EEG expert-engineered features [May 23]

This text continues the results of May 16th. The last discussion was: 1) use SchRes features only, 2) make four plots [6 best users versus all users], [correct responses only versus all responses], 3) compare various kernels in Gaussian Process Classification models, 4) order features by importance.

Attention! Starting this date, only Neuropype-generated data will be used to support the correct comparison with the other models and to hold the system compatibility. Now the filtered data were used. After this Wednesday, more than 30 new users will be added. The new dataset with segmented and unfiltered data is expected.

List of the expert-engineered features

The ERP features are collected from the expert note and the SchRes paper. For the sources, see the precious document and its Appendix. Before the feature extraction, the standard scaler was used. The time segments from Table 1 were averaged. For the 10-20 placement, the nearest electrodes from the BioSemi cap were designated. The sources are doi.org/10.1016/j.schres.2023.02.019 and doi.org/10.1093/arclin/acx082.

Table 1. List of expert-engineered features for the recognition task

Electrode	Peak	After onset	End	Comment
PO9	P1	110	160	recognition
PO10	P1	110	160	recognition
PO7	P2	200	410	recognition
PO8	P2	200	410	recognition
PO7	P3	410	650	recognition
PO8	P3	410	650	recognition
AF7	LNP	500	800	encoding, item-specific (front)
AF7	LNP	400	750	recognition, associative

Three selected models

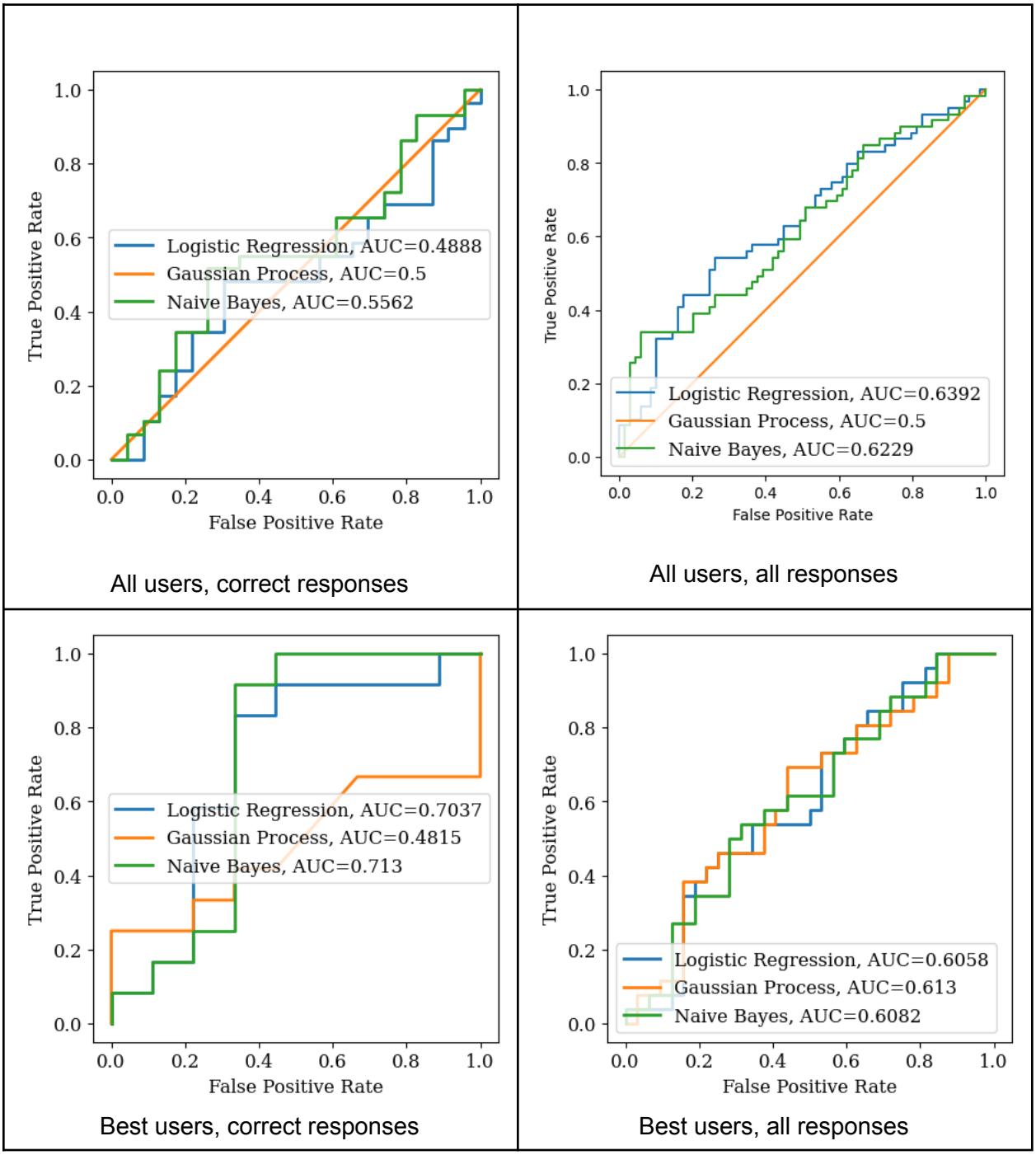

Figure 1. Comparison of three basic selected models fitting new data

Conclusion: Plan to find the simplest model structure for the best users. Then generalize this model structure for the whole set.

Comparison of the Gaussian Process Classification models

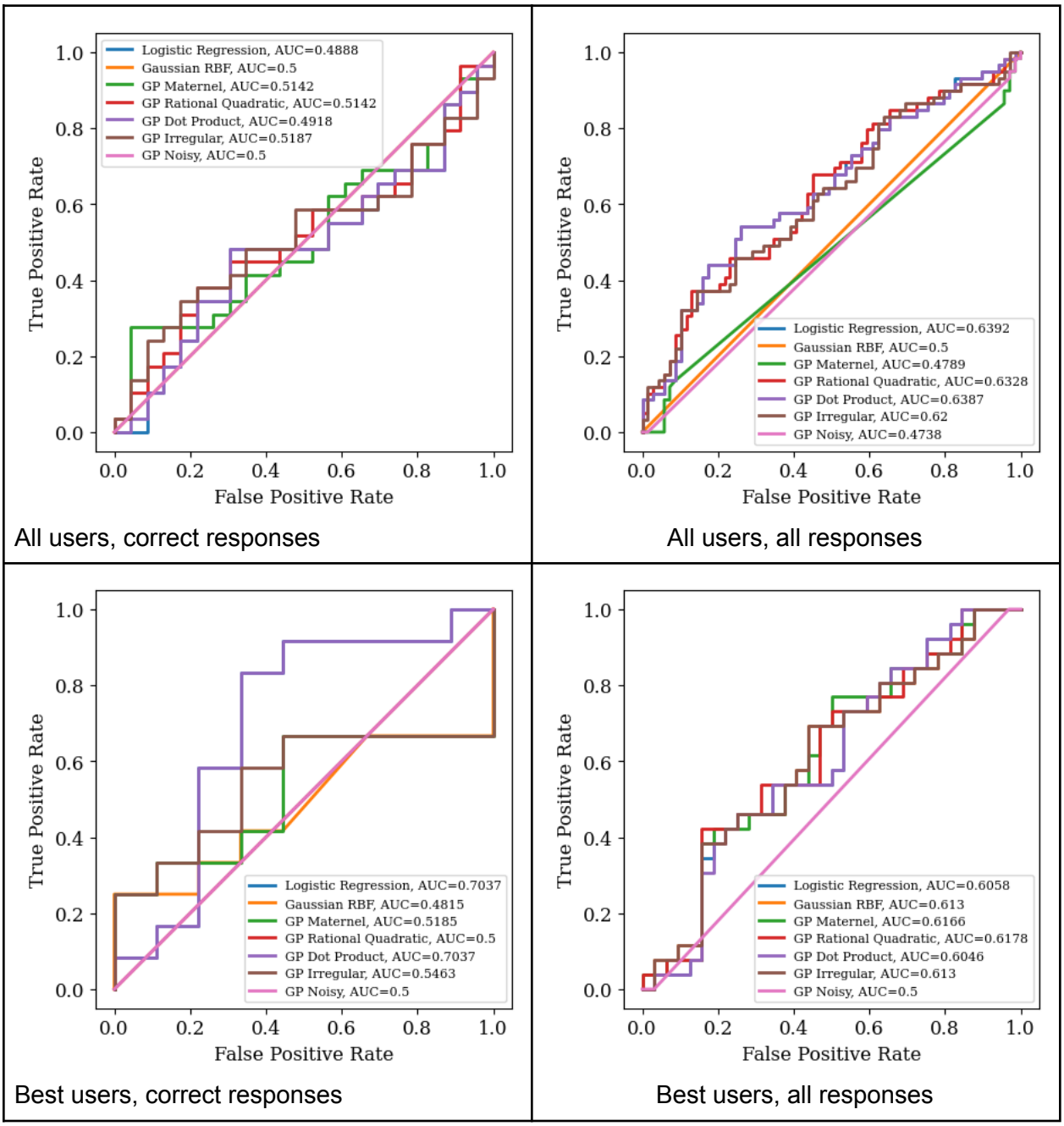

Figure 2. Comparison of six kernels of Gaussian Precesses Classification model fitting new data

Conclusion: The Dot product kernel and Rational Quadratic kernel deliver stable results in the Gaussian Process model.

Features, ordered by importance

Warning! Since the data is from NeuroPype with unknown preprocessing and filtering, for now, the meaningfulness of this plot is in doubt.

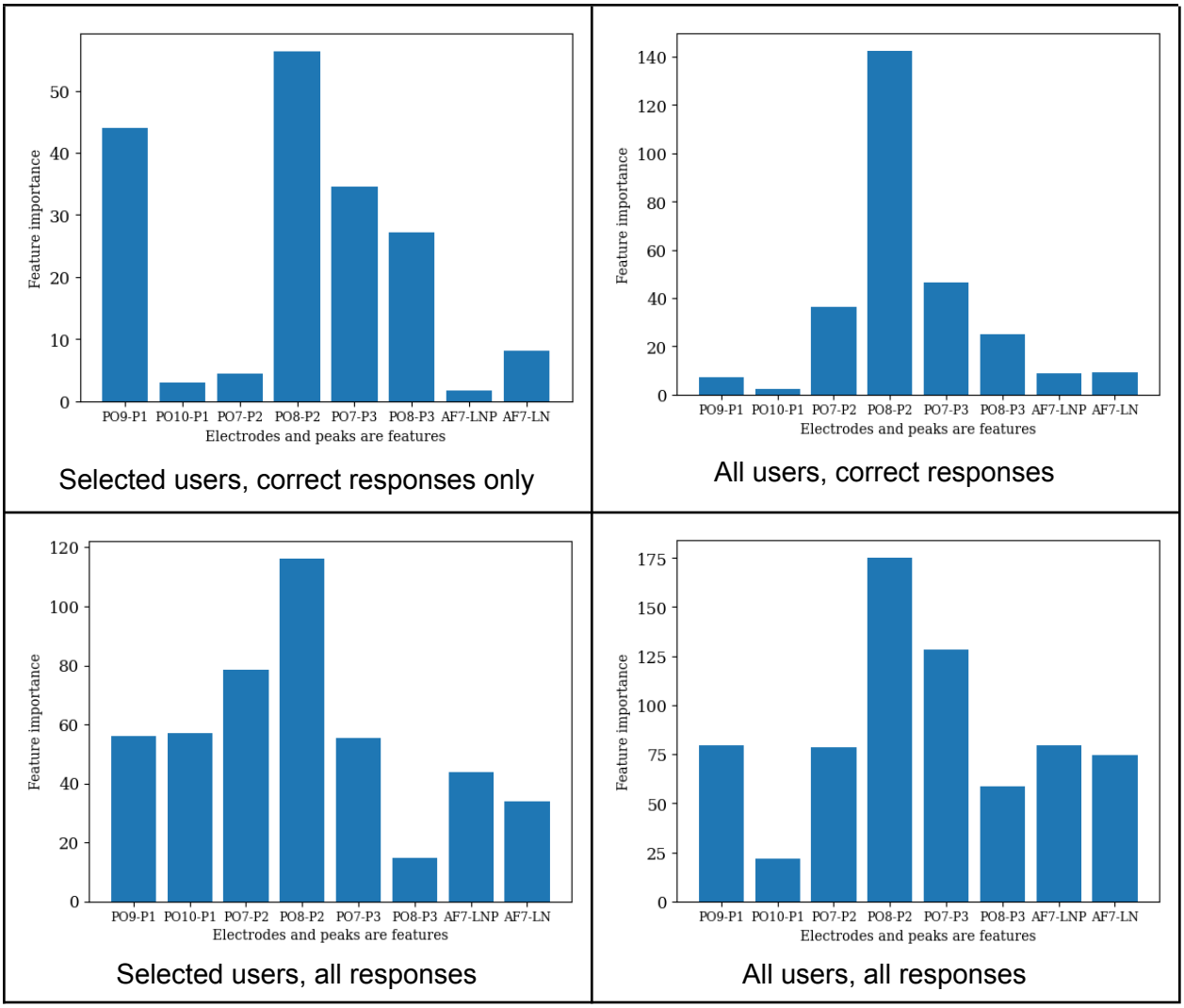

Figure 3. Feature importances for ridge-regression (elastic net) model

Conclusion: The electrode PO8 P2 (200 – 410 ms) is selected even on noisy datasets. For the selected users, the electrode PO7 P3 (410 – 650) is also important. The electrode AF7 LNP was not selected.