Kevin Whitney

Design Project 1

Project Proposal

**Problem Identification:**

The problem that I will be working on over the course of this term will be creating an application that not only translates the ASL alphabet in real time, but also houses several other features that will be used to teach users the ASL alphabet in a fun and interactive way, utilizing computer vision and machine learning. This problem is not something I have directly worked with in the past, however several of my family members are working in the field of education, specifically with children with disabilities. Because of this, I have seen first hand just how important a tool that sign language can be, not only for the teachers, but for anyone. I hope to offer a fun and interactive way to learn this skill as well as offering useful tools to the users in the process. The way that this application would be marketed is for young children in schools to learn the ASL alphabet in a way that captures and keeps their attention.

**Project Requirements:**

* Feature List
  + Translator
  + User Accounts (i.e. logins, create logins, tracking data)
  + Time trial game, how many letters the user can sign before time runs out. This will track users high scores as well if they are logged in
  + Section for practicing ASL with a reference
* Technologies
  + OpenCV library, used for the computer vision side of the project
  + TensorFlow, machine learning aspect
  + Inception, Google’s pretrained CNN that we will retrain with our own data
  + Languages: Python (OpenCV and TensorFlow Python Libraries, as well as TKinter for GUI)
  + Panda for Python for use of managing SQL data
* User interface
  + Application would open directly to camera feed of user, translator would be working right away
  + Bottom or side panel containing other features (game, account creation, practice tool, etc.)
  + User would be able to navigate between areas that they want
* Database
  + The main use of a database in this sense would simply be the high scores of users in the game categories. Since data of users will be stored, users and their logins will also have to be stored so that they may login and see their scores.
  + This can all easily be done using a simple SQL database.
* Networking
  + Again, the networking side of things would be primarily user for the games. This would include communicating with the database in order to handle logins/creation of accounts and managing the high scores of the user when they play the time trial game.

**Solution:**

The basis of this project (the translation aspect) will be completed by combining several different steps. These include, in order, extracting the user’s hand image from a camera feed, sending this image to our neural network, returning the data to our program of the result, and displaying the result to the user.

* OpenCV and Hand Extraction
  + Show user the camera feed and box out where their hand will be recorded.
  + Gather camera feed from user’s webcam, and capture the initial background of the camera feed
  + Compare this frame to every other frame past this, and find the absolute difference of the two
  + Threshold the image to give a binary image of the anything new in the frame (in this case, the user’s hand)
* Centralized Neural Network
  + Retrain the top level of Google’s Inception model with our hand data
  + Run program and save the extracted hand image from above
  + Give photo to the trained model and return the result, and upon this action save the current hand image and repeat

Once these two stages are complete, the project becomes building an application around this functionality. Using TKinter we will create a GUI around this that allows the user’s to not have to deal with the ugly backend of this program. As well, features will be added in to the GUI. These are listed in more detail below.

* Account Creation and Login, High Scores
  + Users must be able to not only login to their accounts, but also be able to create accounts from the GUI. This will all be done using SQL and a SQL database.
  + Users high scores must be kept in the database, and if a user is logged in, they must be edited if the user beats their own high score. They should also be available for viewing from the home menu.
  + Inserts and updates of the SQL table will be done utilizing a mixture of MyPySQL for connections, and Panda for data manipulation
* Practice Mode
  + Practice mode simply brings the user to a screen in which they have an ASL Alphabet chart on the side of the screen that they can practice with as long as they want.
* Time Trial (Game)
  + The game that this project will contain is a basic time trial game
  + As a counter counts down, the user is prompted to sign certain letters of the alphabet with no reference or help
  + Each time they sign the correct letter, their score goes up
  + Upon completion, the score (if higher than their current FIVE high scores), is put in to the SQL database.
  + The user is then shown a screen containing their high scores, allowing them to see their progress and see how they can improve.

**Conclusion:**

The overall finished product of this project is an application that children can use to learn the ASL Alphabet. Although it houses features that can be used by anyone, the main audience is a school environment so that I can offer a fun learning tool for children to learn a basic skill, that hopefully keeps their attention more than a teacher at the front of the classroom. A small break, that not only showcases the interesting aspects of what technology can do, but does some good in the process.