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1. Title: Connectivity-based Meta-Bands: A new approach
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4. Keywords: electroencephalographic; magnetoencephalographic; canonical frequency bands; functional neural network; Connectivity-based Meta-Bands.
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6. Summary:

- (1): This article addresses the limitations of the canonical frequency band approach to filter and analyze neural signals in EEG and MEG studies.
- (2): The past methods have used a segmentation of frequency bands, which may not be adapted to individual idiosyncrasies. The proposed approach, Connectivity-based Meta-Bands, is well motivated, and it aims to automatically identify frequency ranges based on the topological similarity of the frequency-dependent functional neural network.
- (3): The methodology proposed in this paper uses resting-state neural activity of 195 cognitively healthy subjects from three different databases. It applies a narrow-band filter bank to MEG and EEG signals from 1 to 70 Hz with a 0.5 Hz step. The connectivity in each of these filtered signals was estimated using the orthogonalized version of the amplitude envelope correlation to obtain the frequency-dependent functional neural network. Finally, a community detection algorithm was used to identify communities in the frequency domain showing a similar network topology.
- (4): The proposed Connectivity-based Meta Bands algorithm was assessed with two types of synthetic signals to configure the hyper-parameters. The classical approaches to band segmentation reflect the underlying network topologies at the group level for the MEG signals, but they fail to adapt to individual differentiating patterns revealed by the proposed methodology. The results indicate the potential of the new approach to support personalized, data-driven connectivity analyses.

8. Conclusion:

- (1): The significance of this piece of work is the proposal of a new approach, Connectivity-based Meta-Bands, that aims to overcome the limitations of the canonical frequency band approach in filtering and analyzing neural signals in EEG and MEG studies.
- (2): Innovation point: The proposed approach, Connectivity-based Meta-Bands, introduces a new method that automatically identifies frequency ranges based on the topological similarity of the frequency-dependent functional neural network, which could support personalized, data-driven connectivity analyses. Performance: The methodology was assessed with

two types of synthetic signals and the results indicate the potential of the new approach to adapt to individual differentiating patterns revealed by the proposed methodology. Workload: Although the article presents a well-motivated proposal, the methodology and results lack a more detailed discussion and comparison with other state-of-the-art approaches, which could improve the overall understanding and contribution of the proposed approach.