Introduction

For this project, we will use all of the 2013 Kaggle Challenge for Facial Expression Recognition (FER), to annotate face images with their corresponding facial expressions. This is the same dataset used for homework 3 but this is more complete. A few examples of the face images is shown in Figure 1. To complete the assignment you will need to download the homework4.zip file from myCourses as it contains the images, but in vectorized form. You will need to reshape the face vectors back into 48×48 grayscale images.

Figure 1: The top row shows three examples of correctly labeled faces from the Kaggle challenge; left to right - angry, disgust and fear. The bottom row shows three incorrectly labeled faces; left to right - happy, sad and surprise. Neutral face is not shown.

The faces have been automatically registered so that the face is more or less centered and occupies about the same amount of space in each image. Your task is to categorize each face based on the emotion shown in the facial expression in to one of seven categories (0=Angry, 1=Disgust, 2=Fear, 3=Happy, 4=Sad, 5=Surprise, 6=Neutral) using a convolutional neural network (CNN) architecture.

The data file provided is *fer2013.csv* and it contains three columns, "emotion", "pixels" and "Usage". The "emotion" column contains a numeric code ranging from 0 to 6, inclusive, for the emotion that is present in the image. The "pixels" column contains a string surrounded in quotes for each image. The contents of this string are space-separated pixel values in row major order. The "Usage" column contains the tag to determine whether the row of data should be used for training (tagged as "Training"), validating (tagged as "PrivateTesting") or testing (tagged as "PublicTesting"). You should report your evaluation results on the rows tagged "PublicTesting".

The dataset consists of 28,709 training samples, and 3,589 validation and testing samples each. This dataset was prepared by Pierre-Luc Carrier and Aaron Courville, as part of their research and they graciously made it publicly available for others' use. In homework4.zip, you will find a bibliography (.bib) file, please cite the documents there in your final report.

Requirements

You are free to perform this project in any language of your choice and on any platform that you wish, as long we can get access to, and run the platform for grading your work. Your final report is due on **Tuesday December 12th 2017, by 11:59pm**. You are strongly encouraged to start the assignment early and don't be afraid to ask for help from either the TA or the Instructor. You are welcome to look online for similar CNN solutions and have discussions about the project on myCourses, but please do not post your solutions or any closely related material.

You are allowed to collaborate with other students as far as discussing ideas and possible solutions. **However you are still required to code the solution yourself. Copying others' code and changing all the variable names is not permitted**. You can use solutions found on the web but YOU MUST refer to them in your submission write-up. Your solutions should be submitted via Dropbox on myCourses.

The data, the .bib file and these instructions are provided in the zipped file **homework4.zip** which can be downloaded from myCourses. Please use the latex report template used for homework 3 for your final report. Your submitted zipped file for this assignment should be named **LastnameFirstname_final.zip**. Failure to follow this naming convention will result in delays in grading your work. Your zipped file should contain: (i) a PDF file named LastnameFirstname_report.pdf with your report, showing output images and explanatory text, where appropriate; (ii) the source code used to generate the solutions (with code comments). Please provide a README file which will give us directions to execute your code for the assignment. You do not need to include any images with your final submission (but you should have images in your report).

You should turn in both your code and report discussing your solution and results to get full credit.