

# AFFECTIVE COMPUTING, HCI, EMOTION-BASED IMAGE RETRIEVAL

**Manuel J. Fonseca**

LASIGE

FC/ULisboa



<https://webpages.ciencias.ulisboa.pt/~mjfonseca/>

1

## Research Topics

**Human-Computer Interaction (HCI)**

**Affective Computing (Emotion Recognition)**

**Brain-Computer Interfaces (BCI)**

**Gaze Interaction (Eyetracking)**

**Health Informatics**

**Multimedia Retrieval (Images)**

**Sketch Recognition & Interaction**

2

# 01

## HEALTH INFORMATICS

3

### Reminiscence Therapy



4

## RT Digital Platform

**Support RT sessions @ Home**

**Utopic goal: available worldwide for everybody**

### **Main Features:**

- Minimizes negative emotions

- Avoids showing potential negative images

- Removes images that elicit negative emotions

- Adjusts the set of images automatically

5

## What do we already have

### **Digital platform architecture**

#### **Backend**

- Database

- Webservices to insert/retrieve information from the DB

#### **Emotion Recognizers**

- From images

- From people (EDA, EEG)

6

## Proposal: RT-Session

### Application to perform RT Sessions

Presentation of images

Identification of the region of focus

Automatic generation of the set of Images (IDSS)

### Integration with all the existing components

Emotions from images & from people

Image retrieval system + Backend

Algorithms (gaze, IDSS) | Software integration | Web Application | User Interface  
Web technologies (Angular, HTML, JS) | Java

7

## Proposal: RT-Portal

### Web portal of the platform

#### To be used by caregivers for:

Insert info about caregivers, patients & sessions

Visualize patients' evolution

Access information about past sessions

#### Should be designed with caregivers

User requirements + Participatory design

Web Application/Portal | User Interface | User Research  
Web technologies (Angular, HTML, JS) | Java

8

# 02

## AFFECTIVE COMPUTING (EMOTION RECOGNITION)

9

### Two Sources

**Stimuli (images, videos)**



**People**



10

## Emotions Elicited by Images/videos



### Low-level Features

Color  
Texture  
Shape  
Composition

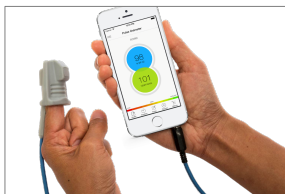
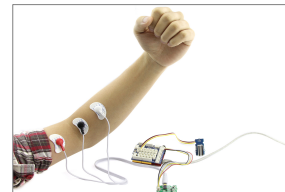
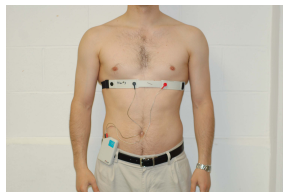
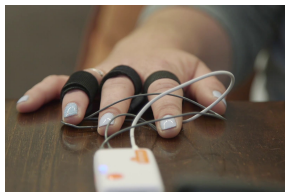
### Semantic Features

Human Faces  
Objects, animals, etc.  
Actions  
(meaning)

70% recognition rate Polarity

11

## Emotions Felt by People



### Physiological Signals

Galvanic Skin Response (GSR)  
Electrocardiography (ECG)  
Electromyography (EMG)  
Respiratory Rate (RR)  
Electroencephalography (EEG)

12

## Proposal: EmoVideo

### Emotions Elicited by Videos

Use low-level features (color, texture, etc.)

Use as basis the emotion recognizer from images

Explore dynamic features of the video (e.g. zoom-in, zoom-out, camera movements, etc.)

Identify emotions in key-frames

Algorithms | Video analysis | Integration | Feature extraction | Machine Learning  
Java | Python

13

## Proposal: EmoPhy

### Emotion recognition from physiological signals

Study the Relationship between the several signals

Develop algorithms for each type of signal  
(EDA/EEG)

Combination of the two algorithms

Explore other signals collected by the Muse 2 device

Algorithms | Signal Analysis | Feature Extraction | Machine Learning  
Java | Python

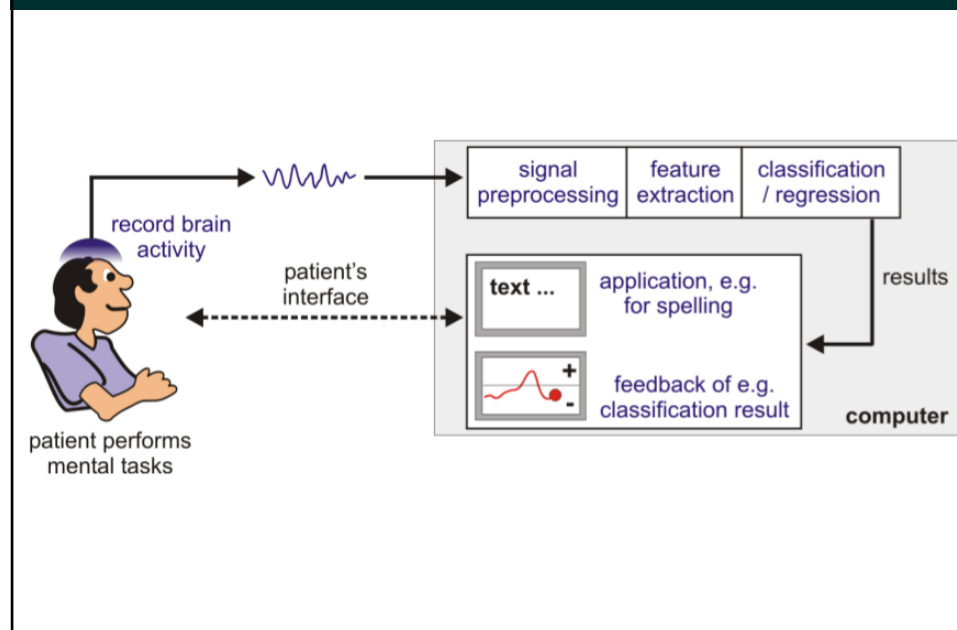
14

# 03

## BRAIN-COMPUTER INTERFACES (BCI)

15

### How BCI Works



16



## Non-invasive EEG Devices



g.tec BCI



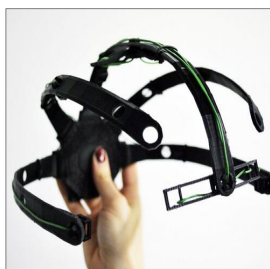
NeuroSky MindWave



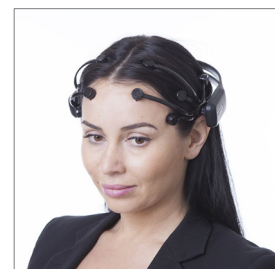
Emotiv Insight



Muse 2



Open BCI



Emotiv Epoc

17

## How P300 works?

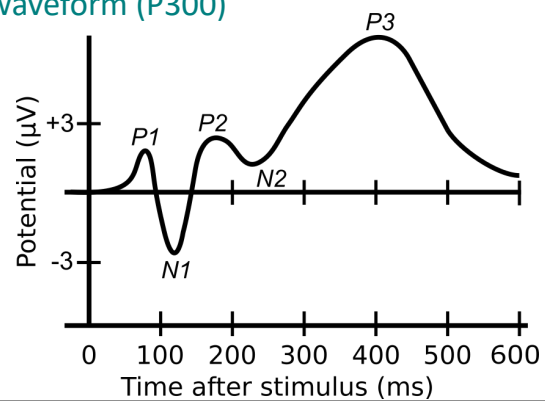
### Generation of events

**Visual**, auditory, motor

### Brain responds to event

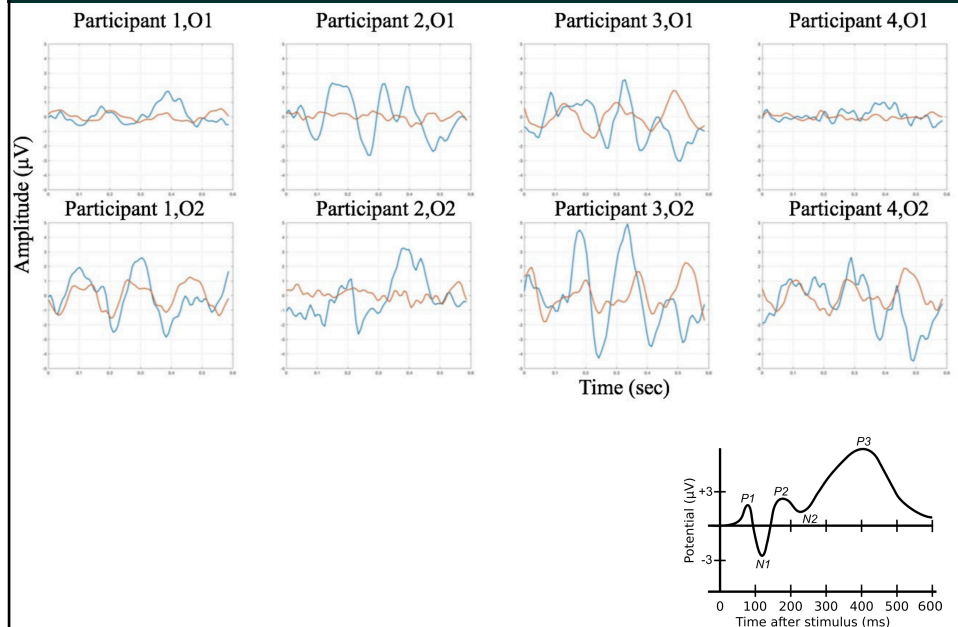
Generates a typical waveform (P300)

Peak 300 – 400 ms



18

## Why is a Challenge?



19

## Proposal: P300.ID

**Algorithm to detect P300 wave**

**Should be user-independent**

**Effective and Efficient**

Algorithms | Signal Analysis | Feature Extraction | Machine Learning  
Java | Python

20

# 04

## GAZE INTERACTION

21

### Gaze Interaction (only)

**Interaction technique based on gaze only**

**Uses an Eyetracker (or webcam)**

**For people with mobility restrictions (not only)**

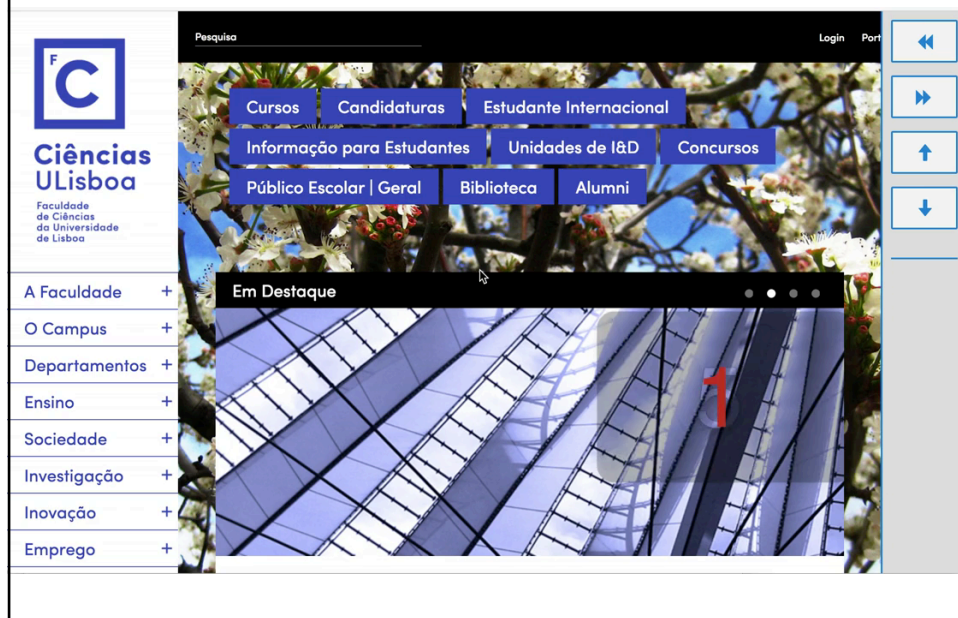
#### **EyeLinks (MSc 16/17)**

Fast and accurate navigation on Webpages

Add-on for Google Chrome

22

## EyeLinks (Msc 16/17)



23

## Proposal: EyeTyping

**Text input using only Gaze**

**Efficient and Effective (few errors)**

**Integrate navigation + writing in Webpages**

**Will use EyeLinks as basis**

Algorithms | Gaze Interaction | Text Input  
Web Technologies (JS, HTML, jQuery)

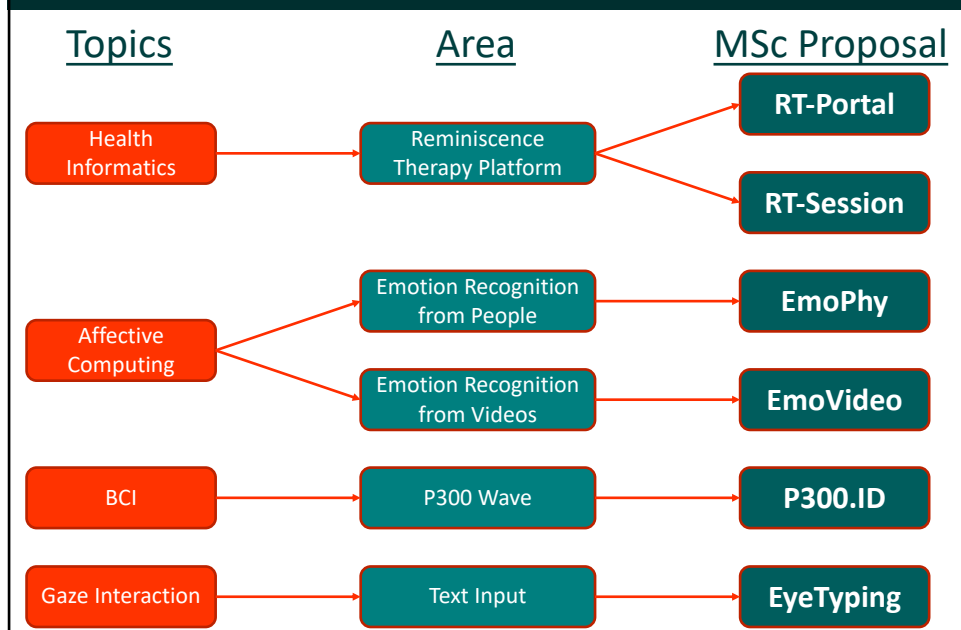
24

# 05

## IN SUMMARY

25

### Overview



26

**THANK YOU!**

[https://webpages.ciencias.ulisboa.pt/  
~mjfonseca/supervision/msc-2021.html](https://webpages.ciencias.ulisboa.pt/~mjfonseca/supervision/msc-2021.html)