NEURONS REAL AND IMAGINED

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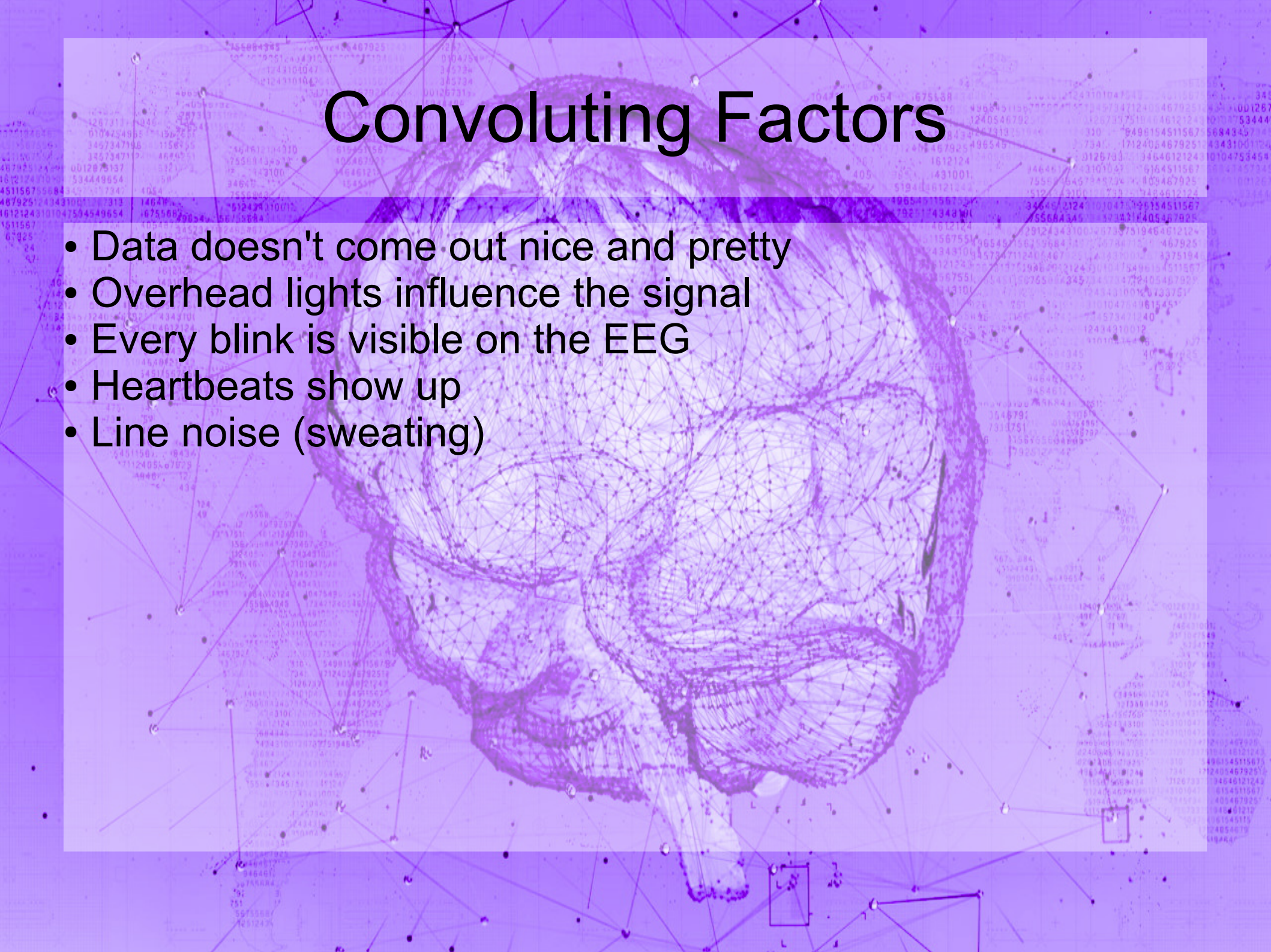
Procedure

- Brain activity generates postsynaptic potential
- This can penetrate tissue
- EEG picks it up at the scalp
- Then comes the fun part: analysis!

Convoluting Factors

- Data doesn't come out nice and pretty
- Overhead lights influence the signal
- Every blink is visible on the EEG
- Heartbeats show up
- Line noise (sweating)



Old Pipeline

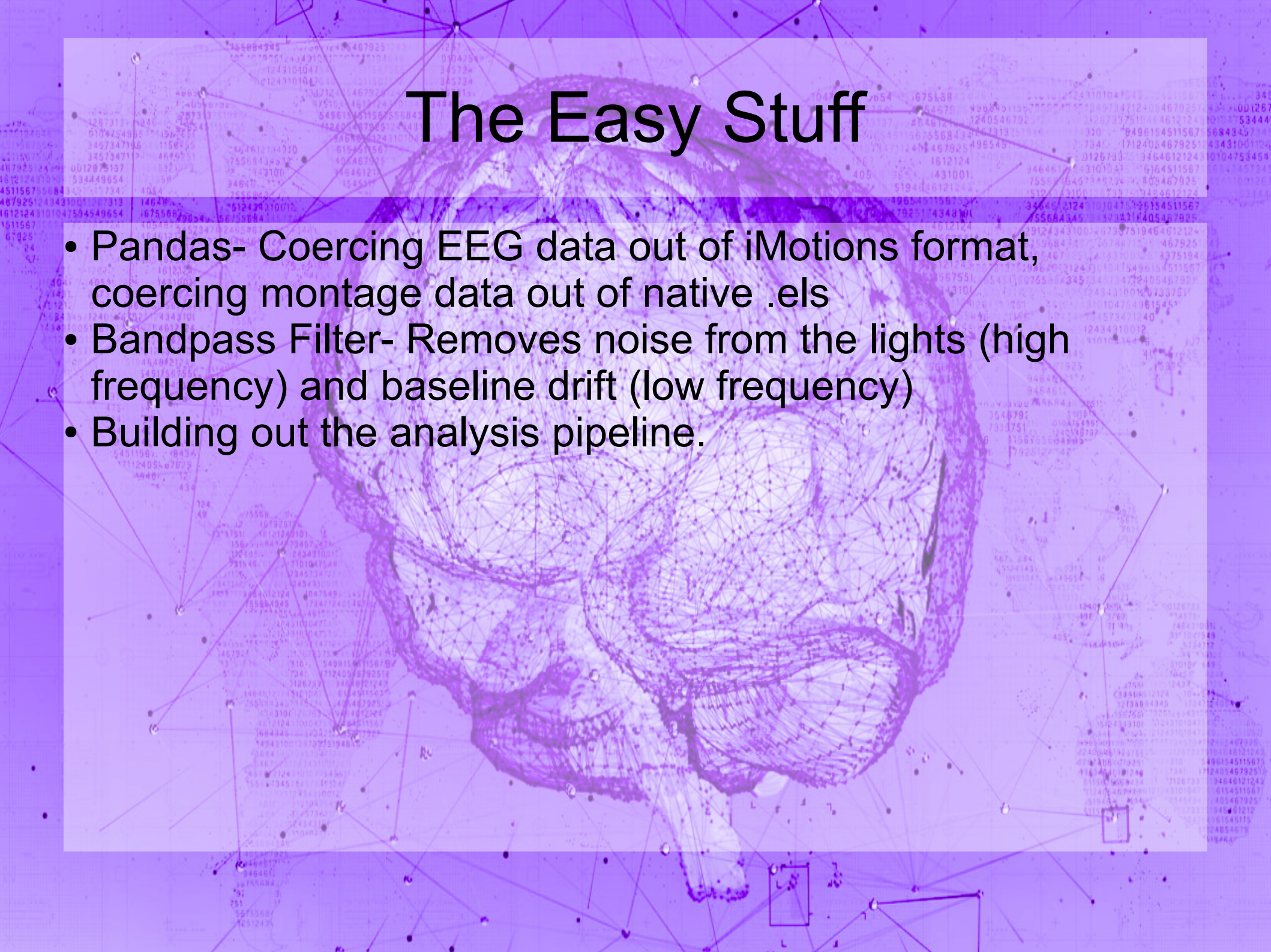
- iMotions moves data from EEG to computer
- Lots of manual cleaning with EEGLab

Enter: MNE

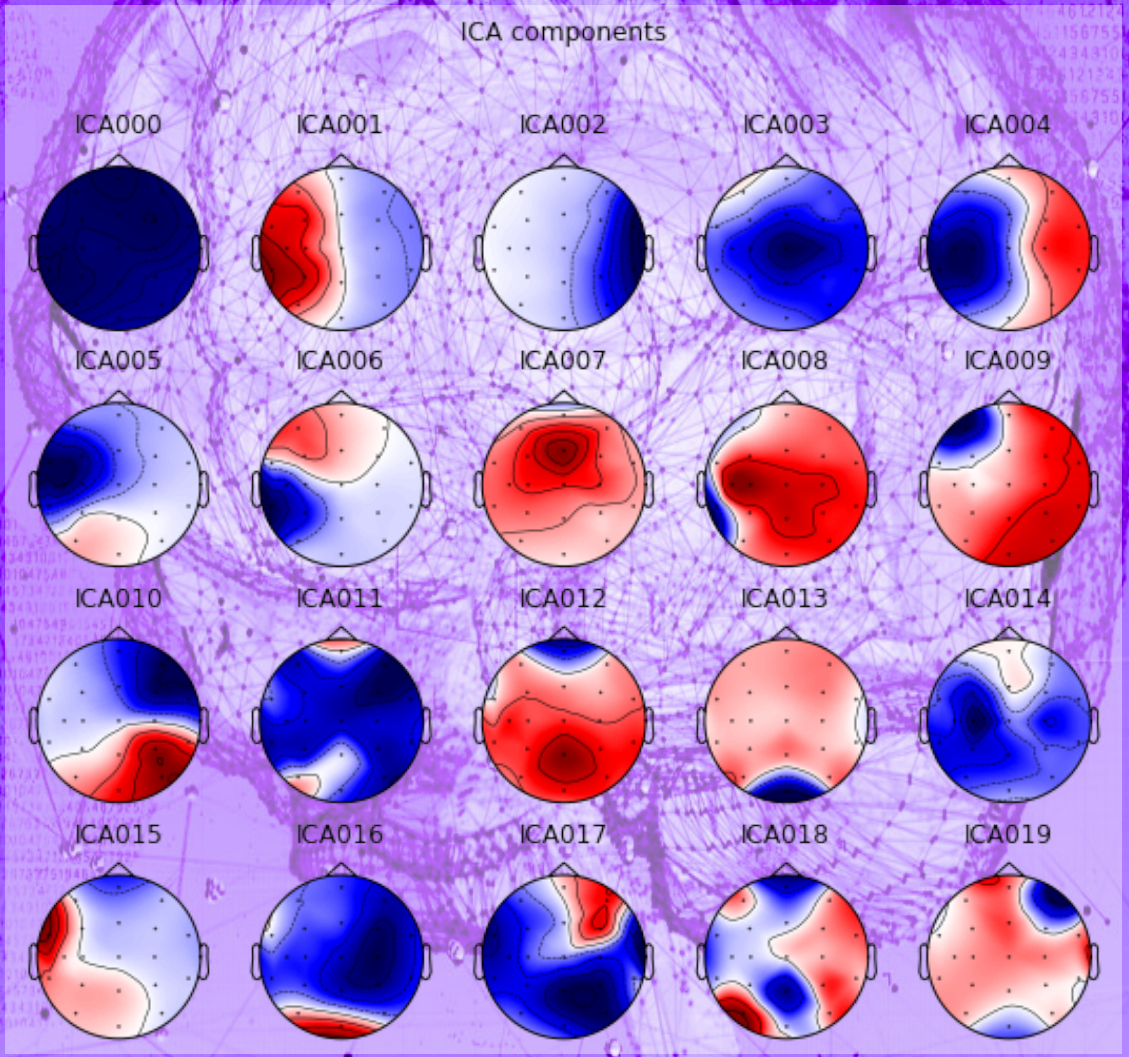
- Implemented in Python to replace tools like EEGLab for analysis and cleaning.
- Any paper we can understand, we can implement (modularity)
- FREE (Explainable/shareable science! Yay!)

The Easy Stuff

- Pandas- Coercing EEG data out of iMotions format, coercing montage data out of native .els
- Bandpass Filter- Removes noise from the lights (high frequency) and baseline drift (low frequency)
- Building out the analysis pipeline.



Independent Components Analysis

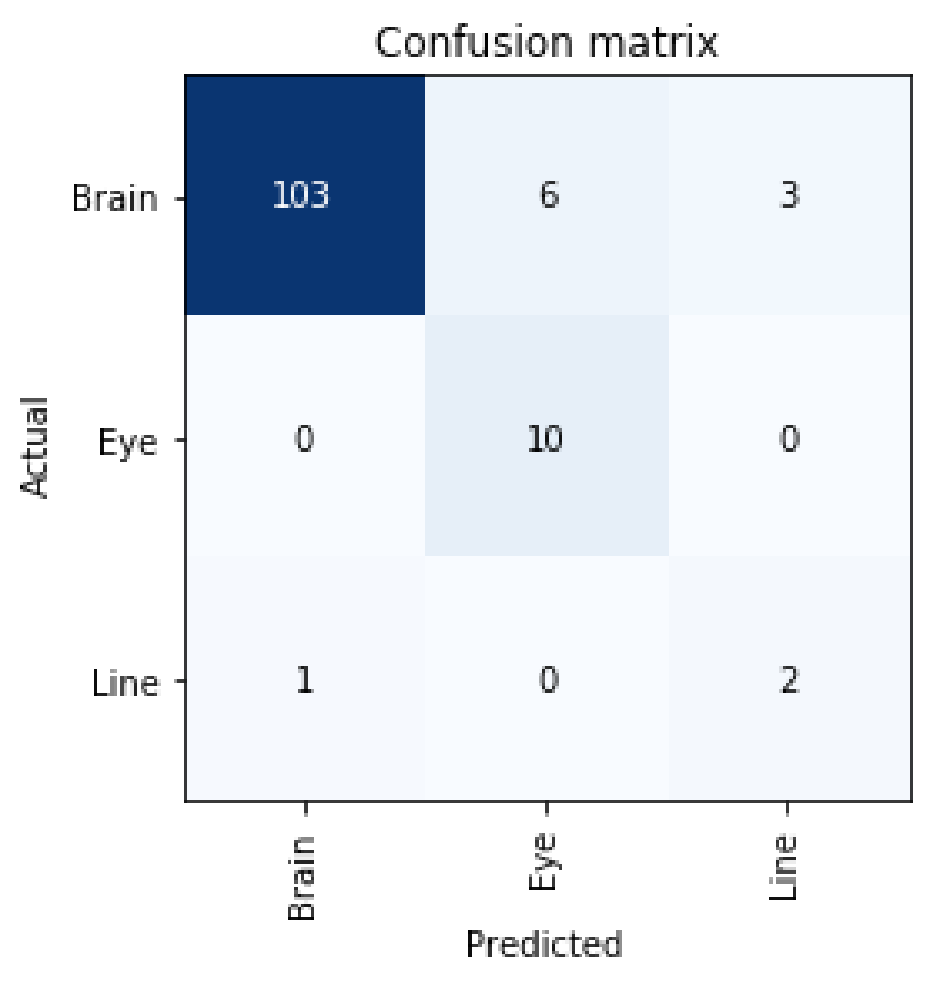


ANN-ICA

- Hasasneh et al. From Palestine Ahliya University College outlined a procedure with MNE Python to use an ANN to classify ICA components without manual observation.
- Two CNNs, one for 1D time, another for 2D space
- Doesn't generalize well (uniform time segments, single sensor configuration)
- Hopes to improve with hybrid model to generalize to any given sensor setup, any time interval.

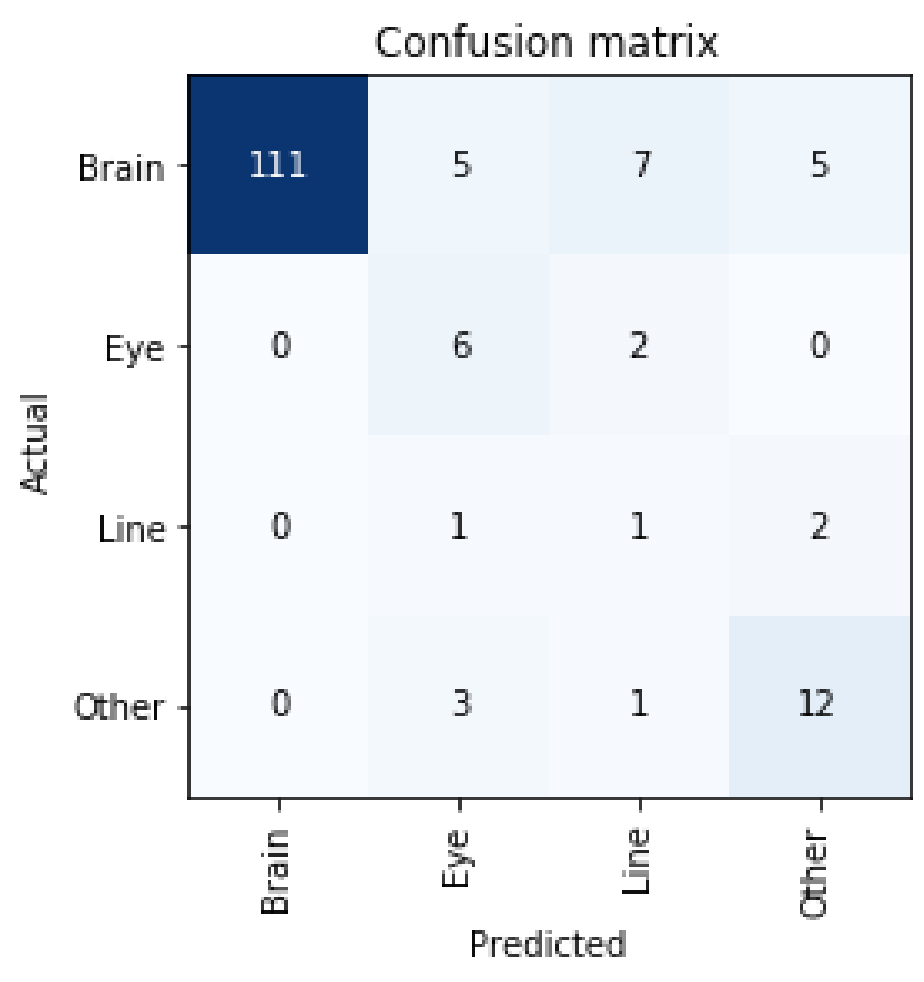
Initial Results

- After applying Resnet, things look promising!



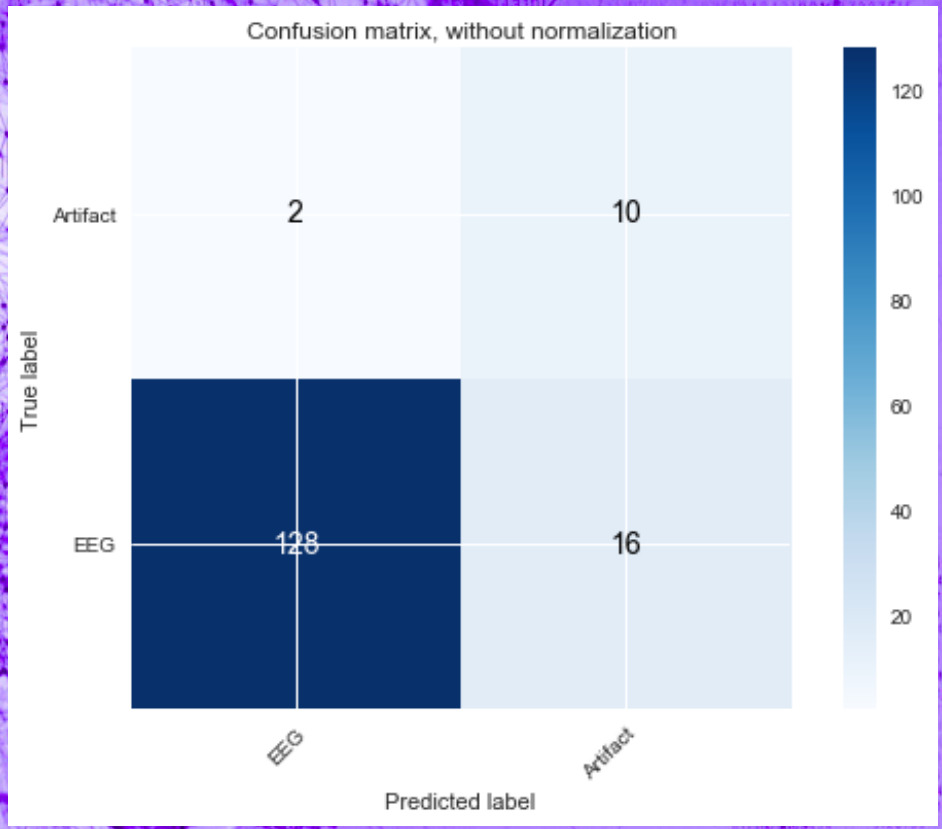
Refined Results

- However, after spotting an error in our validation process, accuracy suffered.
- We divided nonartifactual components into two classes, “Brain” and “Other” and received better accuracy.



Refined Results

- We're not concerned with fine-grained classification, we need artifacts vs. non-artifacts
- Currently 88% accurate, favors the under-represented class (better safe than sorry)



Further Direction

- Expand to account for temporal data after we can get a better data set, using recurrent neural net (RNN) hybrid architecture
- Qualitative Validation
- Build out semi-supervised pipeline for refining the model as new data comes in.

Thank You. Questions?

- Thank you to Tarleton Behavioral Neuroscience and Psychophysiology Research Group for data
- Thank you to Tarleton Math Department for teaching me what to do with it.
- Photo Credit: Kurt Mogony

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