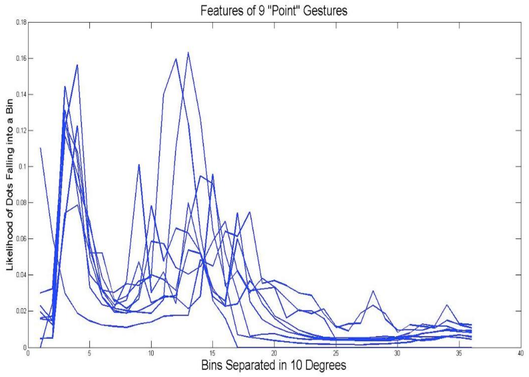
2D Still Image Hand Gesture Recognition

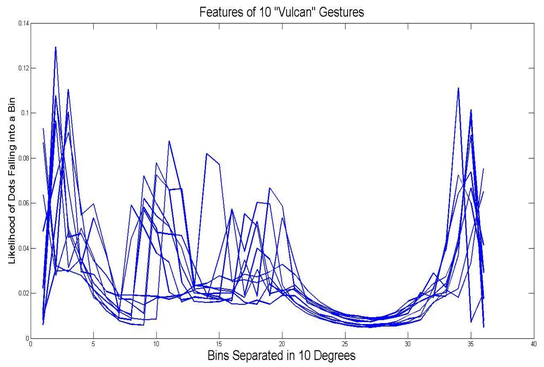
ELEC 301 Signals and Systems Project by Zihe Huang, Chenxin Fu, Minyang Ma, Aoliang Zhi

Introduction & Background

Hand gesture is useful for delivering information that cannot be conveyed through speech or type from humans. In this project, we developed a 2D hand gesture recognition method which is able to identify simple static hand gestures like “stop”, “point”, ”okay” and “up” etc.

Hand gesture recognition can be applied to the area of security, remote control, and assistance of certain groups of disabled people(e.g. translating sign language). Video games industry is an early adopter of this technology because it provides a more intuitive way for humans to interact with computers.





Processing Images

Edge Extraction

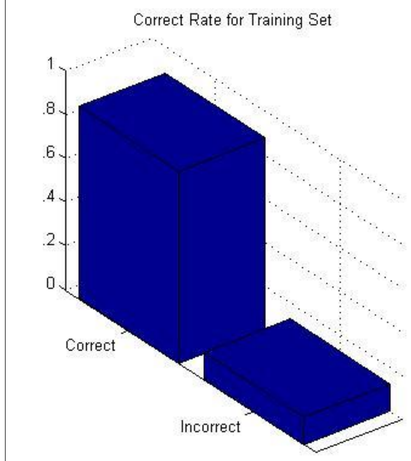
1) Take a group of training images for each gesture, one of which is the “Vulcan” gesture. (Figure 1)
2) Convert it to grayscale. (Figure 2)
3) Filter out noise and convert the image to a binary matrix. Label and crop out the largest connected component in the binary matrix. (Figure 3)
4) Obtain the edge matrix.(Fig. 4)
5) Repeat this procedure for all 7 gestures.

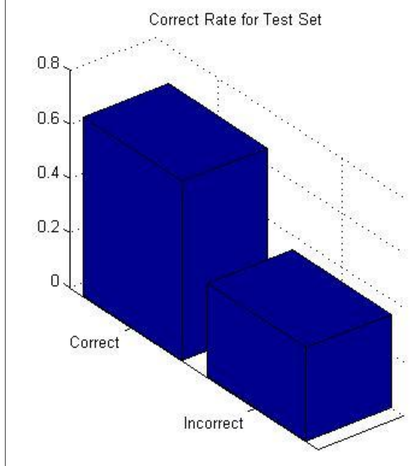
Making Prediction

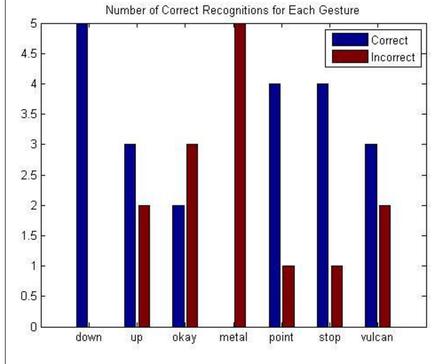
Feature Extraction & Prediction

1) As shown in Figure 5, we first divide the edge matrix into n equal bins and count a_i , the number of 1s in each bin, by obtaining a polar form of the edge matrix. Let feature vector $\vec{f} = \{a_1, a_2, \dots a_n\}$
2) For an input image, we extract its feature vector $\overrightarrow{f_{input}}$ utilizing the same method and calculate $\vec{d}$, the distances from $\overrightarrow{f_{input}}$ to all feature vectors of training images.
3) We find the k minimum values in $\vec{d}$, and compute the mode of them, which gives us the most likely gesture of the image.

Results







Program Flow

Sample Gestures (Training Data)

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Edge Detector

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Feature Extraction

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Feature Analysis

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Compare to Training data

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Derive Conclusion

Future Work

1) Explore other features such as shape context, HOG or classifiers such as SVM.
2) Expand the work content into motion gesture detection

Acknowledgement

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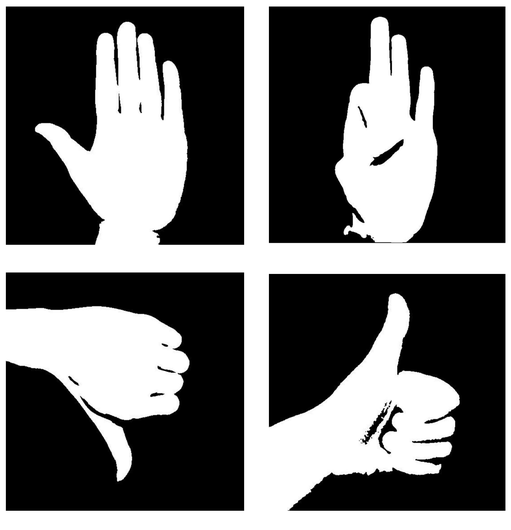

Figure 1

Figure 2

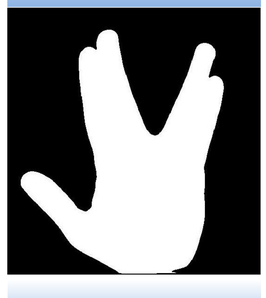

Figure 3

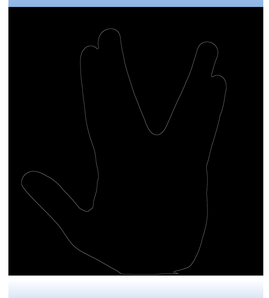

Figure 4

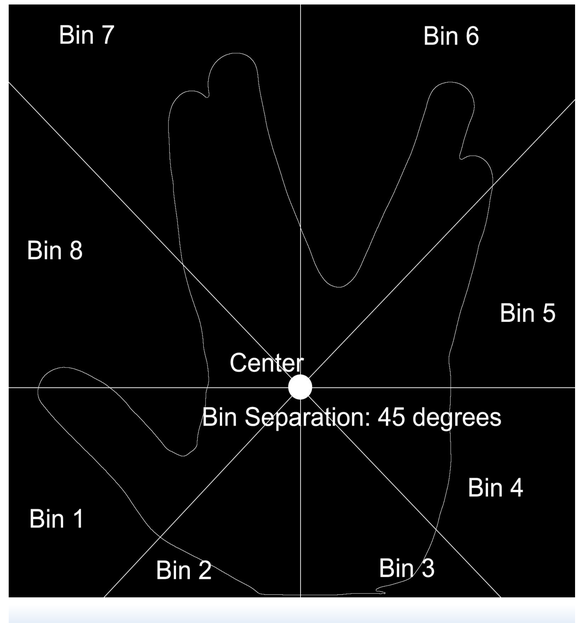

Figure 5

Summary of Methods

We use edge detector to obtain the edge of the gesture and collect features of the image to construct our training data. Then we compare the test image to our training data and select the closest gesture among our 7 gestures.