# Data-driven method for tracking early EEG maturation

**Koolen N., Dereymaeker A., Räsänen O., Stjerna S., Jansen K., Vervisch J., Matic V., De Vos M., Naulaers G., Van Huffel S., Vanhatalo S.**

## I. OBJECTIVE

EEG is a commonly used diagnostic method for preterm brain monitoring, however its visual analysis is subjective and time-consuming. Here, we introduce a purely data-driven metric able to follow preterm EEG maturation.

## II. DATA

We used a dataset of 84 EEG recordings from 22 neonates, recorded at postmenstrual age (PMA) of 27-40 weeks. We used two hours of EEG data including active and quiet sleep, measured at 250Hz at nine standard electrode locations.

## III. METHODOLOGY

We designed a purely data-driven approach for maturational index based on features from a histogram of line length (LL) signal of the two hour EEG epoch. Age correlation of 28 features are obtained using the mutual information function (MIF); for the number of data points in 20 predefined bins and 8 statistical histogram features. Finally, we created “EEG growth chart” based on these features, after dimensionality was reduced by two approaches, factor scoring and tensor decomposition. Categorical regression analysis was applied to define the prediction intervals.

## IV. RESULTS & DISCUSSION

We found a shift in the histogram shape during maturation. Consequently, 12 out of 28 histogram features showed a steep developmental correlation to PMA ($r > 0.7$; $p<0.001$). Six features were selected based on the MIF (>0.37): 3 bins and 3 global features: mean, interquartile range, 95% percentile. After dimensionality reduction, we found a nonlinear S-shape developmental trend, with steepest maturation between 31-36 weeks.

## V. CONCLUSION

Our findings show a strong maturational shift in the EEG complexity measured by LL, and we demonstrate how this can be used in a purely data driven manner to yield maturational index, the foundation of EEG growth charts. A special feature with this index is its potential to use across different EEG systems and recording constellations, which may open possibilities to collecting normative data in multicenter settings.