring is by converting the audio to spectrogram and chromagram images and follow the steps mentioned for image classification below.

For the image classification, we will be following a dual pathway:

1. We will extract features from the images and then use these as inputs to ML techniques such as logistic regression, SVM, etc.
2. For image classification tasks, our primary focus will be on using convolutional neural networks (CNN). Our plan is to initially construct a basic CNN model using our own architecture and analyze the performance. Then we would like to utilize the concepts of transfer learning and fine tuning for classification. We would like to use pre-trained models/networks such as VGG19, ResNet50, InceptionV3, etc to understand whether we can improve upon our base CNN model.

• Evaluation metrics (specifically model inputs and outputs)

Since, this is a classification task, these are some of the evaluation metrics that we intend to use based on the nature of the dataset (classes balanced vs imbalanced)

1. ROC AUC
2. F1 Score
3. Precision/Recall
4. Accuracy

Additional Note:

We have 2 datasets for audio classification. When we are done with the in-depth and comprehensive analysis of the datasets, we will take a call whether we will merge the datasets or not. The same logic applies for the 2 datasets for image classification.