Identification of Neural Correlates of Face Recognition using Machine Learning Approach

Shreya Gupta
Delhi Technological University
shreyagupta_bt2k16@dtu.ac.in

Presentation Outline

Why this topic

Why we need this face recognition model in healthcare and engineering

Methodology

How is the problem being solved

Approach

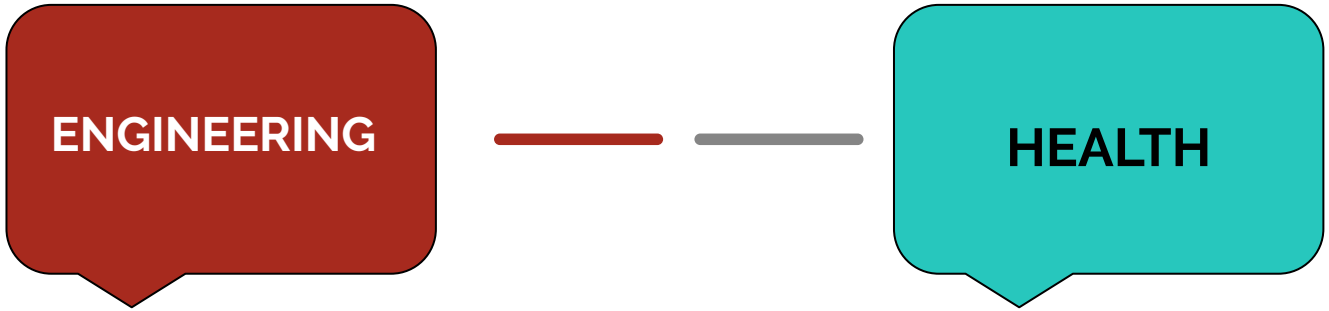
Why and what technologies are used

Results, shortcomings and future scope

Opening doors for future research

Neural Correlates of Face Recognition

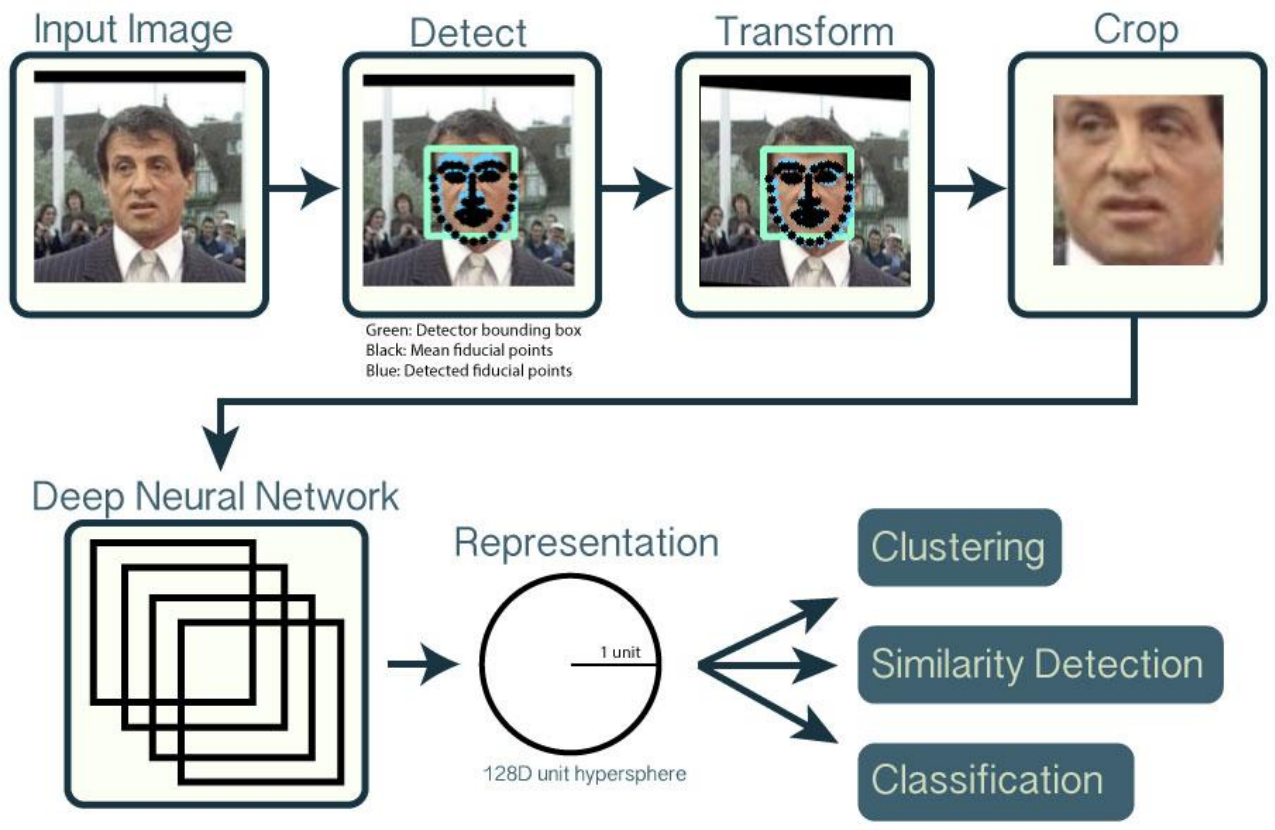
Purpose of the Paper - Macro



Provide face recognition models that work similar to how a human brain does.

Assist people suffering from autism and prosopagnosia lead a better life.

Existing Approach



Problem

Illumination effects

Angle, pose and expression variation

Aging, occlusion and quality of images

Enter Neuroscience

Methodology

Stimuli (if any)

- auditory
- visual
- somatosensory
- olfactory
- ...

Task

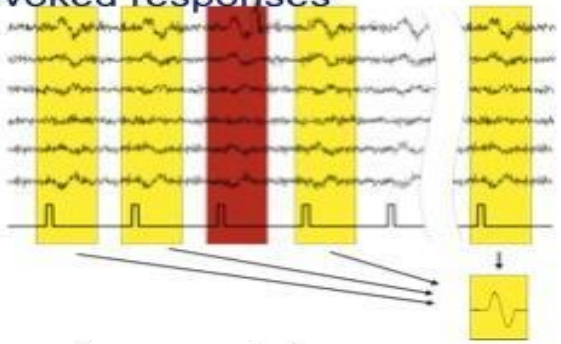
- attend/ignore
- detect + react
- detect + count
- imagine
- observe/imitate
- ...

Behavioral responses

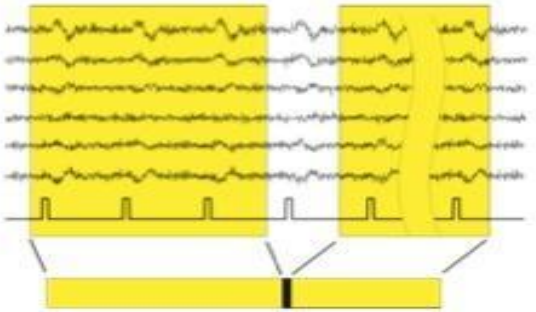
- limb/finger movement
- speech
- ...

MEG/EEG

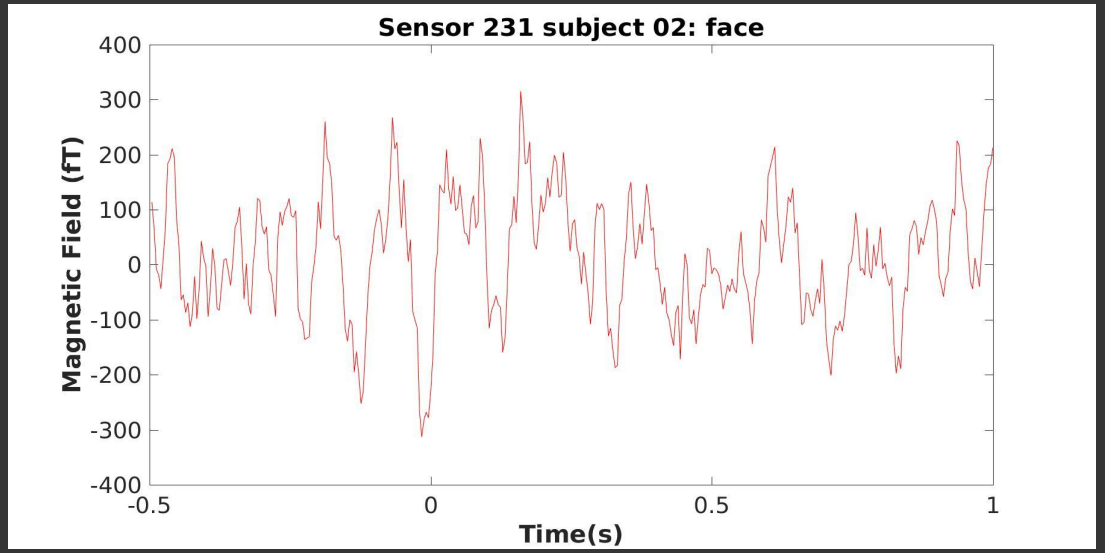
- evoked responses

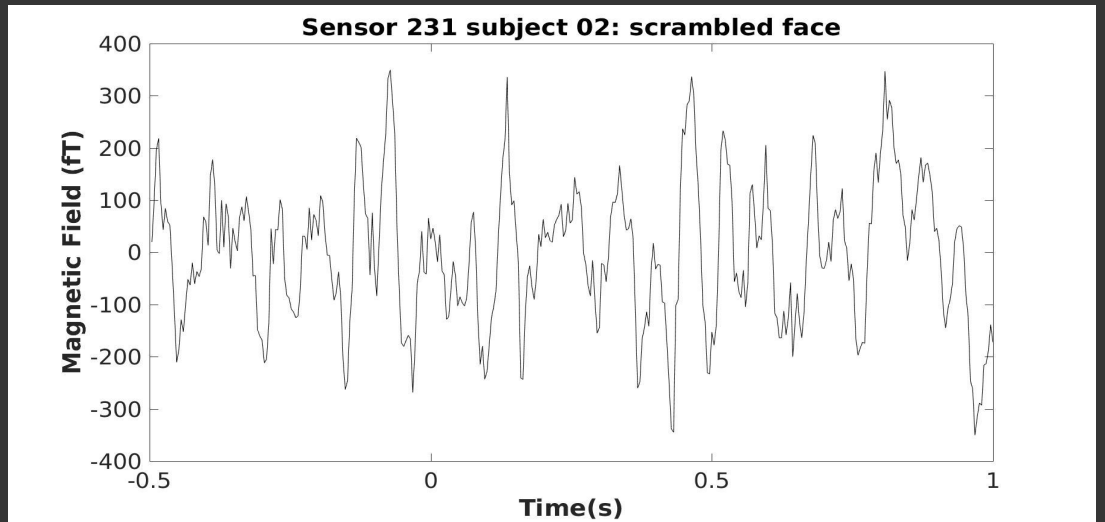


- spontaneous data



Problem 1: Not all signals are “correct”


Sensor 231 subject 02: face
Magnetic Field (fT)
400
300
200
100
0
-100
-200
-300
-400
-0.5
0
0.5
1
Time(s)


Sensor 231 subject 02: scrambled face
Magnetic Field (fT)
400
300
200
100
0
-100
-200
-300
-400
-0.5
0
0.5
1
Time(s)

Problem 2: **No clear demarcation between the signals.**

Machine Learning did what humans could not: find the patterns between signals classified as face and scrambled face.

ENTERS MACHINE LEARNING

Central purpose

- Identify neurons in brain responsible for visual identification.
- Detect timestamps during which classification occured.

Technicalities

Dataset: Decoding the Human Brain (Kaggle)

Dataset dimensions: 580 X 306 X 375

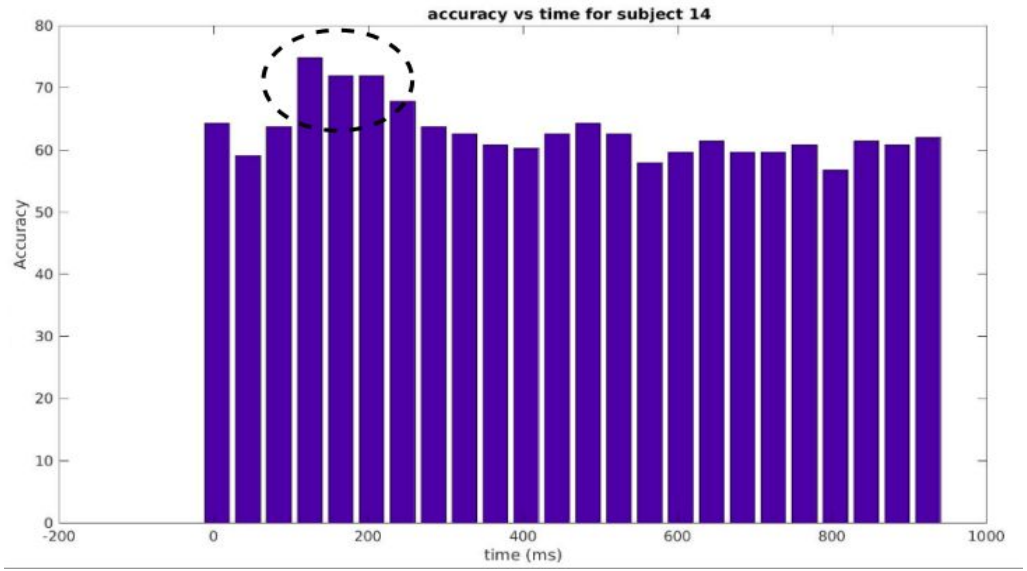
Machine Learning technique: Support Vector Machines (SVM)

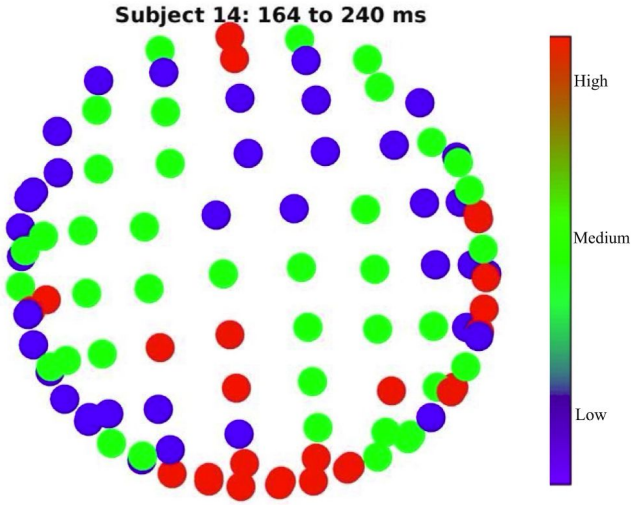
Validation technique: 70:30 Hold Out Cross Validation

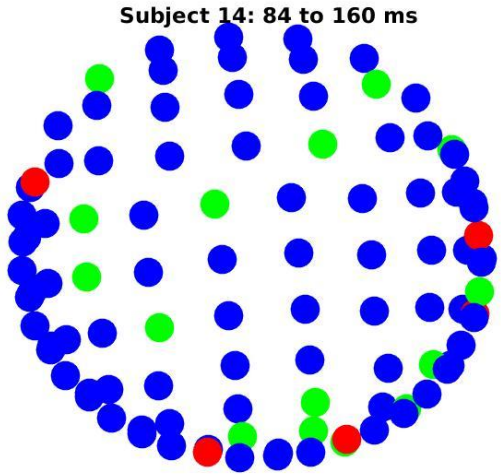
Performance Measure: Accuracy

Findings and Results

- Sensors in occipito-temporal, occipito-parietal lobe are most actively involved in visual classification.







- Reduction in the effective time-stamp of 100-360 ms to 124-240 ms.

Value of Research

- → Reduces the computational cost of the model (by 54%) while establishing the essential relationships between MEG signals and facial detection.
- → Model independent of illumination defects, pose variation etc.
- → Can artificially assist ASD patients recognise faces.

Research Limitations and future scope

- Scope of increasing accuracy.
- Pool more diverse data.
- Identify features captured during resultant time-stamps using eye-tracking.

Thank you.

Special Acknowledgement:

Prof. Tapan Gandhi for constant guide and support
Kaggle for providing the dataset