



HAND GEOMETRY DETECTION

Project Proposal

Abstract

Submitted in partial fulfillment of the requirements for the image processing course.

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INTRODUCTION

PURPOSE

This project aims to create a program that identifies the geometry of the human hand.

OVERVIEW

The program uses image processing to prepare the image for analysis where contours in an image are detected. These contours are then returned to be compared to the set standard for how a human hand contour would look like.

DATASET

[The dataset](#) was needed to have references for many hands. This dataset has 11,076 colored images (1600×1200 pixels) of 190 subjects of varying ages from 18 to 75 years old. Each subject was asked to open and close his fingers of the right and left hands. Each hand was photographed from both dorsal and palmar sides with a white background and placed approximately in the same distance from the camera. [1]

EXAMPLES

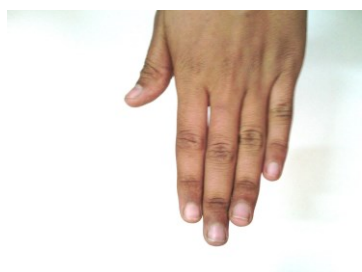


Figure 1: Dorsal left hand, closed fingers



Figure 2: Dorsal left hand, opened fingers



Figure 3: Dorsal right hand, closed fingers



Figure 4: Dorsal right hand, opened fingers



Figure 5: Palmar left hand, closed fingers



Figure 6: Palmar left hand, opened fingers



Figure 7: Palmar right hand, closed fingers



Figure 8: Palmar right hand, opened fingers

PROCESS



- Preprocessing
 - The image is preprocessed to detect the outlines of the shape of the hand.
 - I use gray level slicing to binarize the image to highlight the intensity levels between 75 and 230 which appeared to be the average range for the skin tone level.
- Segmentation
 - I use Canny edge detection to detect the edges of the shape of the hand.
- Contour Detection
 - The image of the edges is then inputted into a contour detection algorithm that detects any curve joining all the continuous points (along the boundary), having same color or intensity. [2]
- Shape approximation
 - The resulting contours are then approximated to another shape with a smaller number of vertices depending upon the precision we specify. It is an implementation of Douglas-Peucker algorithm.
- Shape matching
 - The abstracted shape is then evaluated to check if it has the basic features of a hand.
 - A hand is essentially an 11-side polygon with 4 reflex angles that represent the spacings between fingers.
- Result
 - The program takes the matching result and outputs if the object in the image was a hand.

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REFERENCES

- [1] S. Mukherjee, "Hands and palm images dataset," 2021. [Online]. Available: <https://www.kaggle.com/datasets/shyambhu/hands-and-palm-images-dataset>.

- [2] S. Singh, "Medium," 22 May 2020. [Online]. Available: <https://medium.com/simply-dev/detecting-geometrical-shapes-in-an-image-using-opencv-bad67c40174f#9708>.