Physiological Feature Selection Methods for Emotion Recognition

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Content

- Emotion Recognition
- Machine learning
- Features
- Problem Statement
- Solution Approach
- Feature Selection Methods
- Results
- Next Steps
- Solution

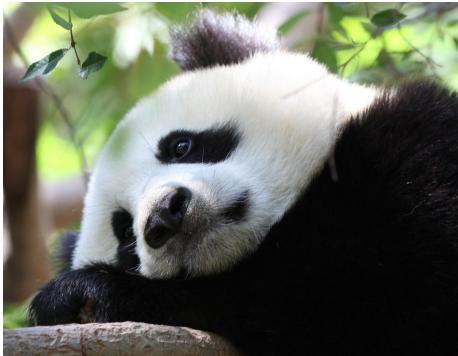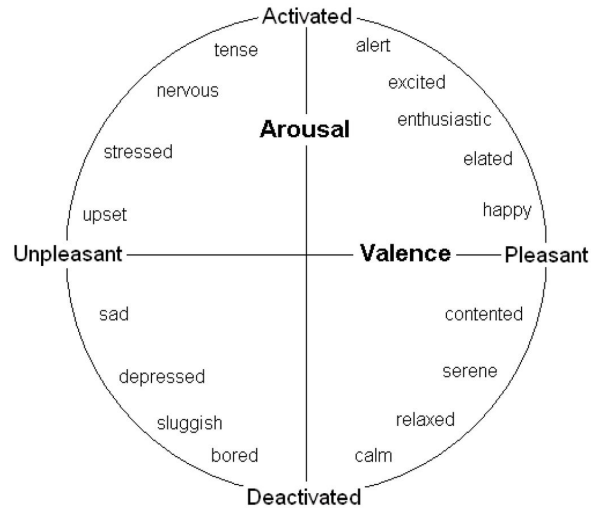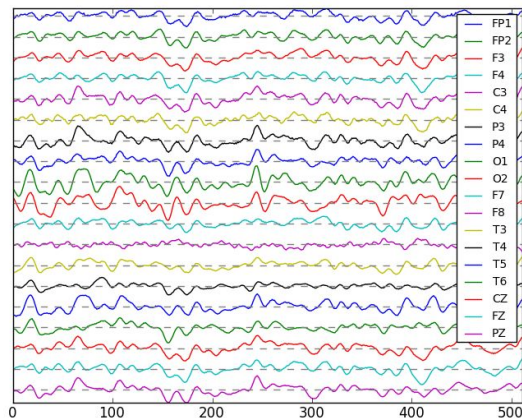# Emotion Recognition

Expression
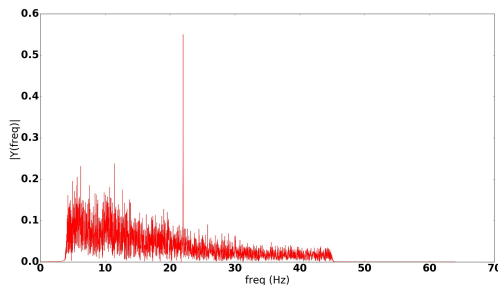

Physiological

Emotion in the brain
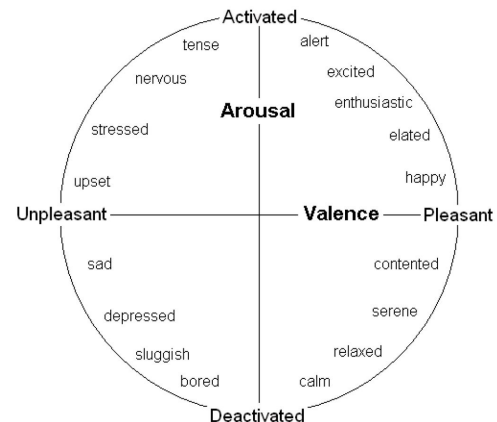
Emotion Classification

Classification with Machine Learning

Input: brain waves

Feature Extraction and Machine Learning

Output: valence/arousal
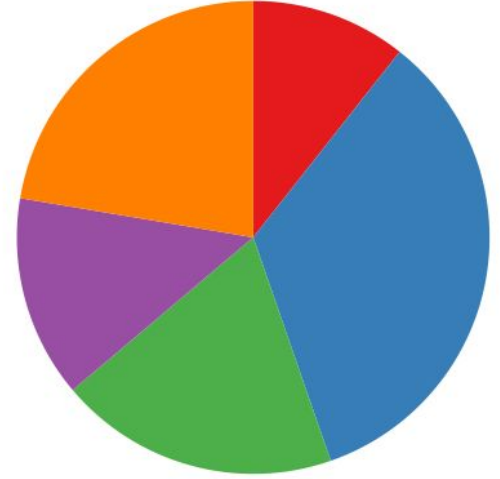
Features

EEG

Non - EEG

EEG features

Power of a specific channel
(PSD, DE)

(A)symmetry features
- Left vs. Right
- Front vs.Back

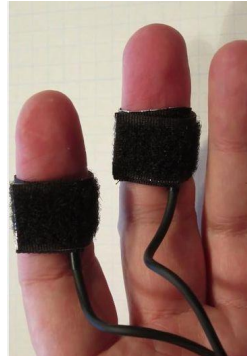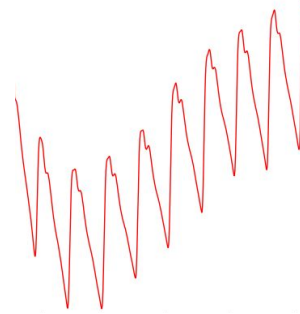Fractions of different
wavebands

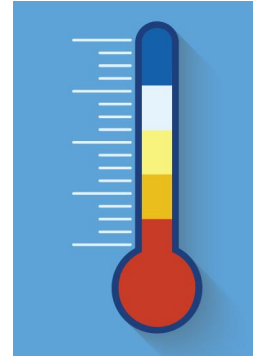# Non - EEG Features

Heart Rate

Respiration Rate

Galvanic Skin Response

Plethysmograph (blood pressure)

Skin Temperature

Not all features are good features

Disagreement on Features

Personal Differences
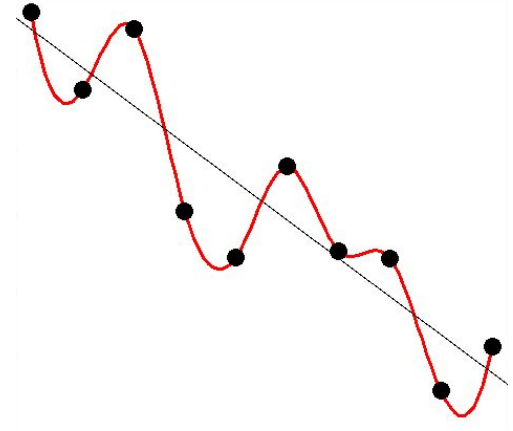
Overfitting

Problem statement

Find good features

Added value of physiological features

Solution

Test Set

Dataset

Train set

FS

Top 30

add

CV error

better ?

Build model

Feature
Selection

Test error
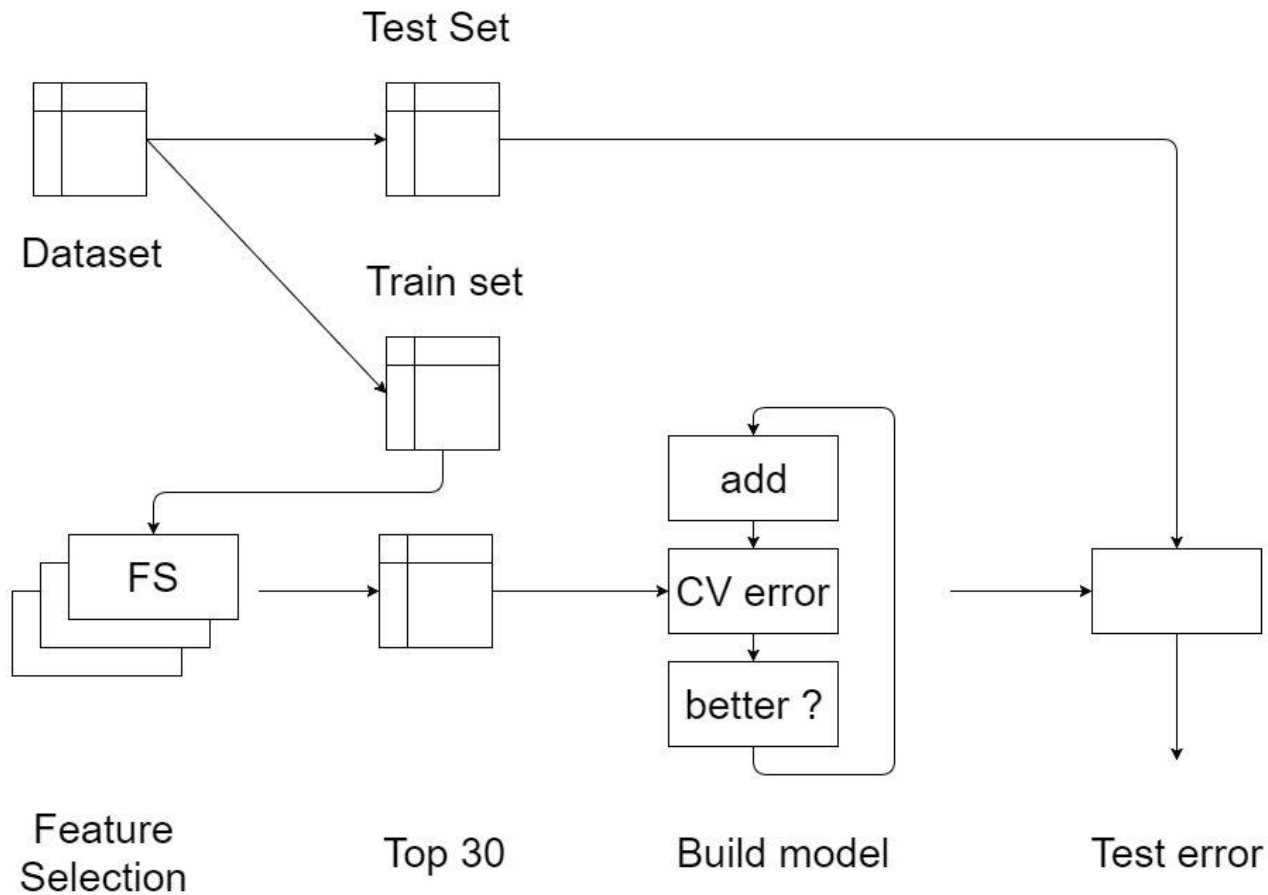
Feature Selection: General Flow

IN:
EEG and non-EEG features
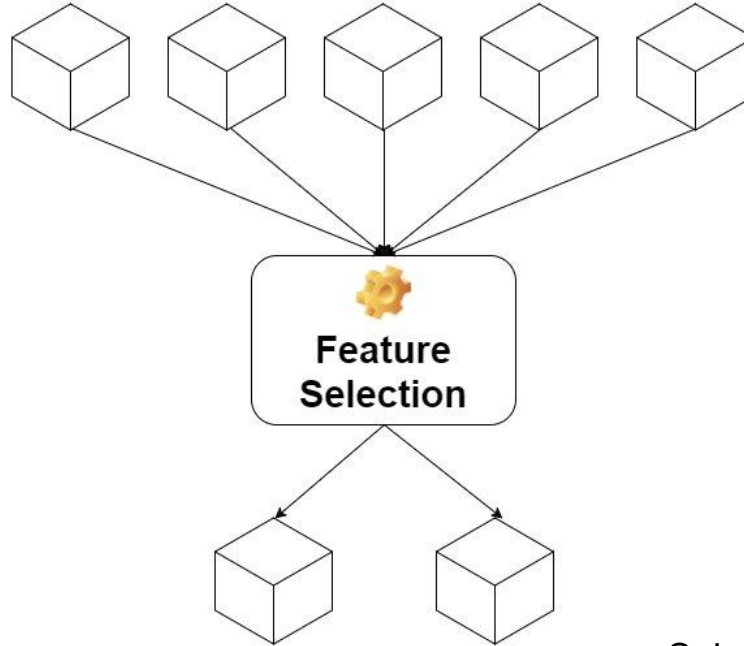
Feature Selection

OUT:
Subset of features that can predict emotion
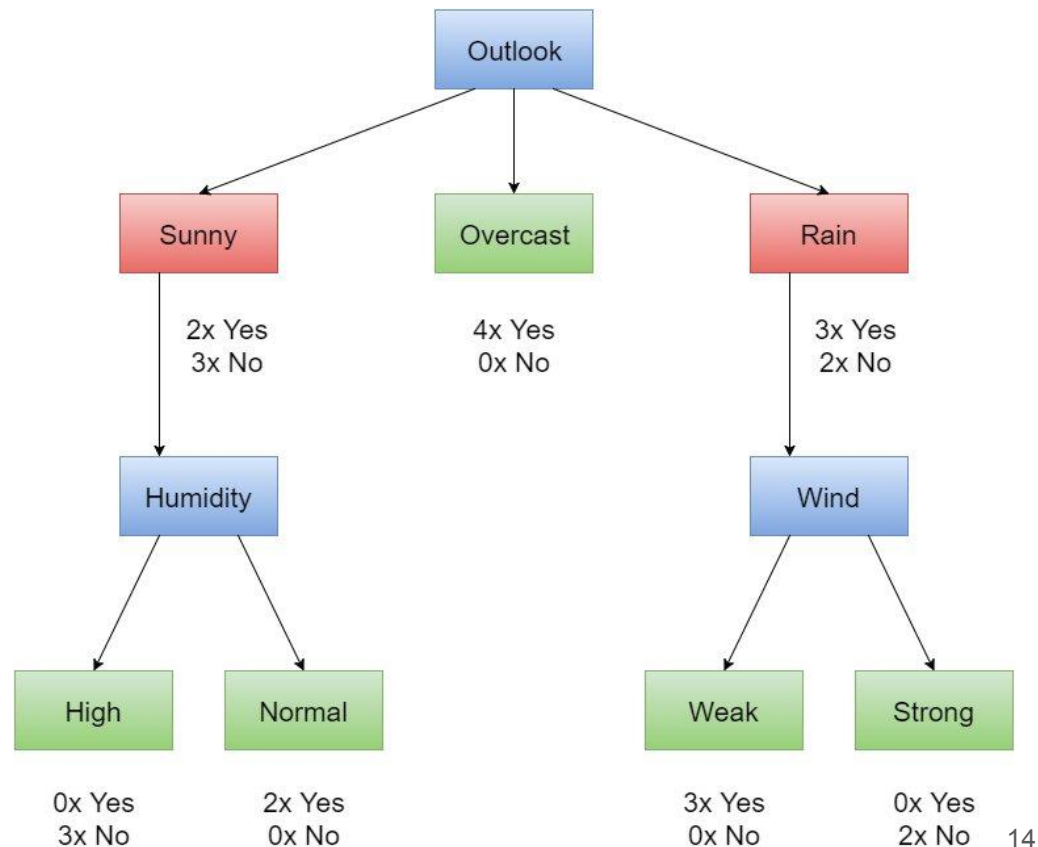
Feature Selection Methods
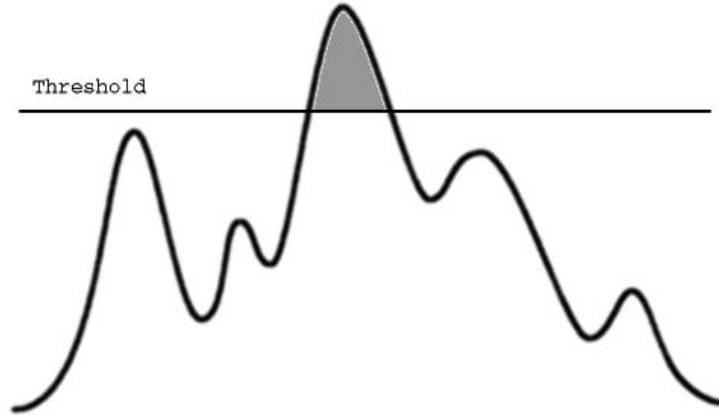
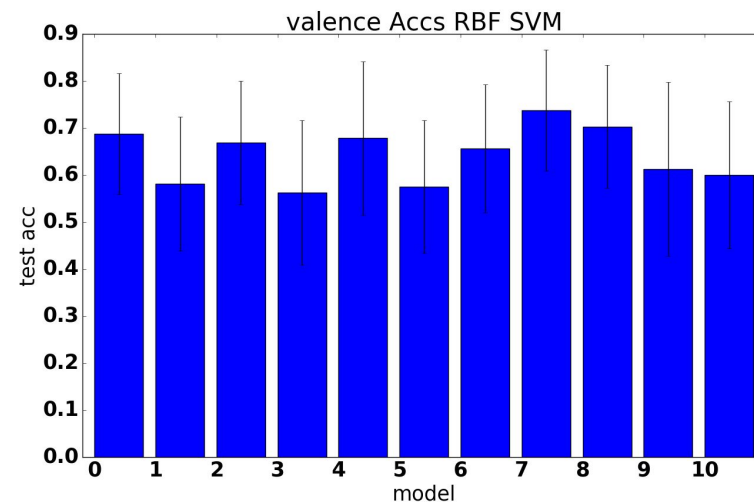Filter Method

Wrapper Method

FS: Embedded - Random forests

Day	Outlook	Humidity	Wind	Play tennis
1	sunny	high	weak	no
2	sunny	high	strong	no
3	overcast	high	weak	yes
4	rain	high	weak	yes
5	rain	normal	weak	yes
6	rain	normal	strong	no
7	overcast	normal	strong	yes
8	sunny	high	weak	no
9	sunny	normal	weak	yes
10	rain	normal	weak	yes
11	sunny	normal	strong	yes
12	overcast	high	strong	yes
13	overcast	normal	weak	yes
14	rain	high	strong	no

Outlook

Sunny — 2x Yes / 3x No
Overcast — 4x Yes / 0x No
Rain — 3x Yes / 2x No

Humidity
- High — 0x Yes / 3x No
- Normal — 2x Yes / 0x No

Wind
- Weak — 3x Yes / 0x No
- Strong — 0x Yes / 2x No

14

FS: Embedded - Random Forests

All Data

random subset

tree

random subset

tree

random subset

tree

random subset

tree

tree

At each node:
   choose some small subset of variables at random
   find a variable (and a value for that variable) which optimizes the split
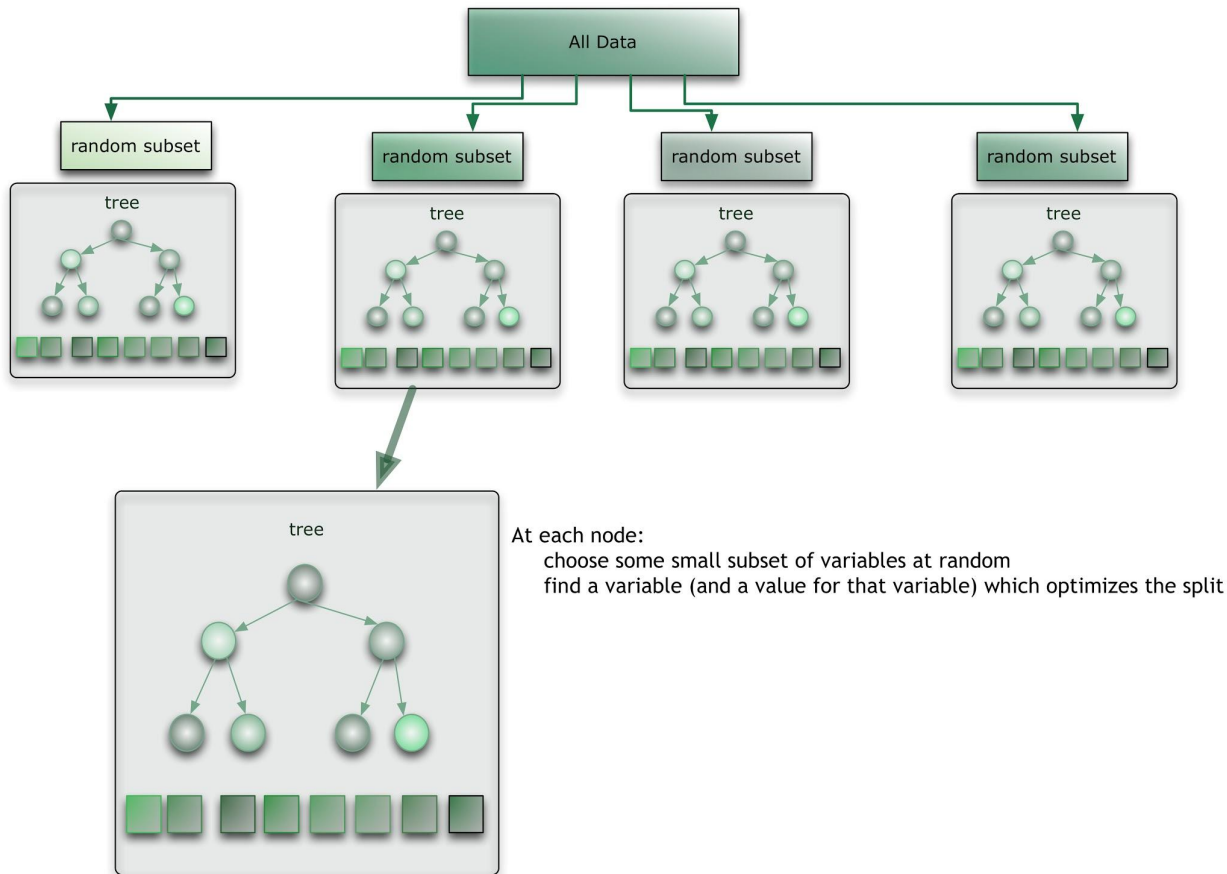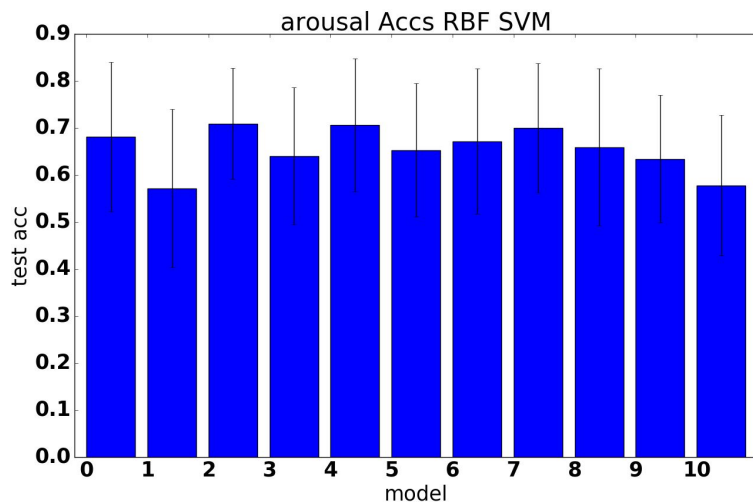
Results

0	1	2	3	4	5	6	7	8	9
Pearson	MI	dCorr	LR	L1	L2	SVM	RF	LDA	PCA

Results: non-EEG / EEG / ALL (RF)

Arousal RF acc for different feat sets

Valence RF acc for different feat sets
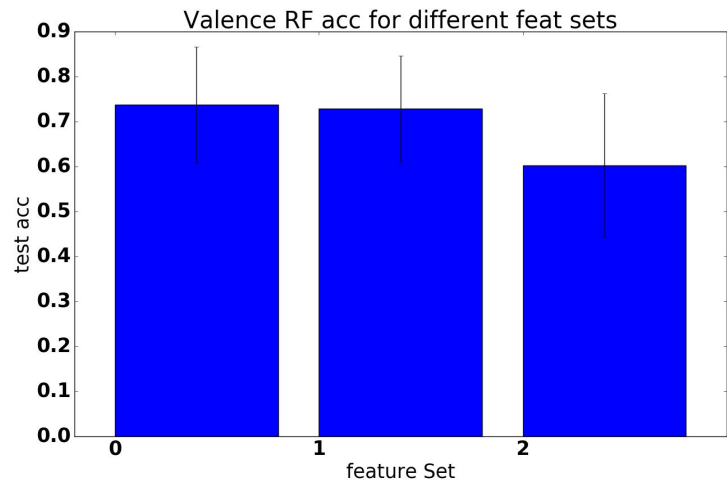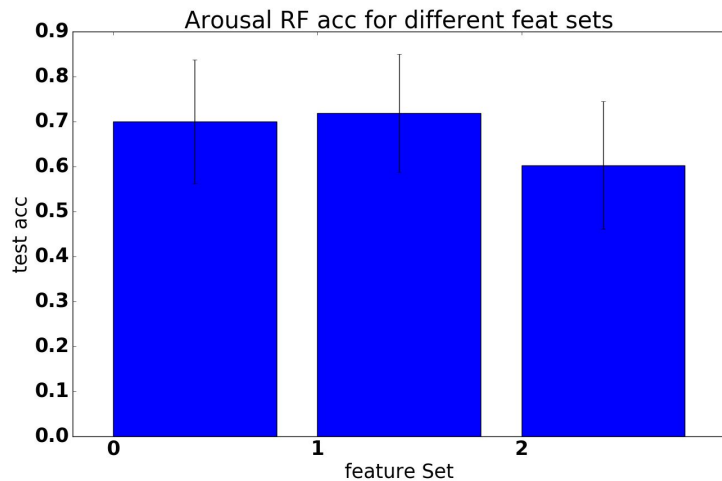
0	1	2
ALL	EEG	non-EEG

Next steps

Stability of the feature selection methods

Find features that work for all persons

Questions