Visualizing Brain Functional Networks using EEG Recordings

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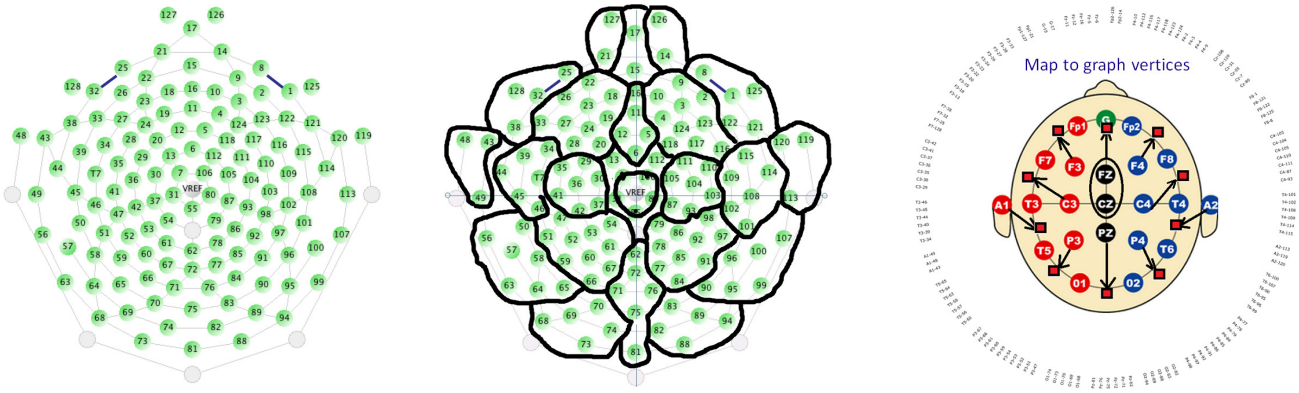
I. PROBLEM

Visualizing brain functional networks from electroencephalographic (EEG) recordings is both useful and needed when studying a particular cognitive paradigm. Typically, EEG time series are recorded from an array of electrodes with a given spatial distribution. The electrodes network can be regarded as a graph and different measures between the graph nodes can be subsequently defined. Making sense of these measures across space and time and interpreting them is a challenging problem. It is the purpose of this abstract to propose a useful and interactive display scheme of EEG sensors data that preserves the main structures of the scalp geography.

II. SENSORS MAPPING

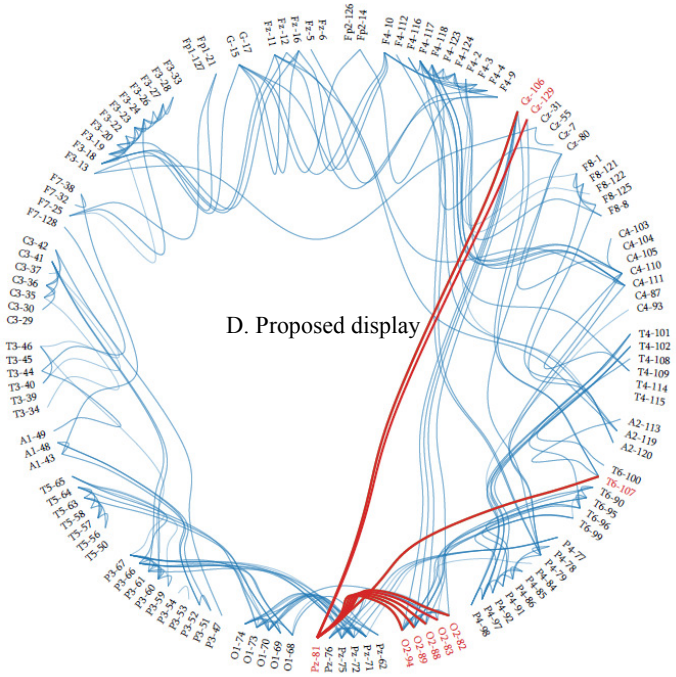
Assuming a data acquisition system from Electric Geodesics Inc. [1], the considered network can be seen in (A) for a setting including 129 electrodes. These electrodes are first grouped according to the standard 10-20 system of electrode placement (B), and then mapped to the circumference of a circle, resulting in the display shown in (C).



A. Channel locations B. Channels assembled based on the 10-20 system C. Channels mapped to circle's circumference

III. VISUALIZATION

Using action script, it becomes possible to interactively visualize any square matrix containing values that correspond to all electrodes combinations. These values may denote measures of statistical dependence [2]. Upon hovering over one of the nodes (D), the main nodes exhibiting higher dependence will be highlighted. Edges are displayed as splines for readability and user-friendliness [3]. It is also possible to color code the forward and backward links for non-symmetric matrices. A time-variant version of the dependence graph is developed to visualize connections across time, enabling a better understanding of the cognitive dynamics involved.



D. Proposed display

REFERENCES

[1] Electric Geodesics Inc., "Geodesic sensor net manual," pp. 29–30.
[2] Fadlallah et al., *IEEE Trans Biomed Eng*, 59 (10) 2773-2781, 2012.
[3] Flare, http://flare.prefuse.org/

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