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| Question: | 6/21 (VCEG) | | |
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| Title: | **Proposed CE on enabling automatic channel grouping** | | |
| Purpose: | Proposal | | |

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# Abstract

This document proposes a new CE on the automatic generation of channel groups from signal analysis. BX16 [1] showed that having the correct grouping of channels can significantly increase the performance of the encoding, but could also result in undesired behavior since the proposal relied upon the textual naming (labels) of the channels in the input files, which is not uniformly conformed to across applications. Given that the labels in the input files cannot be relied upon, this CE proposes automatic generation of these groups without using additional metadata.

# Problem statement

BX16 showed that for the CHB-MIT test dataset of scalp-electrode EEG recordings, creating channel groups based on the physical location of the electrodes-pairs for each channel can significantly increase the performance of the H.BWC encoder. This was achieved by manually specifying the channel groups based upon the labels given by the EDF file header.

While there are broad industry standards for the naming of EEG electrode positions, such as the 10-10 or 10-20 system, they are frequently not followed. As an example, the EEG meditation study of [2] uses the labels A1 through A32, and B1 through B32 to indicate the 64 channels of EEG data in their BDF files, which correspond to the physical cable connections on the Biosemi signal acquisition system. To map these labels onto the 10-20 system, an additional location file is needed.

Furthermore, many files do not contain a single modality, combining signals such as EEG with pleth, accelerometry, gyroscope data, etc. These additional modalities have an even more varied naming usage than EEG alone.

# Proposed Solution

To enable the automatic generation of channel groups without reliance on string matching, label handling, or predefined metadata, several methods can be used to determine both the optimum number of groups and the assignment of channels in each group. The proposed solution leverages inter-channel correlation and applies clustering techniques to determine the groups during the encoder runtime. This method is agnostic to the signal types, relying solely on the statistical similarity between signals rather than their type or label. As a result, it should enable a significant increase in encoder performance without the need to manually specify the groups, or handle the error-prone text labels. Currently the implementation is based upon the version 1 H.BWC test model and will be updated to the latest version ready and finalized in the coming period.

# Conclusion

We ask for the inclusion of this CE proposal in the planned CEs, and support with cross-checking the implementation as soon as it is finalized.

# References

1. Leon Holtmeier, Sophie Pientka, Heiner Kirchhoffer, Paul Haase, Jonathan Pfaff, Heiko Schwarz, Detlev Marpe, Thomas Wiegand, “Description of the application of high-level syntax for reordering and grouping of channels for EEG signals”Q.6/SG21 doc. BX16, April 2025, Virtual.
2. Arnaud Delorme and Tracy Brandmeyer (2024). EEG meditation study. OpenNeuro. [Dataset] doi: doi:10.18112/openneuro.ds001787.v1.1.1

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