

Sign Language Recognition

CS 7641 Group 3

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Problem Definition

Motivation

- According to the WHO, 5% of the world population suffers from some extent of speech - hearing impairment.
- We intend to use Sign language recognition, powered by machine learning translation to bridge the communication gap between the hearing and hearing impaired community.

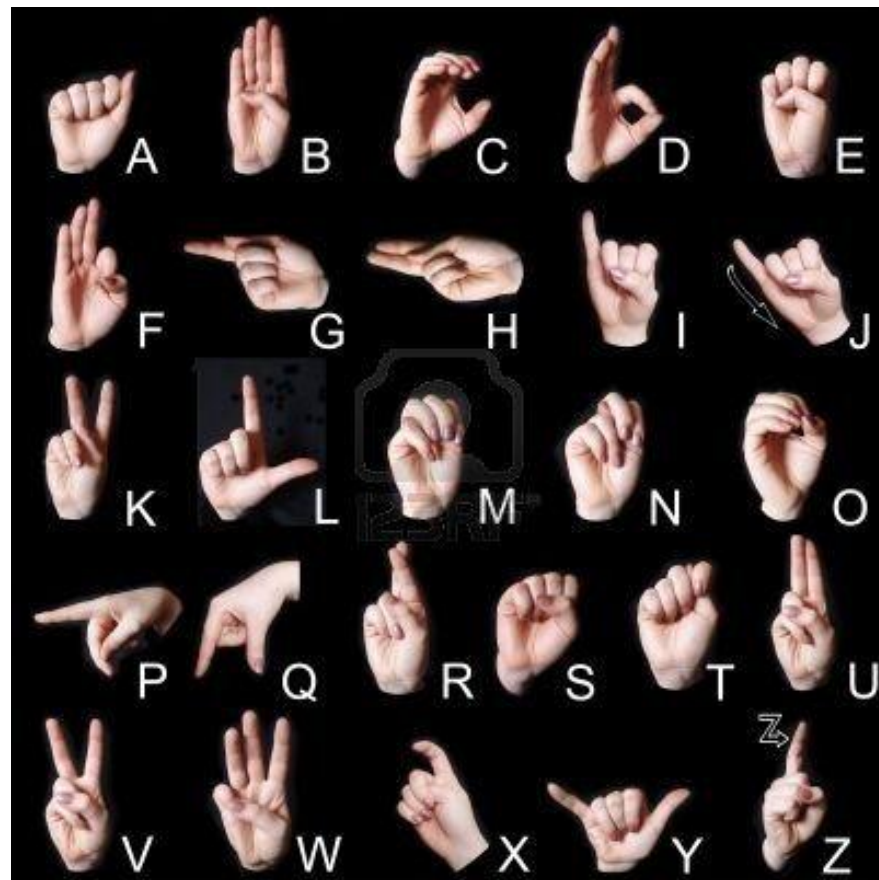
Literature Review

- In the past PCA , Kurtosis position [1] and skeleton[4] have been used for feature extraction paired with CNN[3],Hidden Markov Chain[1] and SVM[2] for classification.
- Our approach requires only image input, supported by feature extraction from OpenPose framework and classification using CNN.

Data Overview

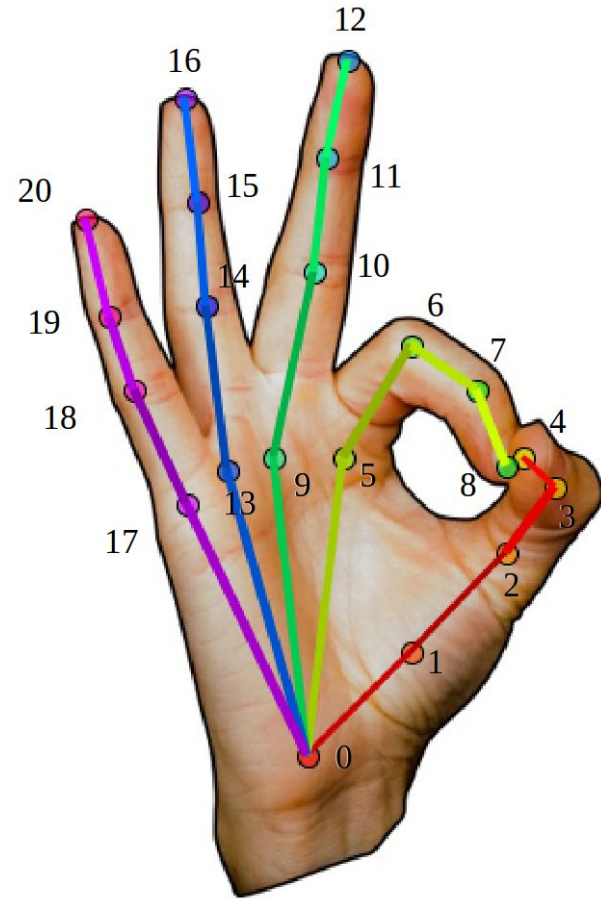
Images of American Sign Language will be used in our analysis.
Images will be filtered for only 24 classes of English alphabets (A-Z) excluding J and Z due to rotation

Dataset	Number of features
Kaggle ASL Dataset	87,000 images of dimension 200*200 with 29 classes
ASL alphabet test dataset	870 images, 30 for each 29 class



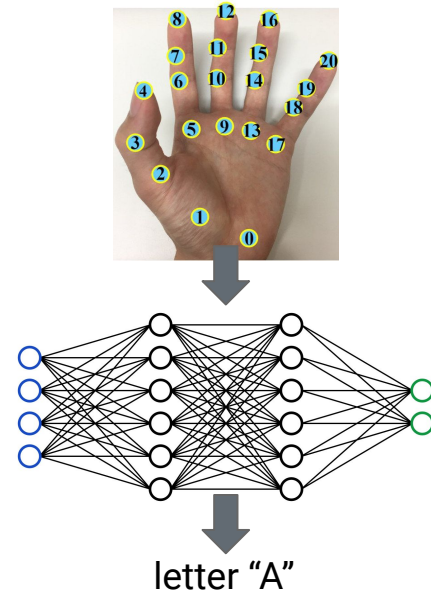
Data Preprocessing

- **Feature extraction**
OpenPose will extract 21 key points on hand for every image output.
- **Dimensionality reduction**
PCA will be used to extract the most important inputs as a combination of 21 features.



Supervised Machine Learning

- Input: (x,y) coordinates of the 21 key points
- Output: predicted meaning of the gesture
- Try models with different
 - Network Types: Deep Neural Network, CNN, Transformer
 - Network Structure: different number of node & layers
- Train and find the best parameters for each model, compare the results
- If time permits, develop a demo application to recognize signs from webcam in real time



	512 nodes	1024 nodes
DNN			
CNN			

Unsupervised Machine Learning

- Objective: Compare gestures across different sign languages
- Input: (x,y) coordinates of the 21 key points
- Output: groups of similar sign language gestures
- Clustering: K-means, DBSCAN



Potential Result

- Classification model for American Sign Language with high detection accuracy
- Clustering model to identify similar characteristics of hand gestures across different countries
- Optional: Application to translate hand gestures from a video in real-time

Project Timeline

	Resource						2022											
	Working Hours						February				March				April			
Project Events	AS	AR	HL	JG	SY	Total Hours												
Literature Review & Project Proposal	2.2	2.2	2.2	2.2	2.2	11												
Data Pre Processing	2.2	2.2	2.2	2.2	2.2	11												
Feature Extraction	4.4	4.4	4.4	4.4	4.4	22												
Modelling (Supervised & Unsupervised)	8.8	8.8	8.8	8.8	8.8	44												
Midpoint Report	1.1	1.1	1.1	1.1	1.1	5.5												
Model Evaluation	2.2	2.2	2.2	2.2	2.2	11												
Final Report	1.1	1.1	1.1	1.1	1.1	5.5												
						110.0												

Key	Team Member
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