

I. Domain Background

With the recent huge advances in technology, the importance of visual recognition and image processing has significantly increased. As Deep Learning and Computer Vision help us better understand images and extract useful information out of them. In the field of Self-driving cars, healthcare and pretty much every field that deals with images, visual recognition is proven to be of high importance.

Sign languages (also known as signed languages) are languages that use manual communication to convey meaning. This can include simultaneously employing hand gestures, movement, orientation of the fingers, arms or body, and facial expressions to convey a speaker's ideas.

II. Problem Statement

In the sign language, numbers can be expressed by moving the hands in a certain way that represent a digit. In this project we will be using this [dataset](#) to train a model to classify the image with the hand sign into its respective digit from 0 to 9 using CNN architecture implemented with keras.

The goal of the project is to make classifier capable of taking an image of hand movement and predict its respective digit in the sign language.

III. Datasets and Inputs

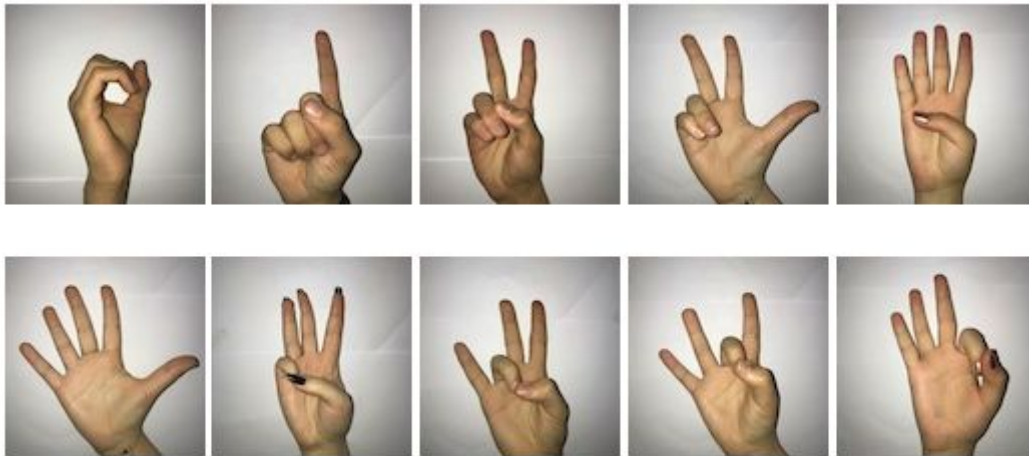
In this project, I'll be using this [dataset](#), it contains 2180 images of hand movements. It'll be the main motive for the project. It was collected by taking pictures of students hands in the [Turkey Ankara Ayrancı Anadolu High School](#).

Here's the content of the dataset. It

- Image size: 64x64
- Color space: Grayscale

- File format: npy
- Number of classes: 10 (Digits: 0-9)
- Number of participant students: 218
- Number of samples per student: 10

Preview for the content of the dataset



Input:

As the image is an array of square pixels (picture elements) arranged in columns and rows, dataset is consists of 2 Numpy arrays, One for X axis of the image, one for Y axis of the image.

IV. Solution Statement

The solution of this problem is to build and train a model that can classify the new unseen image into one of the 10 mentioned classes accurately. I intend to make classification using Convolutional Neural Network, feeding the model with the training set and try to tweak the number of hidden layers to get an acceptable accuracy. I will attend to use CNN using keras. I'll be using other algorithms that I learned throughout the Nanodegree like SVM; And try to compare between the performance of the two mentioned algorithms.

V. Benchmark Model

I'll be using a CNN model to classify the images, this dataset is similar to the CIFAR-10 dataset. I'll benchmark my model against other models in kaggle leaderboard to check if my score is higher or lower. Also, I'll compare with the performance of my two models and use the one with the best performance.

VI. Evaluation Metrics

I'll be evaluating my model using the F1-Score, prediction time, training time and accuracy score tests on the test set to check the accuracy of my model.

VII. Project Design

In this project, I'll start with visualizing the dataset and try to get a better insight about the data. there will not be a preprocessing section as the dataset is already transformed into numpy arrays that have the same size and all in grayscale.

Then, I'll split the data into training, testing, and validation sets. After that I'll try the different models starting with the CNN and then the SVM.

After building the two models I'll compare between their performance to determine which one is better to complete the project with. I'll compare according to an accuracy matrix and other algorithms mentioned in the evaluation section.