COMP6345 - Intelligent Systems

Final Project Report

ASL Assistant

Submitted to:

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I. Problem Description

Communication is one of important aspects in our daily lives. Based on Oxford Dictionaries, communication is defined as the imparting or exchanging of information by speaking, writing, or using some other medium. Humans do not only communicate with others face-to-face but also through the internet such as video calls. However, not everyone has the privilege to have perfect hearing ability. As a result, miscommunications may occur as a result of different method of communication. This often occurs in situations like simply ordering a meal at a local restaurant or shopping for groceries at the supermarkets or grocery stores.

On the other side, if a physically “healthy” people wish to communicate with another people who have impaired hearing, this would create another problem as there is no a universal language in this case except sign language. However, sign language in this case is basic sign language which does not guarantee that everyone interpret the same thing. We hope that by doing this project, we could close the gap or at least minimize the gap of communication between the two groups.

II. Solution Features

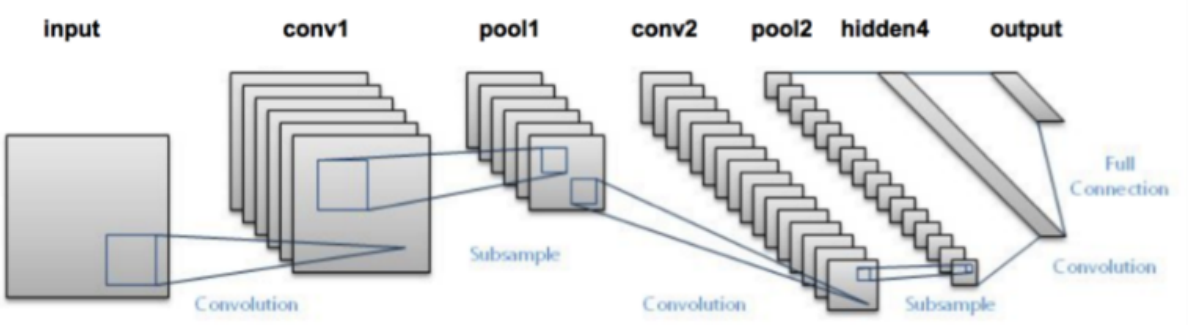
Through our program, we aim to help bridge the “gap” between two different groups (able bodied people and people with disability, specifically speech impaired and mute). The mechanism of this program is that the input, which is in the form of image, will be tested and the output given will be in the form of English character. Therefore, the users must first take a sample image of any hand gesture in ASL (American Sign Language) before being tested by the program.

III. Solution Design Architecture

Model Used: LeNet Architecture

Library used:

- Keras
- Opencv-python (cv2)
- Numpy
- pandas
- Matplotlib
- Sklearn (LabelBinarizer, train_test_split)



```
model = Sequential()
model.add(Conv2D(64, kernel_size=(3,3), activation = 'relu', input_shape=(28, 28 , 1) ))
model.add(MaxPooling2D(pool_size = (2, 2)))

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model.add(MaxPooling2D(pool_size = (2, 2)))

model.add(Conv2D(64, kernel_size = (3, 3), activation = 'relu'))
model.add(MaxPooling2D(pool_size = (2, 2)))

model.add(Flatten())
model.add(Dense(128, activation = 'relu'))
model.add(Dropout(0.20))
model.add(Dense(num_classes, activation = 'softmax'))

model.compile(loss = keras.losses.categorical_crossentropy, optimizer=keras.optimizers.Adam(),
                  metrics=['accuracy'])
history = model.fit(x_train, y_train, validation_data = (x_test, y_test),
                        epochs=epochs, batch_size=batch_size)
```
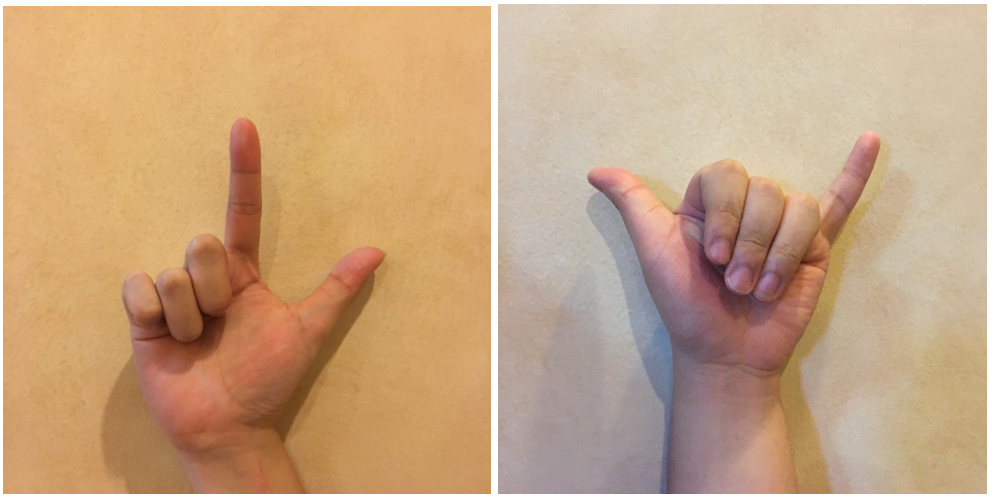
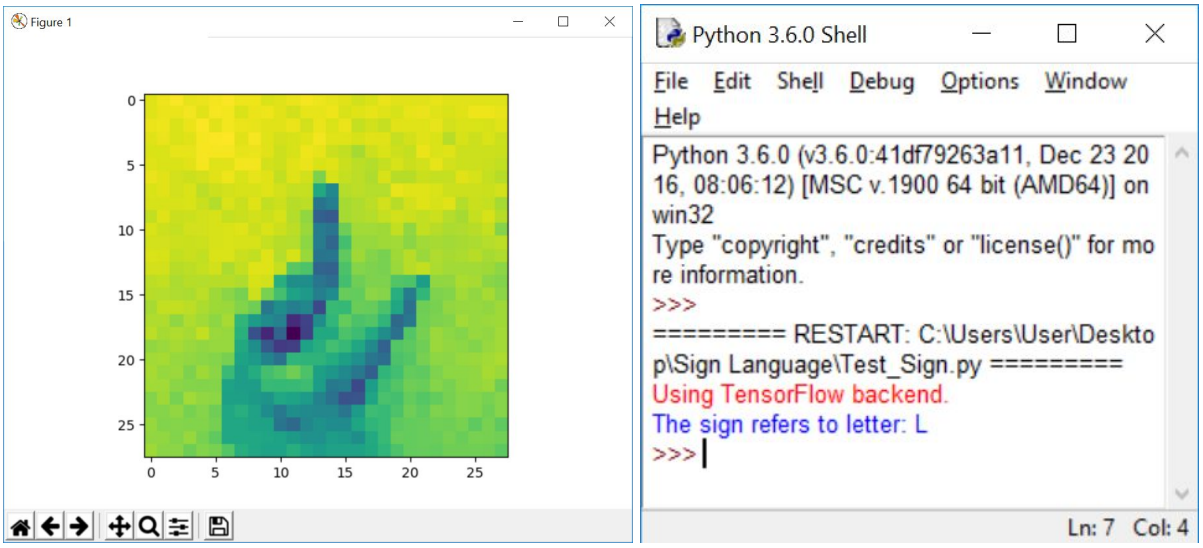

Hidden Layer includes: Flatten, Dense(relu and softmax), and Dropout

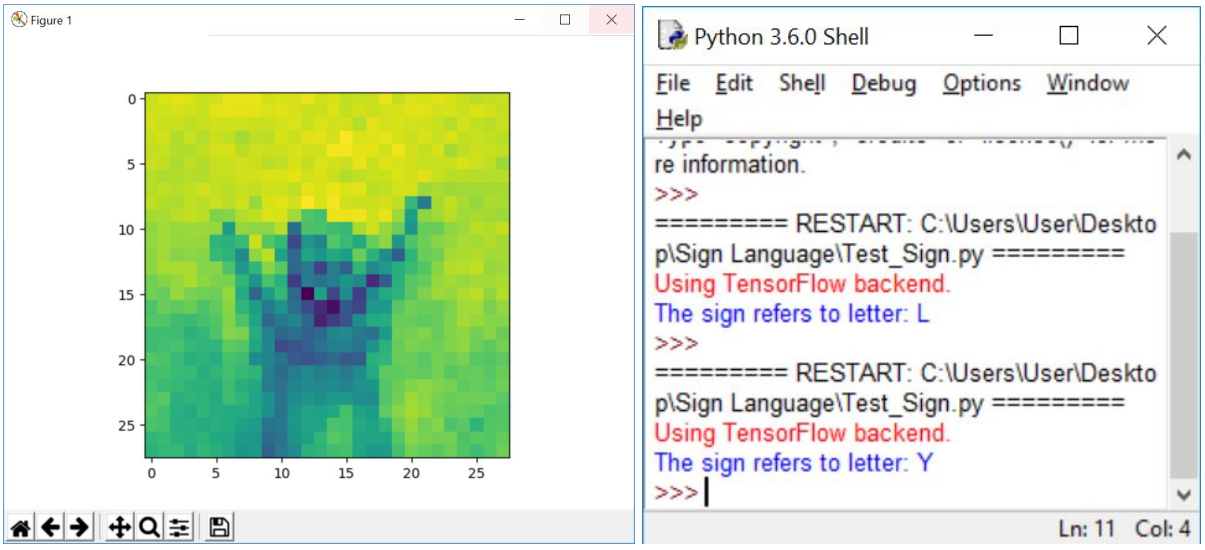
IV. Test(s)



Sample Image of Hand Gesture



Result of the 1st Hand Gesture (Letter L)



Result of the 2st Hand Gesture (Letter Y)

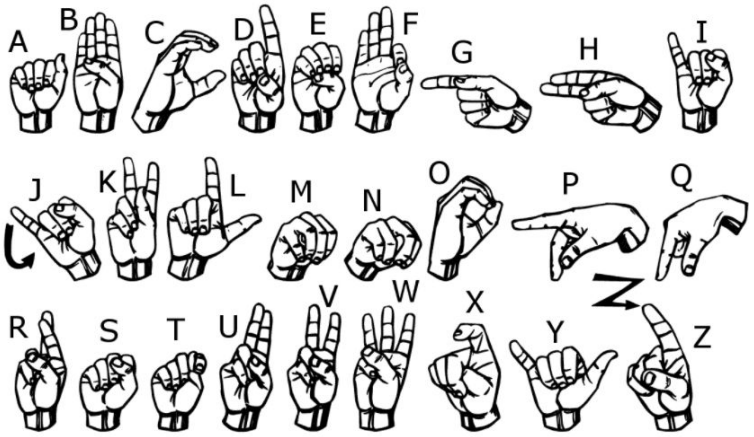
V. Program Manual

Steps:

1. Take a sample picture of a hand gesture in ASL (American Sign Language).
2. Save the picture in .jpg format.
3. Open the python test file.
4. Modify the file name in the python test file.
5. Run the module.
6. The resized picture in grayscale will appear and you can continue to see the tested result of the hand gesture.
7. The tested result will appear in the python shell as shown above.

VI. Limitation(s)

One of the limitations which can be found in this project is the inability to capture motion gestures in American Sign Language (ASL) for 2 alphabets such as J and Z as shown in the picture below. Therefore, we decided to exclude the letter J and Z in the program since it requires motion to train the sign.



The other limitation which can be distinguished in our program is that it is limited to hand gestures which are used to signal only alphabets not words. In some cases, our program may fail to provide the correct answer if the hand gestures are similar to another gestures.

VII. Documentation

- Github
  - https://github.com/stevejo12/IntelligentSystems
- Youtube:
  - https://youtu.be/n5idRk3o6Gk