INTRODUCTION

- The Centers for Disease Control and Prevention estimates that 1 in 59 children has autism spectrum disorder (ASD) (2018).
- Electroencephalography (EEG) is a non-invasive measure of electrical activity that can be used with children.
- Pattern classification of nonlinear measures of EEG has potential to greatly improve clinical diagnosis accuracy.
- Bosl et al. (2018) predicted ASD diagnosis and severity with high accuracy using pattern classification of nonlinear measures.
- This project aims to determine the optimal signal preprocessing steps for nonlinear analysis.

METHODS

- Baseline EEG was collected from 12-month infants with increased risk of ASD based on having an ASD-diagnosed older sibling (N = 88).
- EEGs were segmented into 73 30-second segments with less than 10% artifact contamination based on visual inspection.
- Each segment was processed in two ways:
  - **Filtered**: signal with 100 Hz low-pass, 1 Hz high-pass, and 60 Hz notch filters applied.
  - **HAPPE-processed**: signal with filtering, bad channel rejection, independent component analysis, and MARA artifact removal (Gabard-Durnam et al., 2018).

12 nonlinear measures were computed across 11 wavelet sub-bands (Figure 1) on the two differently-preprocessed signals: Filtered vs. HAPPE-processed.

Each measure for each wavelet band was plotted and five measures were identified as the most robust to analyze statistically (Table 1).

Filtered vs HAPPE-processed nonlinear measures were then compared using Pearson Correlation Coefficients for each of the wavelet sub-bands (Figure 1).

RESULTS

- Figure 2 shows Pearson Correlation Coefficients from the results from nonlinear measures of the filtered signal regressed on the HAPPE-processed signal over 11 different wavebands.
- An insignificant correlation suggests that there was high artifact contamination in that waveband range.
- Higher wavelet levels tended to have less significant Pearson Correlation Coefficients, which may indicate that there was more artifact removal in lower frequencies.
- The most significant correlations for each measure are over different wavelets, suggesting that the measures differ in usefulness for characterizing more short-term (high frequency) or long-term (low frequency) changes in the signal.

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<th>Label</th>
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<tbody>
<tr>
<td>DFA</td>
<td>Detrended Fluctuation Analysis</td>
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SUMMARY & FUTURE DIRECTIONS

- Need to understand why some nonlinear features were more significantly correlated with the filtering and artifact removal, especially because the samples were largely uncontaminated.
- Suggestion that only the most significant nonlinear measures should be used for a specific waveband.