Mirror Therapy

Your private rehabilitation therapist

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PART ONE

Brief introduction

Brief introduction

A rehabilitation system

The system identifies healthy hand gestures and plays the corresponding virtual hand gesture video of impaired hand on the App

Electronic Medical Records

Doctors and patients can check the previous medical records in the application at any time.

Online Doctor

Also, it’s a communication tool for both rehabilitation therapists and patients.

PART TWO

Project Plan

Timeline

Design

- Experiment with hardware (delayed)
- Thoroughly examine signal data to design the best classification algorithm
- Gather information on cloud storage and all possible functionalities
- Gather information on application design and learn new coding language if necessary
- Agree on a final design of end product (might be delay)

Operate

- Beta version bug fixing
- Final product ready
- Distribute to test users and collect feedbacks
- Organize all course documentations for submission/final presentation
- Kick back and wait for that 5

30th Jan--12th Feb

13th Feb--5th Mar

6th Mar--28th May

6th Mar--28th May

Conceive

- Getting to know teammates
- Tasks division
- Understanding project scope and the general workflow of this course

Implement

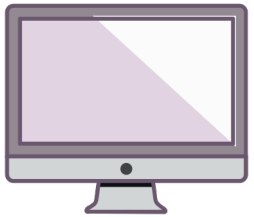
- 3 teams working separately on machine learning, cloud storage and transfer, and application building
- Combine the 3 team’s result and come up with the beta version of the final product

PART THREE

Project Result

Framework

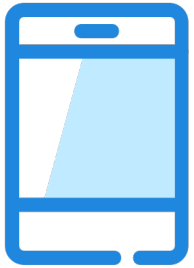
Pre-processing
Classify the gesture



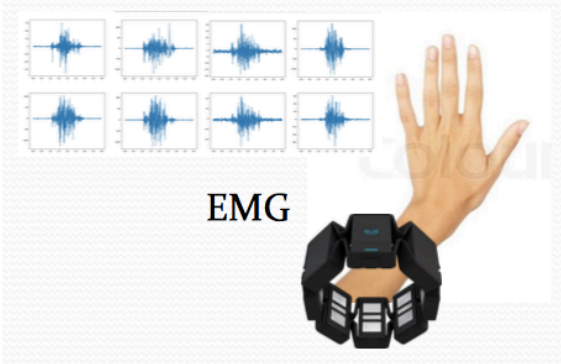
Upload Result

Cloud Server

Read Data



Data Collection



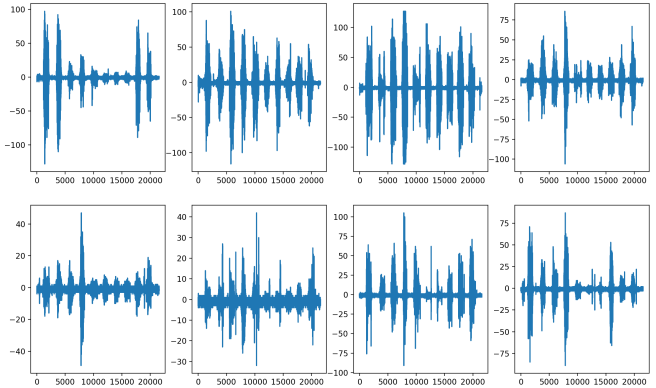
Show the corresponding gesture number

Data Collection

Method: Manual collecting data
get a data set for each gesture

timestamp	emg1	emg2	emg3	emg4	emg5	emg6	emg7	emg8
1.54E+15	1	12	-2	-12	-3	0	-2	0
1.54E+15	1	10	-7	0	-3	-3	-5	-5
1.54E+15	0	0	0	0	0	-1	0	-2
1.54E+15	1	-1	0	5	2	-1	0	1
1.54E+15	-1	-3	4	4	0	0	1	0
1.54E+15	-4	5	-8	-3	-1	-2	-2	0
1.54E+15	5	-4	-9	-7	-2	1	-1	0
1.54E+15	-1	-2	-1	0	0	-1	0	1
1.54E+15	0	-2	14	8	1	0	-1	-3
1.54E+15	-1	1	-14	-9	-2	-1	1	-2
1.54E+15	0	-11	7	1	0	-1	1	1
1.54E+15	-1	1	1	-1	-1	0	0	-2
1.54E+15	-1	0	-8	2	1	-1	-1	-1
1.54E+15	-3	-6	6	8	2	1	0	1
1.54E+15	-4	-15	7	4	0	1	0	-1
1.54E+15	-1	-6	1	-4	-1	2	1	1
1.54E+15	-2	-11	-6	0	1	1	-2	-2
1.54E+15	-2	-20	9	7	3	3	3	1
1.54E+15	-4	-1	-11	-5	-1	2	0	0
1.54E+15	2	14	3	3	2	0	0	0
1.54E+15	0	3	-10	-6	-3	-2	1	2
1.54E+15	-3	21	-26	-11	-5	-6	-3	-4
1.54E+15	-5	-1	-32	-2	-2	-4	-1	-2
1.54E+15	-3	-9	-4	-11	0	4	2	2
1.54E+15	-3	2	-11	-2	-3	-2	0	-2
1.54E+15	1	4	-8	-3	-2	-1	-2	-2
1.54E+15	4	14	-4	-3	-3	-2	-1	-1
1.54E+15	4	21	-1	5	-1	-2	-2	0
1.54E+15	-4	-9	-3	-3	-2	2	0	0
1.54E+15	-1	-5	1	4	0	-1	-1	-2
1.54E+15	-3	-12	7	-1	0	1	1	0
1.54E+15	4	21	-1	1	-1	-2	-2	-2
1.54E+15	-3	-9	-3	0	3	2	1	0
1.54E+15	-2	-6	5	4	3	1	-1	0
1.54E+15	1	1	14	-1	1	2	-1	-1
1.54E+15	-5	-10	-3	-1	1	0	1	-3
1.54E+15	0	17	-19	-2	-2	-2	-3	-2
1.54E+15	3	-9	4	2	0	1	0	2
1.54E+15	2	-27	21	0	3	0	0	1

Pre-Processing



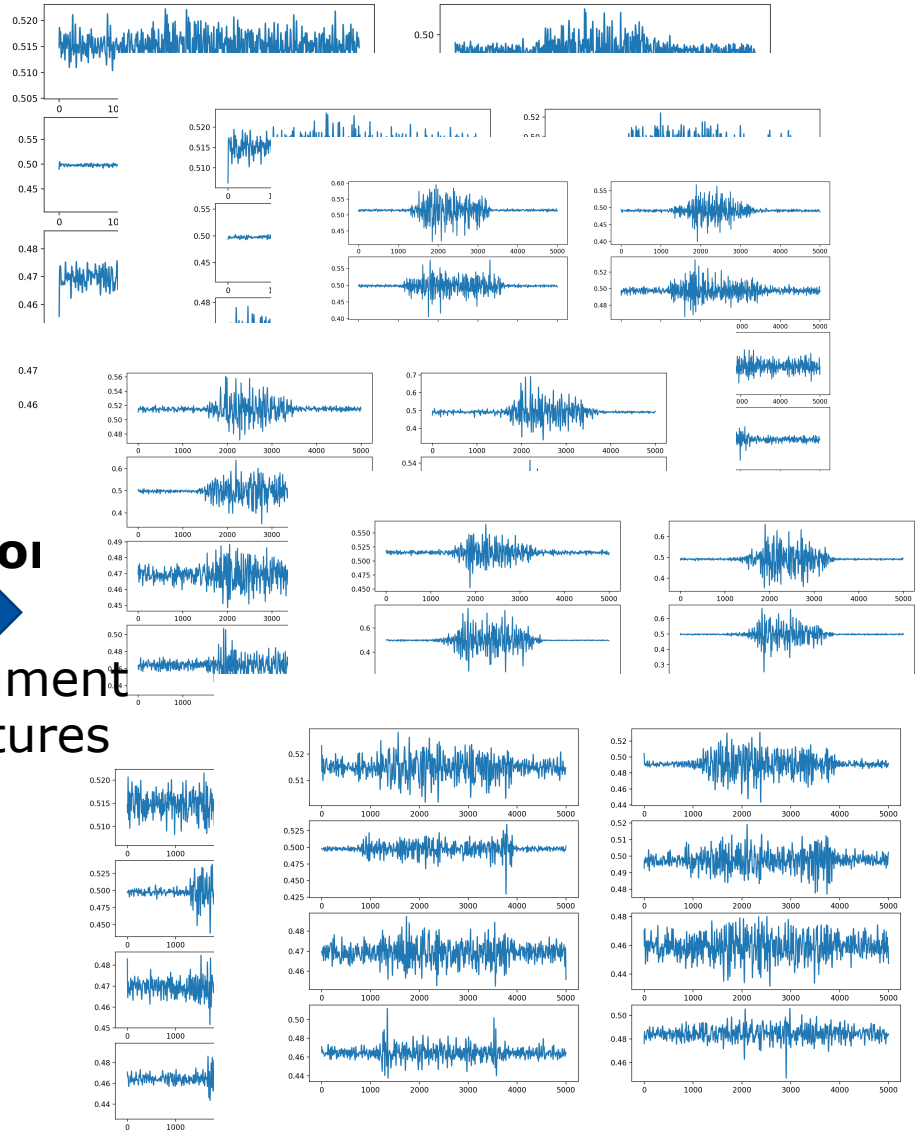
Raw Data : 10 gestures in 8 channels

Cleaning Data

- Fill in missing data
- Resampling data
- Normalization

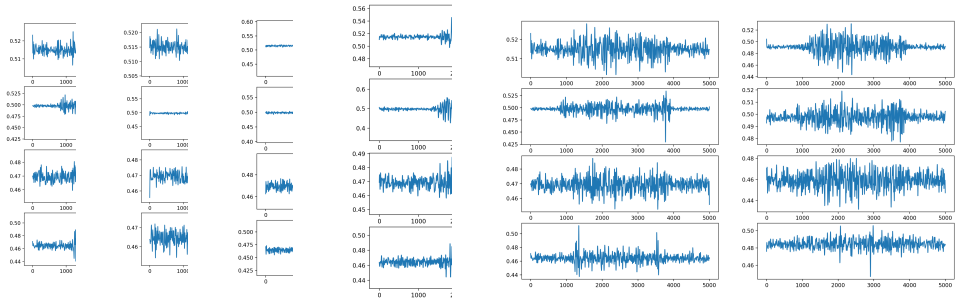
Segmentation

Automatically segment data into ten gestures



Sample Data : 1 gestures in 8 channels

LSTM Classification



Training Data : 1990 gestures

LSTM

input_size
500x8

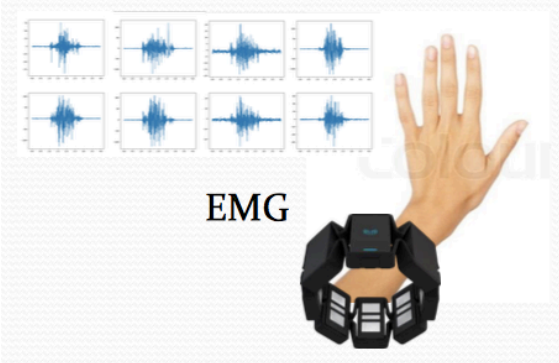
LST M | LST M | … … | LST M | LST M

hidden_size=64

Linear(64, 10)

Backward Propagation

Predictio n Y_test



Collection Data : 1 gesture

Testing

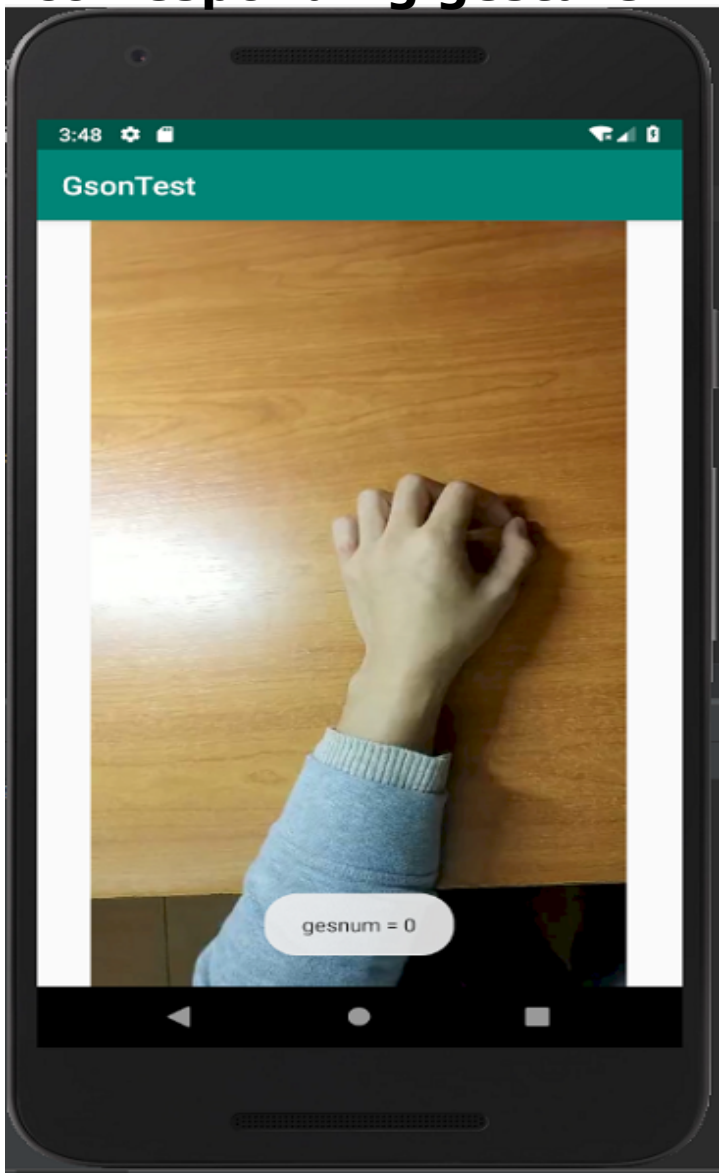
Saved as Model

Prediction

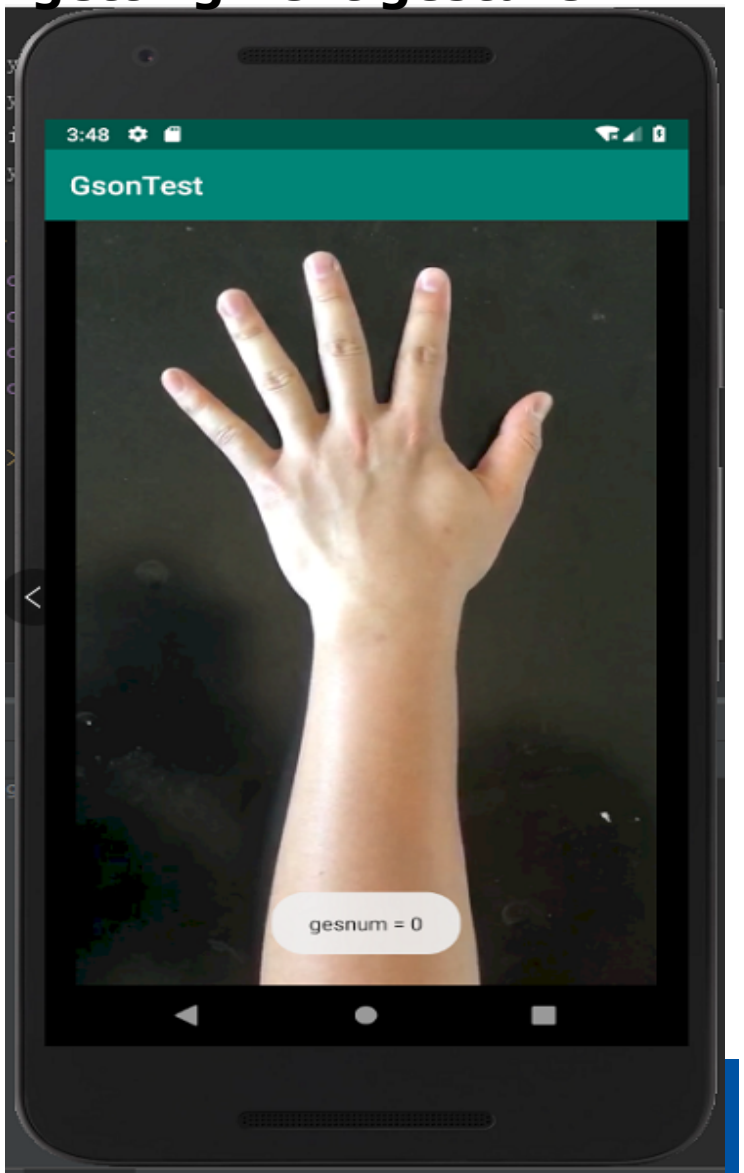
APP Design

Environment: android studio

Function 1: play video with corresponding gesture



Function 2: keep static until getting next gesture



Demo

Product Evaluation

Product structure

advantage

- achieve all function designed
- Shortened the delay

shortage

- too many devices
- manual collecting data

Product Evaluation

Module accuracy

	CNN	RNN
Number of samplings	2510	3650
Accuracy	40%	70%

Product Evaluation

System delay

delay	Theoretical time	Real time	Time difference
Sampling delay	5	5	0
Classification delay	<<0.1	<<0.1	0
Transmission delay	0	1.2+1.5	1
Total	5	6	1

PART FOUR

Review & Reflection

If time could be turned back

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What would we change?

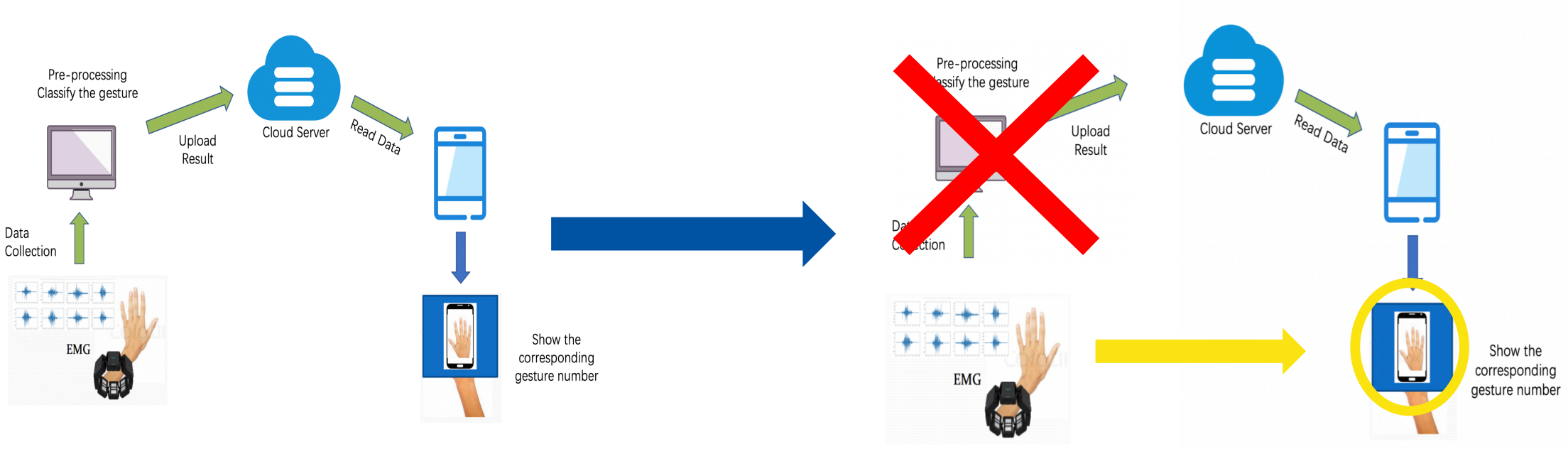
Review and reflection

01 Optimization for the Overall Framework

02 Optimization for Data Collection

03 Optimization for Data Processing

Optimization for the Overall Framework



01 The overall structure of our system could be greatly simplified, making our products more simple and portable.

02 The problem of system delay will be optimized to some degree without using computer as a transfer station.

Optimization for the Data Collecting

01

Time

We should collect data as soon as possible.
The data collection process is actually very complicated, and the data collected is difficult to be standardized, so this process takes us a lot of time.

02

Quality

We were supposed to guarantee the completeness of our data set samples.
All the data we collected came from the same person. Later, in the system testing phase, it was found that such a data set would make our system overfitting.

03

Quantity

The number of samples used in our training system should be greatly increased.
Only a few thousand data of sets are far from enough to meet the learning needs of an accurate identification system.

Optimization for the Data Processing

01

Denoise

Might make machine learning part easier.

02

Spectrogram

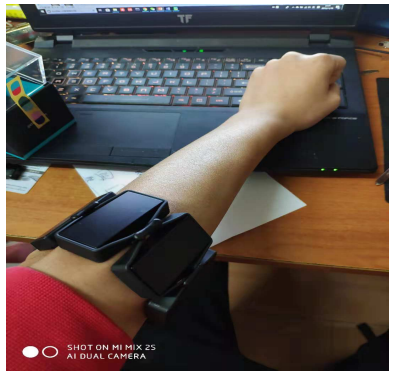
May also be a good choice , which has been mentioned in many projects. Converted them into image recognition and analyzed by neural network, more effective features might be extracted.

Future Prospects

VR

EEG

Portable electronic equipment



sEMG

What would we keep?

Our teamwork spirit and mutual trust

We he help.

Commi rm the leader/

We reg ng on peopl

We see son to get upset.

Inform ith a task given to you.

----Grand rules of Mirror Therapy

THANKS