ASL Fingerspelling Interpretation

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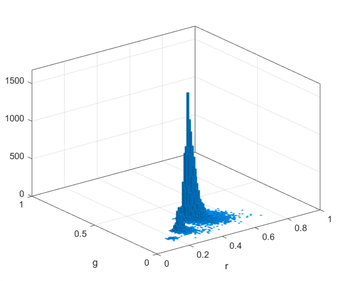
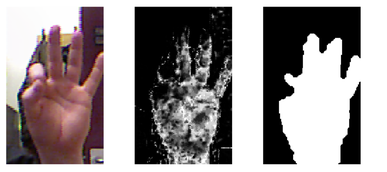
Motivation and Goals

- Develop modern and mobile method of sign language interpretation
- Concepts can be expanded to real-time gesture recognition
- Goal: Real-time implementation on Android app

Future Work - Skin Segmentation

- Use to expand project to cluttered backgrounds
- Likelihood model of rg chromaticity of skin pixels
- Morphological processing on likelihood image



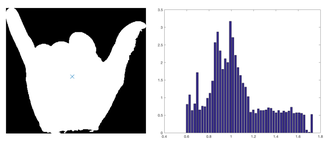


Original image, likelihood image, binary mask

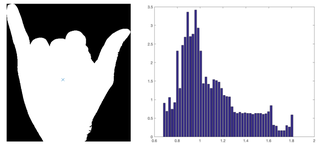
Feature Extraction and Classification

Histogram of Centroid Distances (HOCD)

- Construct a histogram of edge to centroid distances for the morphologically segmented hand image.



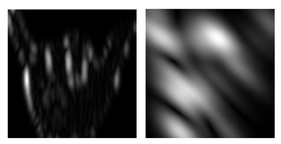
Dataset 'Y'



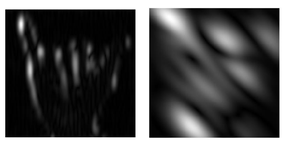
Test Image 'Y'

Gabor Filters

- Flexible gradient operator(scale, orientation)
- Reflect shape of the segmented hand



Dataset 'Y'



Test Image 'Y'

KNN Classifier

- Multiclass classification in MATLAB
- Using the non-parametric K-nearest neighbors algorithm.

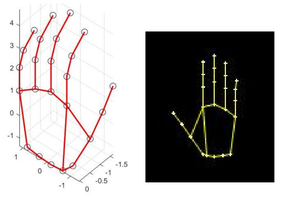
Prediction Pipeline

Capture image on Android app & send to server → Threshold, segment, and crop → Extract Gabor features / Extract HOCD features → Classify using pre-trained KNN Model → Get letter image corresponding to predicted class → Display result on Android App

Future Work - Hand Model

- Ambitious feature extraction using 20-DoF hand model
- Model extraction with a gradient descent method
- Symbol Classification in the model parameter space

Status:
Model extraction in development



Results

- Best generalization error achieved with combination of HOCD + Gabor filter features
- Confusion matrix generated for cross-validated dataset using KNN classification model

Feature Extraction Method(s)	Generalization Error (5-fold cross-validation)	Test Error
Histogram of Centroid Distances	0.1940	0.6
Gabor Filter	0.009	0.5
Histogram of Centroid Distances + Gabor Filter	0.0107	**0.2**