EYE-READER

BRAIN 4

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WHAT IS THE PROBLEM?

PROBLEM: PEOPLE WITH LIMITED MOBILITY NEED HELP TO DO BASIC TASKS SUCH AS READING

GOAL: ENHANCE THE READING EXPERIENCE FOR A BROAD RANGE OF USERS, MAKING IT MORE ACCESSIBLE, CONVENIENT, AND ENJOYABLE.

WHAT IS THE SOLUTION?

PEOPLE WITH LIMITED MOBILITY IN MOST CASES HAVE A FULL RANGE OF EYE MOVEMENT

ALLOW USERS WITH LIMITED MOBILITY TO READ WITHOUT AID:

EYE - CONTROLLED E-READER

OUR PRODUCT

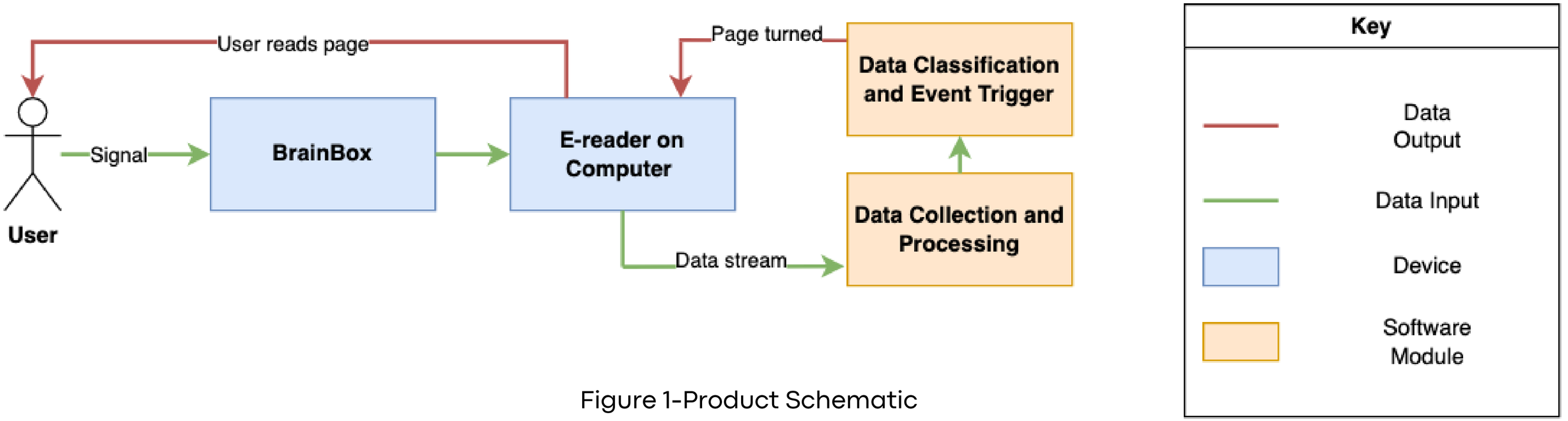


Figure 1-Product Schematic

DATA COLLECTION AND PROCESSING

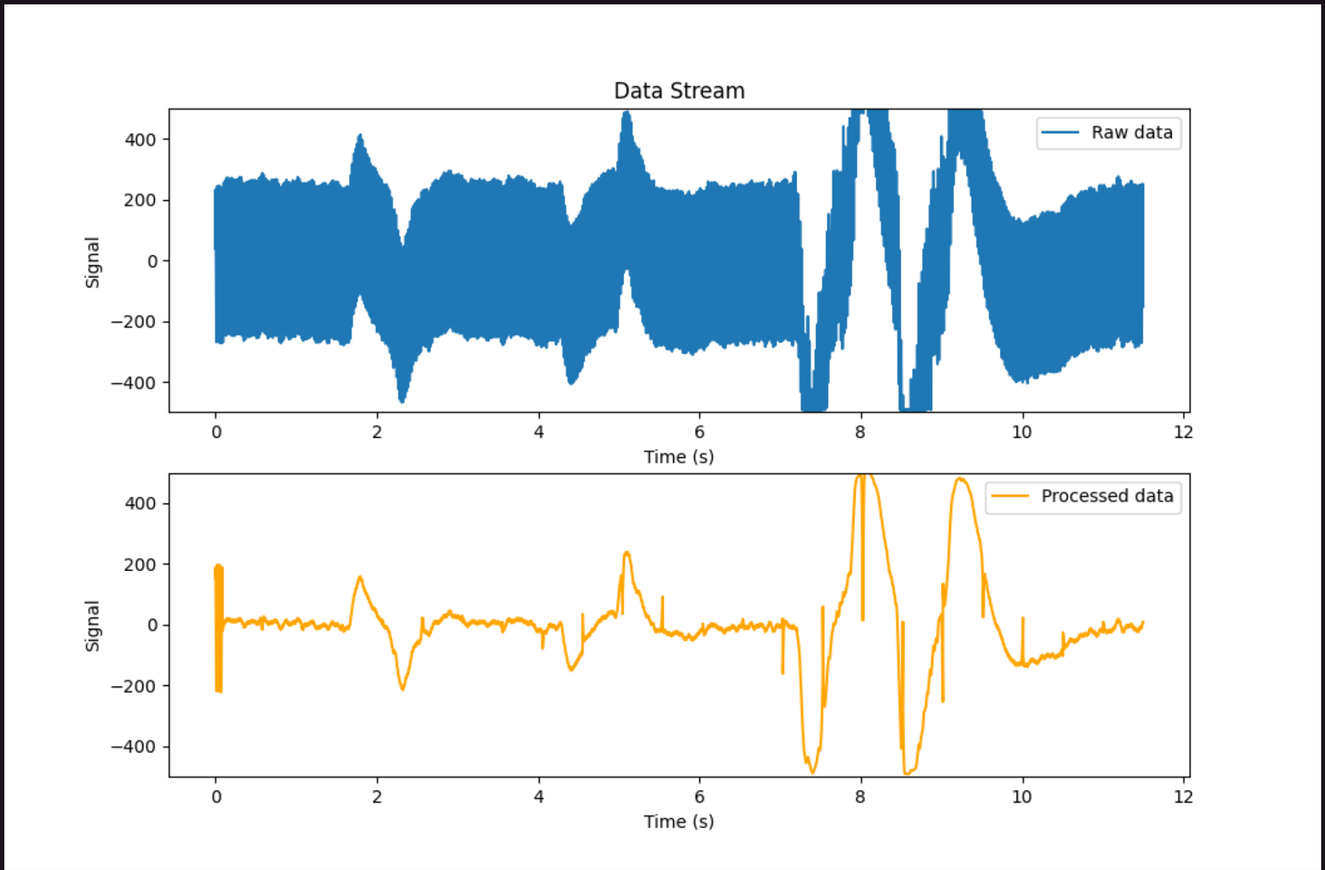


Figure 2-Example Data Stream

DATA COLLECTION

DATA PROCESSING

- Low pass band filter - 20Hz

CLASSIFICATION

METHODOLOGY OF PREDICTING LABEL

DATA LABELLING

Label all the signals for events and non-event

FEATURE MATRIX

Conduct a feature matrix using signals and labels

FEATURE SELECTION

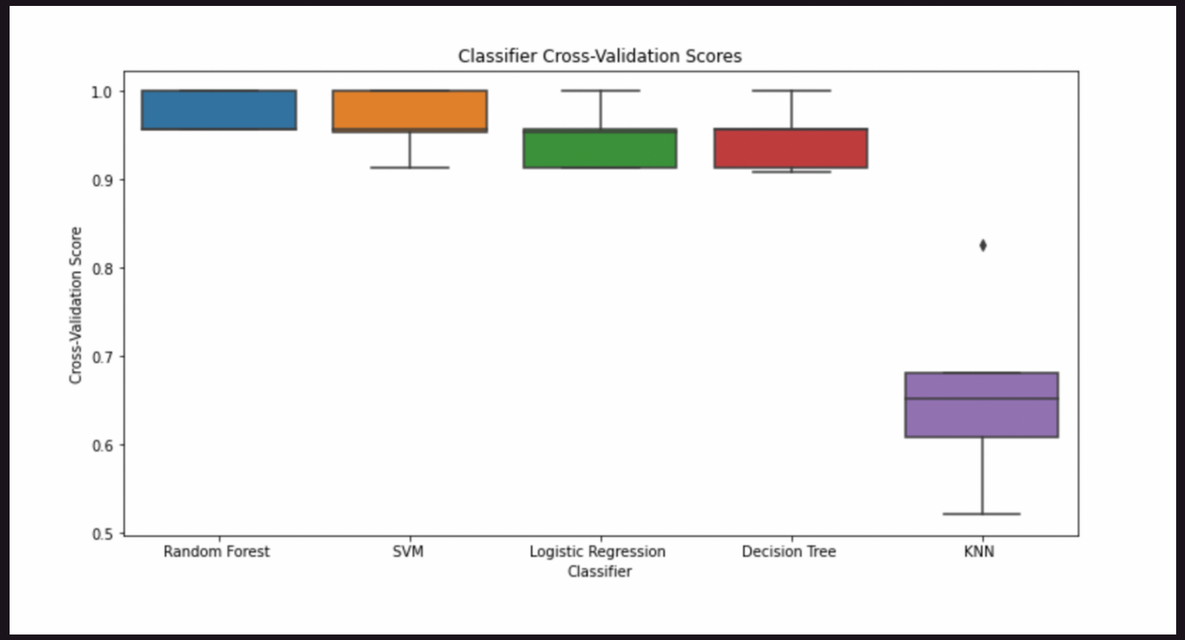
Select significant features

CLASSIFIERS

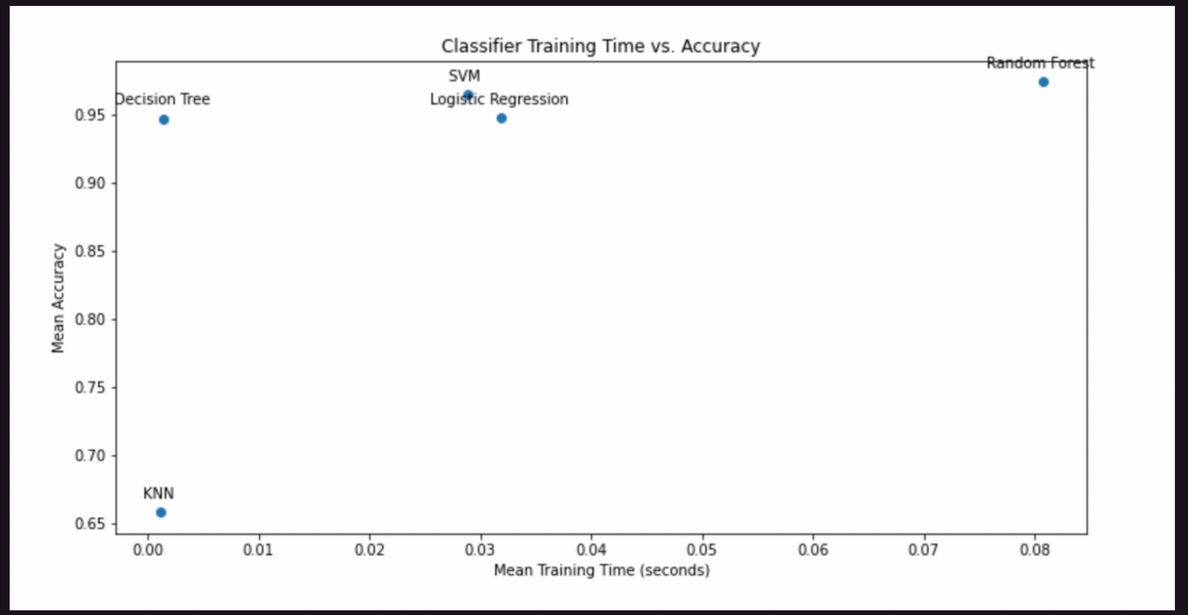
Fit the feature matrix to different classifiers

EVALUATION

CROSS VALIDATION



ACCURACY VS LATENCY



SUMMARY OF RESULTS

PAGE TURN ACCURACY = 91%
START/STOP ACCURACY = 80%

LIMITATIONS

- Time latency
  - Left/Right ~ 1-1.5 s
  - Blink ~ 1.5-2s
- Electrode positioning on temples
- Blink start/stop low robustness

IMPROVEMENTS

- Second brain box with muscular electrode positioning to improve blink accuracy
- More data collection to improve accuracy

A1: GROUP PRESENTATION ROLES

AFRIN: PRODUCING SLIDES, Q&A PREP

FERGUS: PRESENTING, PRODUCING SLIDES

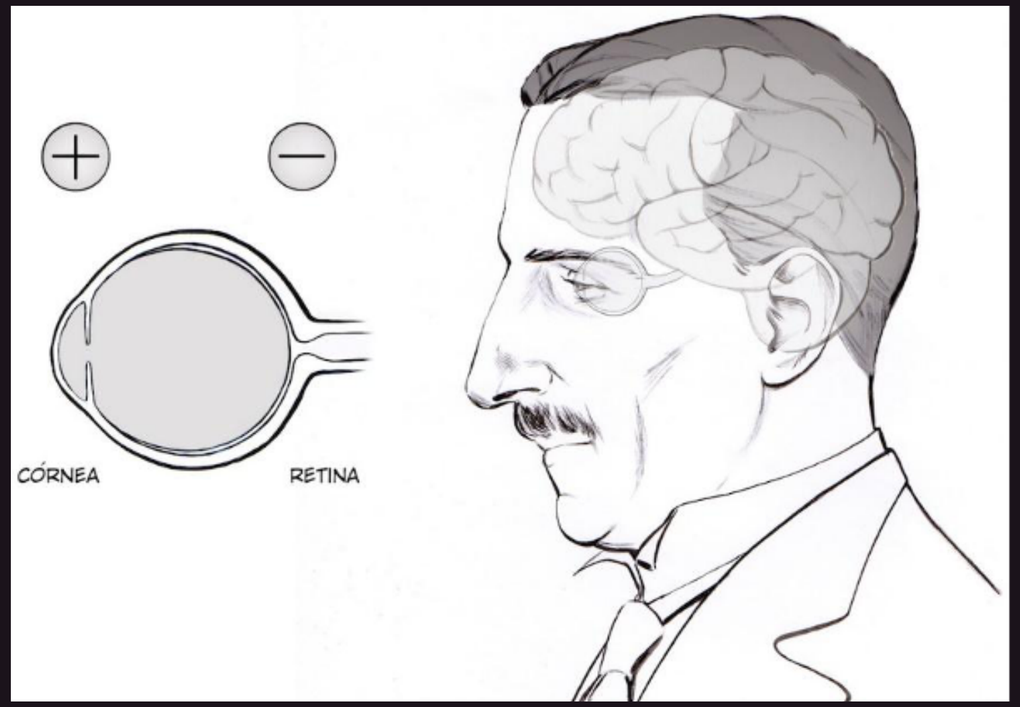
YUSHANG: PRESENTING DEMO, SCRIPT

POOJA: PRESENTING, PRODUCING SLIDES

SHOAJI: PRODUCING SLIDES/SCRIPT

WANCHENG: PRODUCING SLIDES/SCRIPT

A2: UNDERSTANDING THE PHYSICS

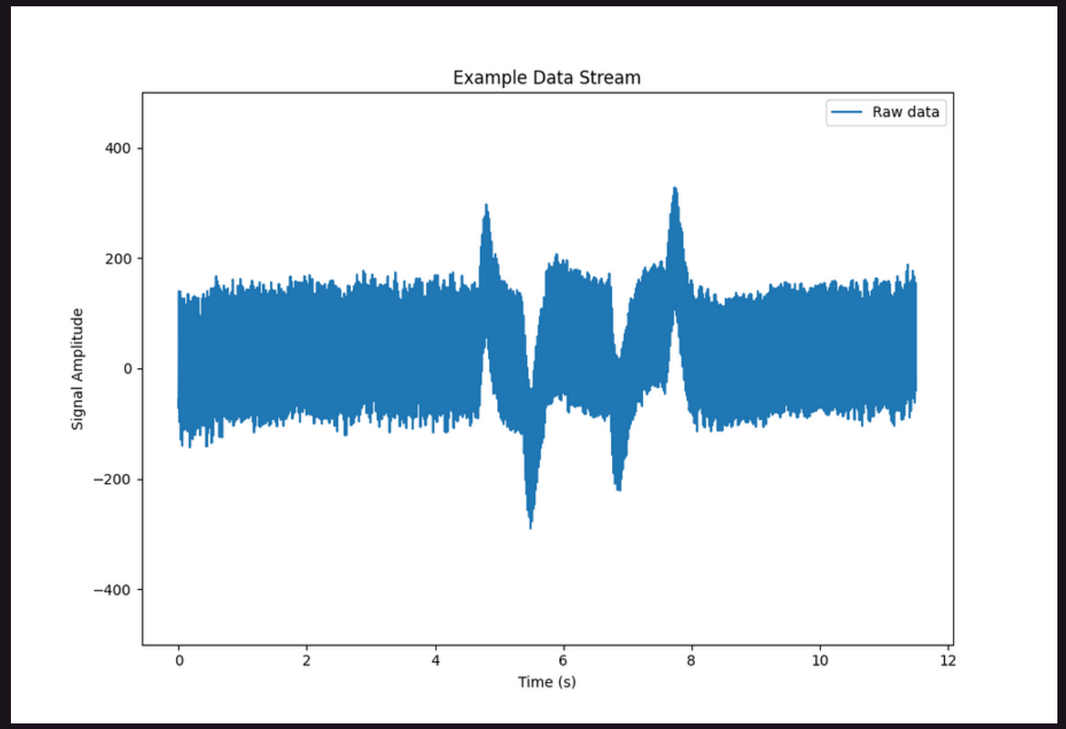


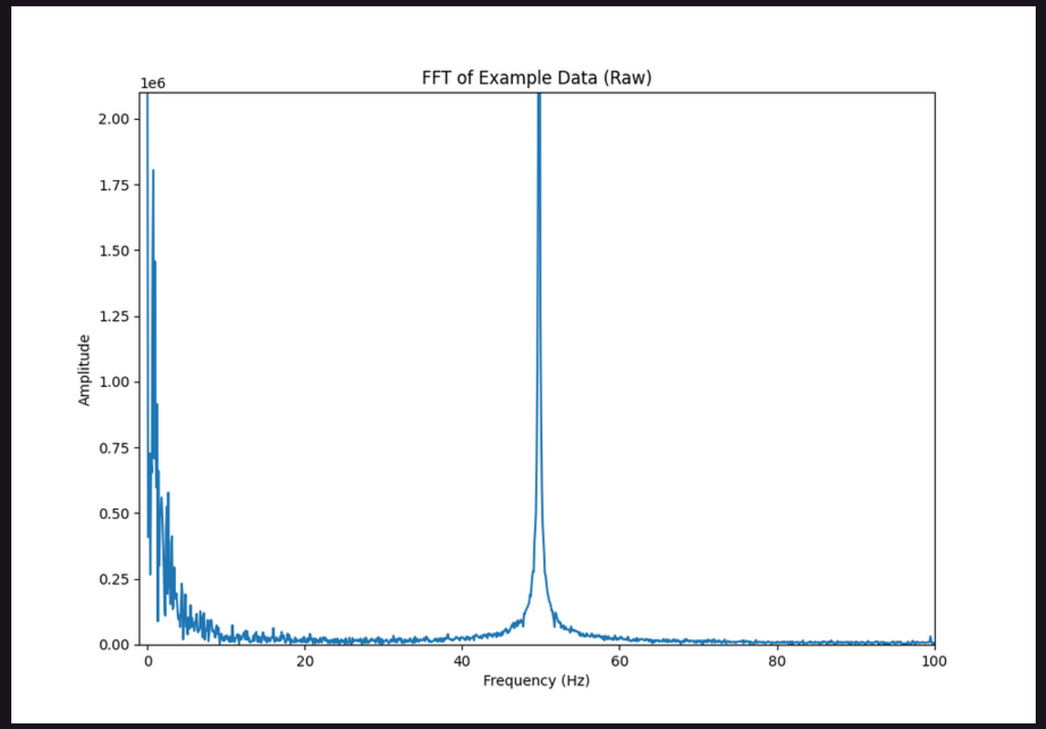
EACH EYE IS AN ELECTRIC DIPOLE

MOVEMENT OF A DIPOLE CAUSES A CHANGING ELECTRIC FIELD

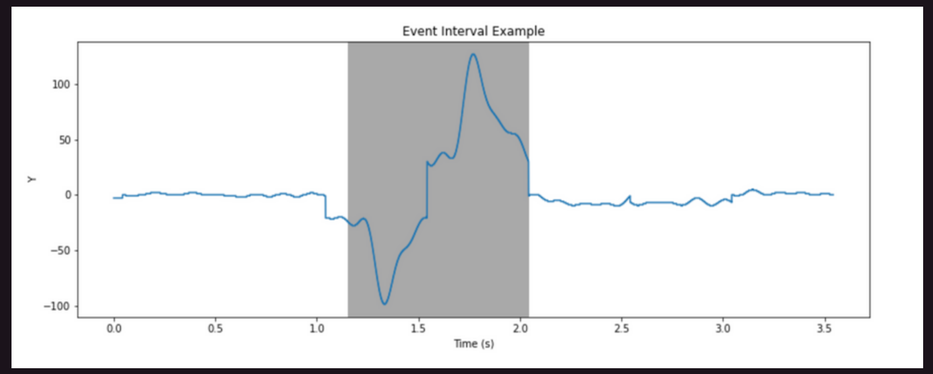
ELECTRODES PLACED CLOSE TO EYE PICK UP CHANGING ELECTRIC FIELD

A3: COM PORT NOISE REDUCTION





A4: CLASSIFICATION



Data Labelling

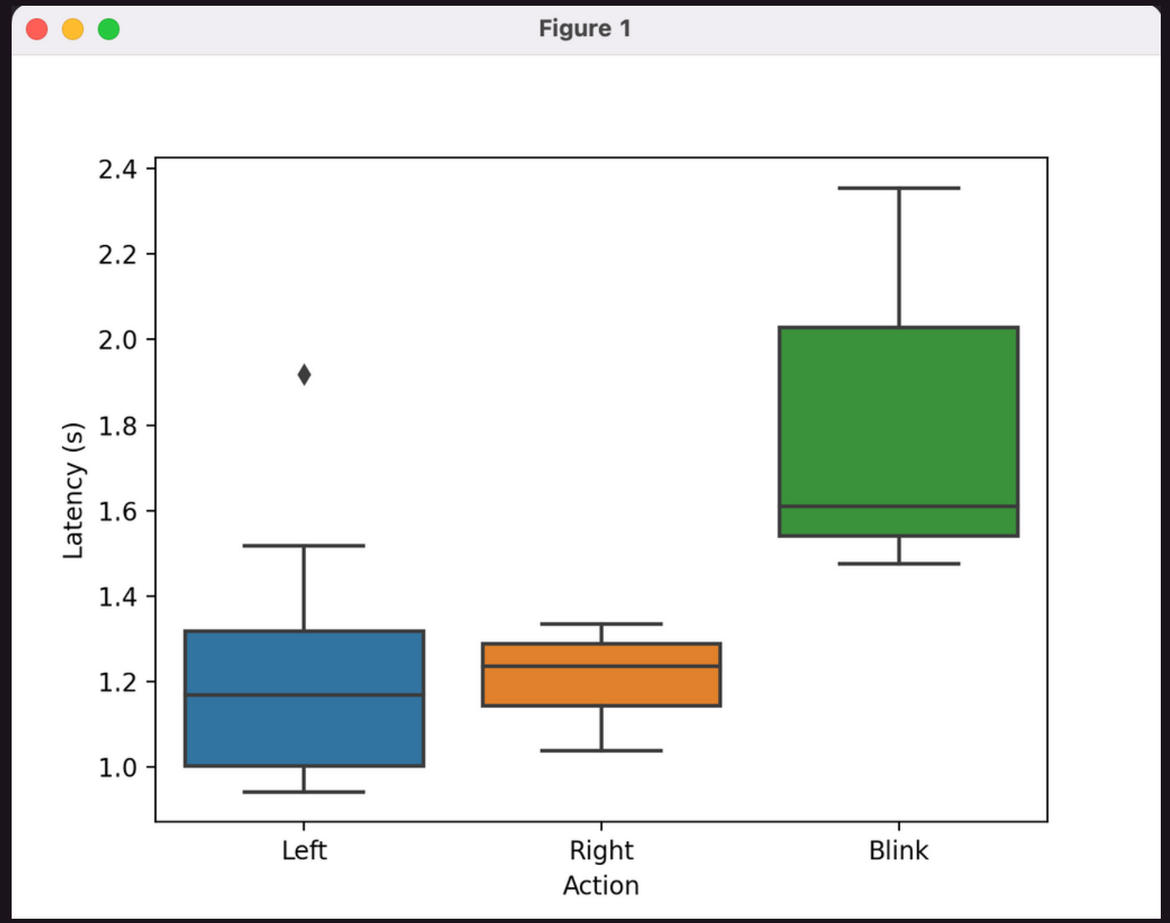
No.	
1	value__mean
2	value__median
3	value__standard_deviation
4	value__variance
5	value__skewness
6	value__kurtosis
7	value__maximum
8	value__minimum
9	value__mean_abs_change
10	value__mean_change
11	value__autocorrelation__lag_1
12	value__quantile__q_0.25
13	value__quantile__q_0.75
14	value__longest_strike_above_mean
15	value__longest_strike_below_mean
16	value__count_above_mean
17	value__count_below_mean
18	value__cid_ce__normalize_True
19	value__first_location_of_maximum
20	value__first_location_of_minimum
21	Label

Conducting a feature matrix

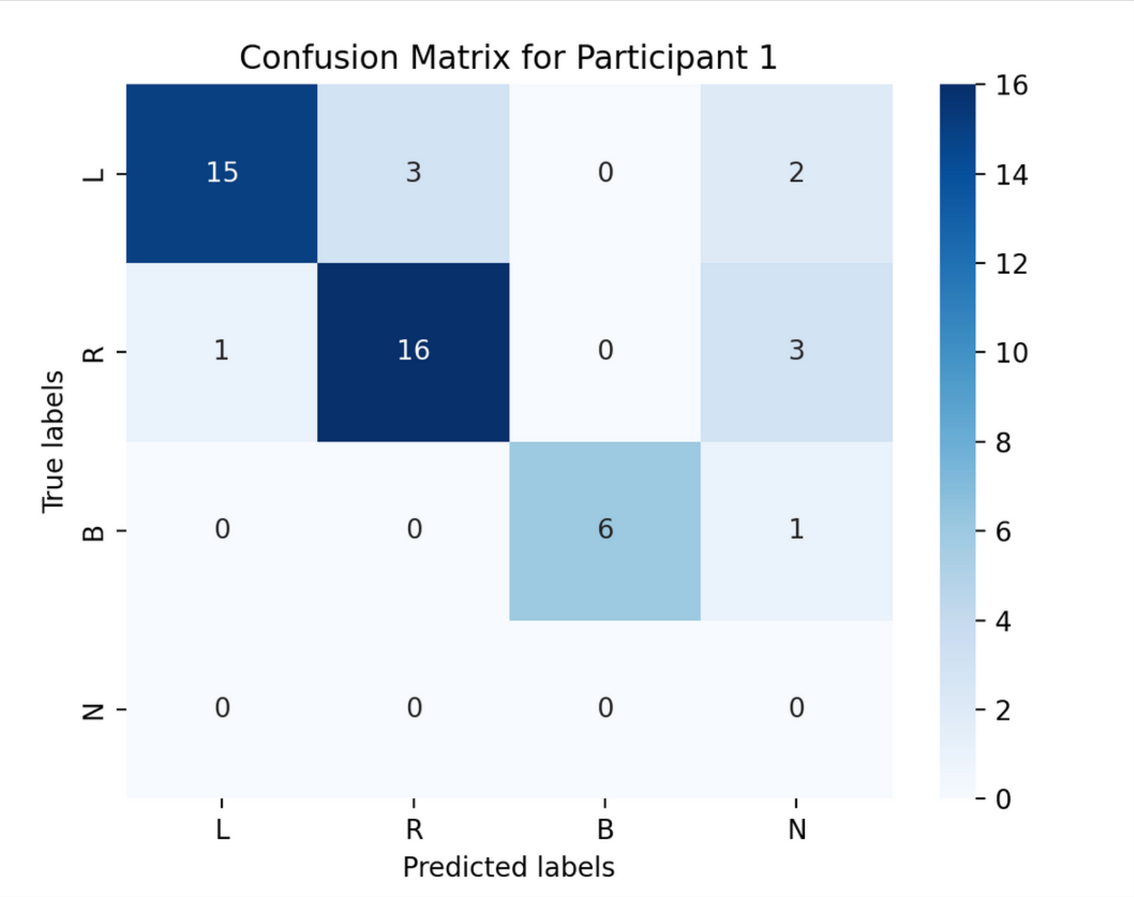
No.	
1	value__mean
2	value__median
3	value__standard_deviation
4	value__kurtosis
5	value__maximum
6	value__minimum
7	value__mean_abs_change
8	value__quantile__q_0.25
9	value__quantile__q_0.75
10	value__count_above_mean
11	value__count_below_mean
12	value__cid_ce__normalize_True
13	Label

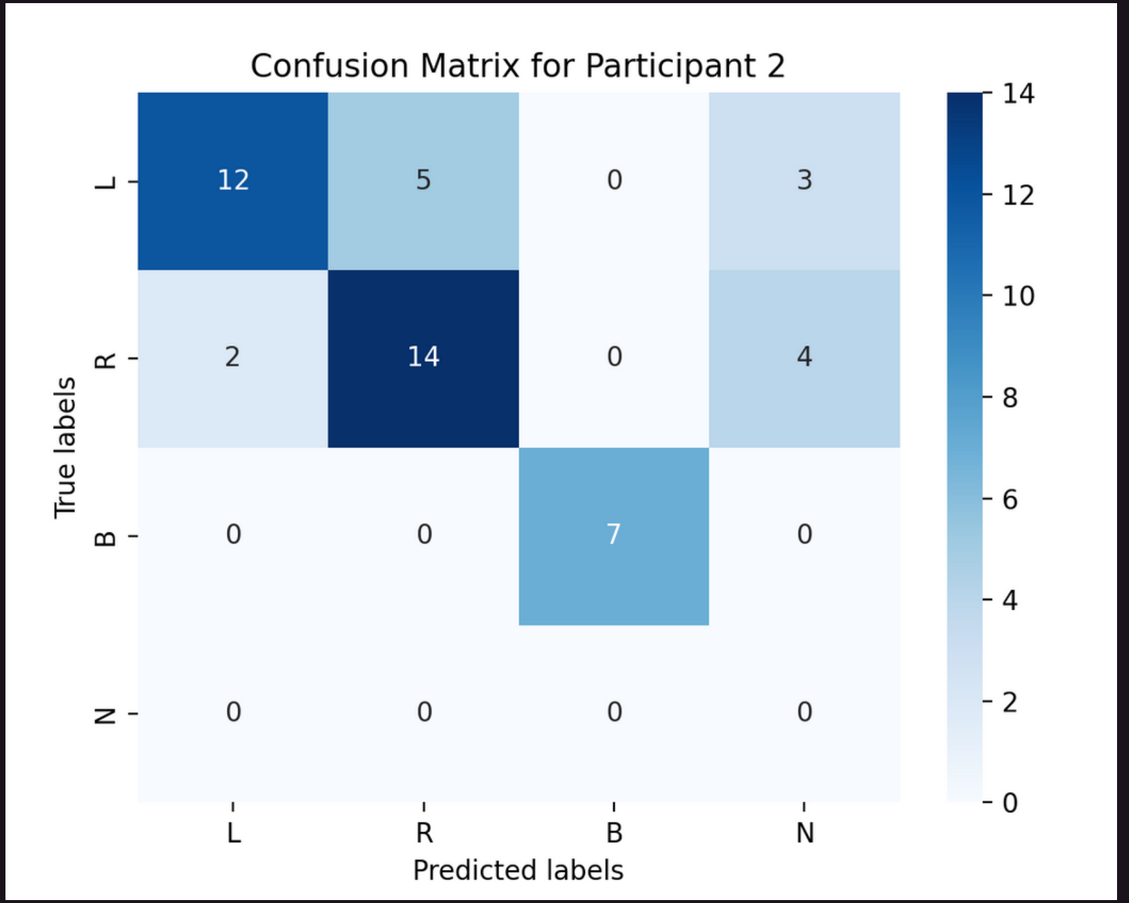
Selecting significant features

A5: LIVE LATENCY EVALUATION



A6: L IVE ROBUSTNESS EVALUATION





A7: OUR MULTIDISCIPLINARY APPROACH