Recent trends in neuroscience propose to move from stationary to Mobile Brain/Body Imaging (MoBI). Traditional late fusion analysis approaches of linking brain and body signals were constructed using instantaneous velocity and Source Power Co-modulation (SPoC). We develop an end-to-end pipeline to evaluate these approaches, providing unique multimodal datasets.

**Methods**
- **Source Power Co-modulation (SPoC):** make unsupervised blind source separation (BSS) more accurate by introducing a target variable (supervised learning). Prefer components whose power co-modulates with the target variable [4].
- **Spatio-spectral Decomposition (SSD):** maximize the signal power at a peak frequency while simultaneously minimizing it at the neighboring, surrounding frequency bins [5].
- **Target signals** were constructed using instantaneous velocity and acceleration of the hand rigid body as participants navigated in the Invisible Maze Task [6].
- We develop an end-to-end pipeline to evaluate these approaches compared with linear regression, testing multiple motion profiles and EEG frequency ranges.
- Components were excluded if they (a) had an inconsistent correlation sign across validation folds, or (b) were flagged by SASICA as displaying focal topology or high autocorrelation.
- Spearman correlation between the estimated source component and actual target signal was computed as part of a 5-fold cross validation experiment.

**Results**
- Across all configurations SPoC (median $\rho_{mean} = 0.13$) out performed the regression-based approach (median $\rho_{mean} = 0.9$).
- Overall 865 of the total 13050 possible SPoC components passed the SASICA selection criteria with a median $\rho_{mean} = 0.16$.
- A high degree of variability exists between subjects in the number and quality of components extracted.

**Discussion**
- Component selection may be improved/standardized by considering consistency and plausibility of spatial filters. This may be applied through a similarity metric or human manual inspection.
- Whereas ICA can isolate localizable dipoles, SPoC finds components of functional significance. Using distributed source localization methods it may be possible to combine both approaches to retrieve localizable sources of functional significance.

**References**


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**Extracting Motion-Related Subspaces from EEG in Mobile Brain/Body Imaging Studies Using Source Power Comodulation**

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**The SPoC Analysis Pipeline**

**Virtual Maze Paradigm**

**MoBI Experimental Setup**

**Source Extraction Method Comparison**

**Correlations of SPoC vs Linear Regression Components**

**Example Component Scalp Topographies**