Learning the Hong Kong Sign Language with the Help of a Kinect Device

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Project Overview

This report describes a software system that helps people to learn the Hong Kong sign language with the help of a Kinect motion sensor device. Users can learn and test their knowledge on sign language in this system.
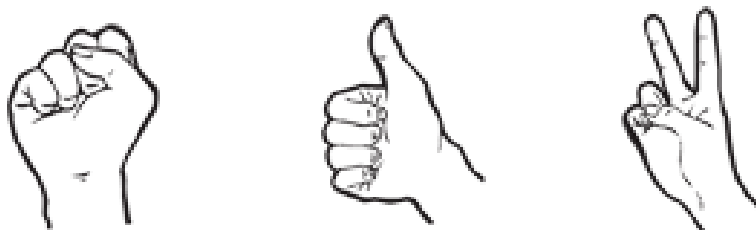
In our software, we use the Turtle algorithm to trace the hand contour, geometrical calculations and color recognition to identify fingertips and palm center, and dynamic time warping to recognize gestures. These data are collected and analyzed by the software to determine if the user performed the gesture correctly.
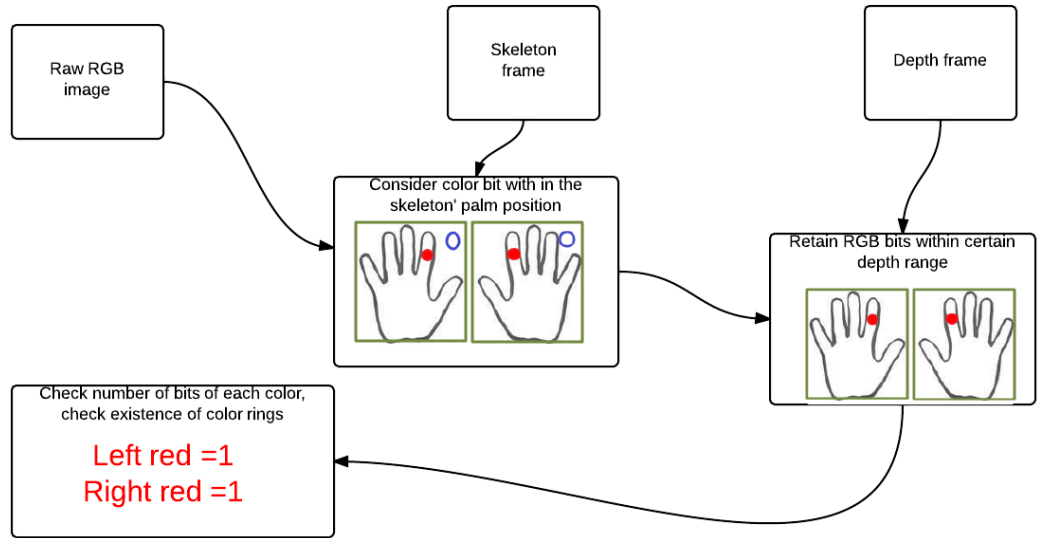
What is Kinect?
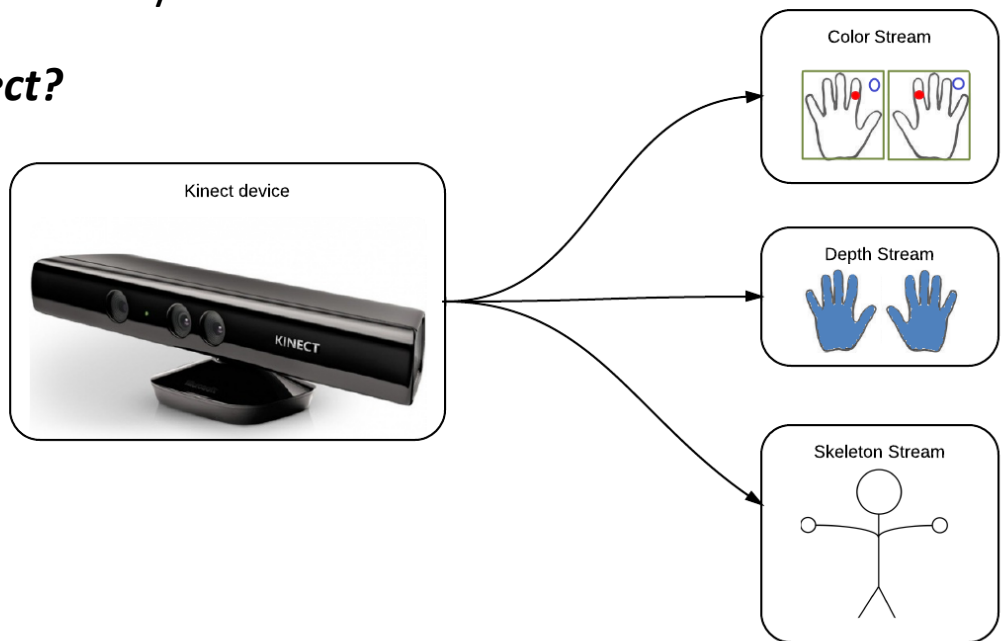
Objective

1. To design a system to recognize fingers and gestures and return results at real time.
2. To help users to learn sign language by watching videos.
3. TO help users follow their learning process by implementing Leitner system.
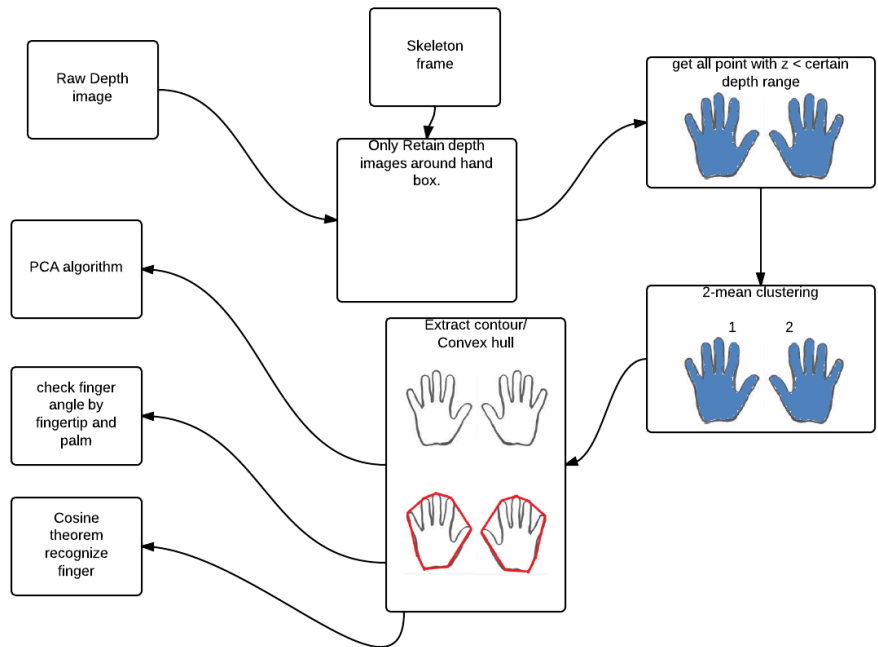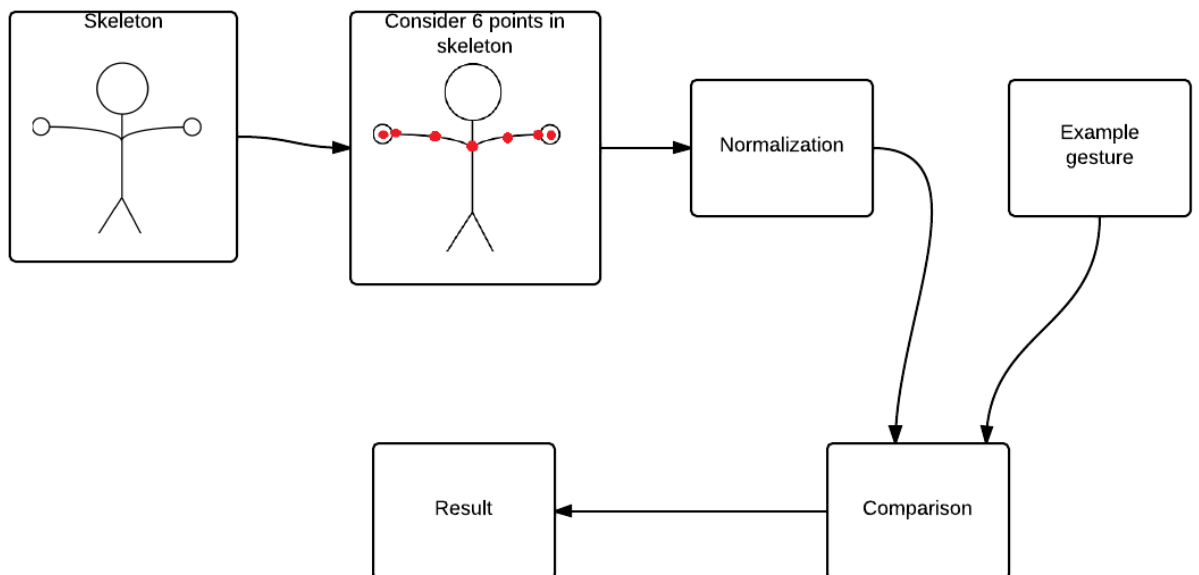
Logic Flow

RGB stream

Raw RGB image

Skeleton frame

Depth frame

Consider color bit with in the skeleton' palm position

Retain RGB bits within certain depth range

Check number of bits of each color, check existence of color rings

Left red =1
Right red =1

Depth Stream

Raw Depth image

Skeleton frame

Only Retain depth images around hand box.

get all point with z < certain depth range

2-mean clustering

1   2

PCA algorithm

Extract contour/ Convex hull

check finger angle by fingertip and palm

Cosine theorem recognize finger

Skeleton Stream

Skeleton

Consider 6 points in skeleton

Normalization

Example gesture

Result

Comparison

Learning by Leitner System

The Leitner system is a widely used method to efficiently use flashcards. In this method flashcards are sorted into groups according to how well you know each one in the learning box. If you succeed, you send the card to the next group. But if you fail, you send it back to the previous group. Each succeeding group has a longer period of time before you are required to revisit the cards.
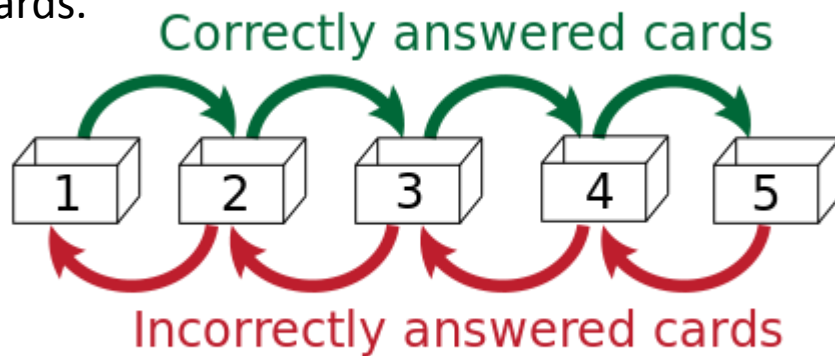
Result – Recognition Rate

Gesture	乾	一樣	冰,凍,冷	失敗	不理會	不喜歡	不知道
(Eng)	Dry	Same	Cold	Fail	Ingore	Dislike	Not know
Accuracy	100%	80%	100%	80%	100%	100%	100%

Gesture	取消	統治者	每週六	汽水	比較	合格	品牌
(Eng)	Cancel	King	Every Sat	Coke	Compare	Pass	Brand
Accuracy	40%	100%	100%	100%	80%	80%	80%

Gesture	不要	不適合	可以,能	好	如常	上	
(Eng)	Not want	Not suitab	Can	Good	As usual	Up	
Accuracy	80%	20%	100%	80%	80%	100%	

In average our system has an 85% accuracy.

Conclusion and Future Work

Information from 3 streams is processed to provide information such as the number of erected fingers, and the locus of the gestures. The system makes use of this information to identify gestures.

In the future, the algorithms may be improved so that the user need not perform the sign language in a slower manner. Different algorithms in image processing may be tried to improve the quality of the depth image.