A PRAGMATIC AUTHENTICATION SYSTEM USING ELECTROENCEPHALOGRAPHY SIGNALS

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MOTIVATION

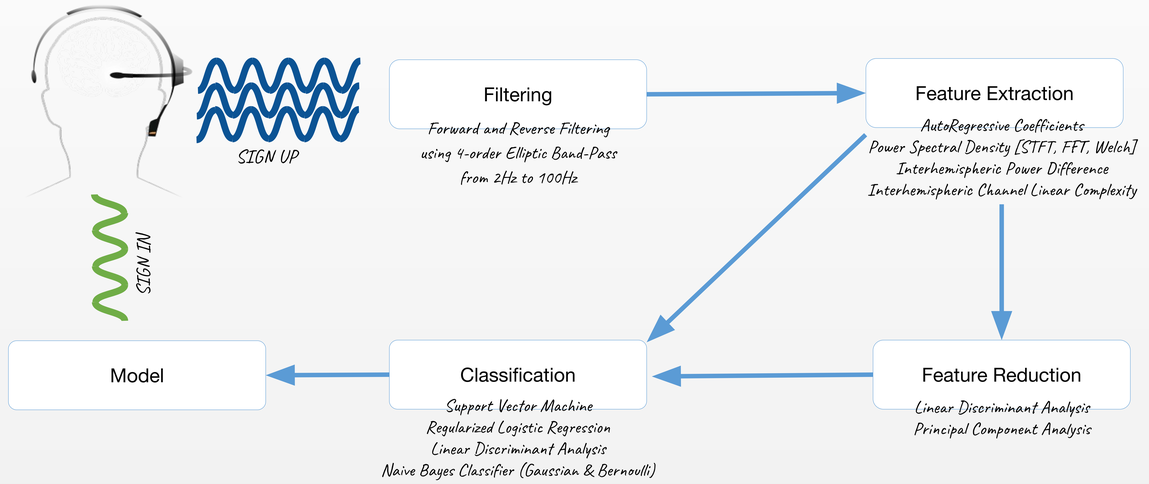
Build a biometric authentication system that:

- is *secure*
- is *seamless* to use
- is *cheap* relative to other biometrics
- combines the best of *knowledge* and *possession* factors.
- can used by *everyone*
- unamenable *to force*
- cannot be *lost*
- cannot be *forgotten*

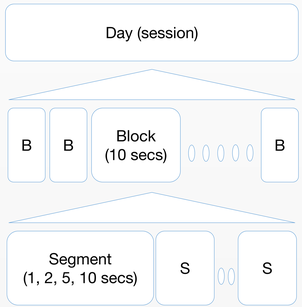
DATASET

Emotiv	Mindwave
128Hz	512Hz
14 channels	1 channel
10 users	29 users
3 sessions	4 sessions
50 second sessions	

PIPELINE



RESULTS



Day Test
One session of data is used, each segment in that session is binary classified, and a single +1 authorizes the user.

Block Test
One block of data is used, each segment in that block is binary classified, and majority voting between segments is used.

Shuffled Cross Validation
Shuffle all the data blocks for each user before partitioning the folds.

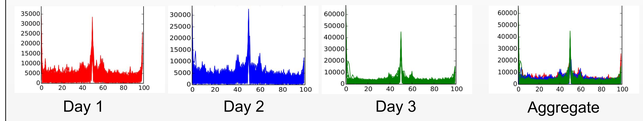
Day Cross Validation
Partitioning the folds according to data from different days used for each user

Cross Validation	BLOCK TEST			DAY TEST		
	FA	FR	Accuracy	FA	FR	Accuracy
Shuffle	0.38	15.72	91.95	3.93	0.75	97.66
Day	1.54	48.00	75.23	10.92	28.75	80.16

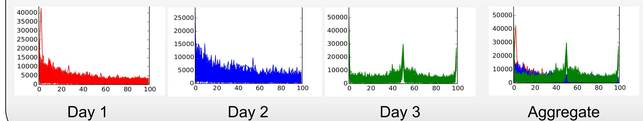
Number of Channels	Best Channel Combination	Accuracy		
		FA	FR	Accuracy
4	AF3 P8 T7 T8	1.43	5.00	96.76
3	AF3 P8 T7	2.14	2.50	97.68
2	AF3 P8	1.79	17.50	90.36
1	P8	0.71	35.00	82.14

ANALYSIS

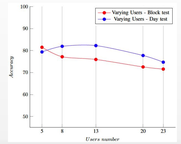
FFT - User 1



FFT - User 2



EFFECT OF REDUCING # USERS:



CONCLUSION

- Shuffle Cross Validation Accuracy 90+% [~literature].
- Day Cross Validation Accuracy 80% Mindwave, and 90% Emotiv [more realistic].
- Training data needs to span different days to capture variations in EEG signals.
- The rate of decline in accuracy as we increased the number of users decreases.

FUTURE WORK

- Figure out what constitutes bad user data and circumvent it.
- Sampling a “good” subset from all users for each user to authenticate.
- Find minimum interval between sessions.
- Investigate identification and matching.

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More information:
http://www.alexu.edu.eg/