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Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Maame Gyamfua Asante-Mensah

PhD Program: Computational and Data Science and Engineering

Title of Thesis: Automatic noise and artifacts removal from biomedical signals and images using tensor completion

Supervisor: Professor Andrzej Cichocki

Name of the Reviewer:

I confirm the absence of any conflict of interest	**Date: 13-05-2023**

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

- Brief evaluation of the thesis quality and overall structure of the dissertation.

The thesis has presented novel research works on tensor based completion methods and their applications to biomedical data. The text consists of 9 chapters and one appendix. The author provides introduction into the thesis, tensor decomposition methods, biomedical data analysis challenges, related works and approaches to hakelizing tensors in the first 5 chapters of the thesis. In the next three chapters the author provides her main contributions, supported by results of computational experiments. The thesis is generally good; the organization is clear and easy to follow.

- The relevance of the topic of dissertation work to its actual content

The topic of the dissertation is fully relevant to its content, as the author consider applications of the developed methods to process biomedical data in order to recover missing values and remove artifacts.

- The relevance of the methods used in the dissertation

Tensor decomposition methods have already been used for processing biomedical data to recover missing values and remove artifacts, as it is discussed in the international literature. The approaches demonstrated state-of-the-art performance. The methods used in the dissertation are appropriate for the research question and the research design.

- The scientific significance of the results obtained and their compliance with the international level and current state of the art

There are three main contributions with novel algorithms proposed supported by extensive experimental evaluations. First, the author uses sparse core tensors of a tensor ring decomposition to perform tensor completion. Second, the author uses cross tensor approximation for tensor completion. Finally, to remove artifacts, the author uses tensor decomposition methods.

- The relevance of the obtained results to applications (if applicable)

MRI and EEG biomedical data processing is a very important applied problem. The authors demonstrate that the proposed methods improve efficiency of MRI and EEG processing and analysis.

- The quality of publications

The candidate's research findings are in compliance with international standards and align with current research trends. These findings were published in good international journals: one q1-q2 journal as the first author, one q1 journal and one q1-q2 journal, as well as in scopus-indexed conference proceedings.

- The summary of issues to be addressed before/during the thesis defense

There are some issues or suggestions that could be discussed during the defense:

1. Please explain why you consider the sparsity of core tensors of tensor ring decomposition under the pre-defined dictionary,
2. Since the thesis focuses on the tensor completion methods, it would be better to also discuss the challenges from perspectives of methods rather than focusing more on challenges related to real world applications in Sec. 1.5,
3. Deep learning methods for data completion or denoising are discussed in the thesis, it would be better to compare with deep learning-based methods for at least some experiments,
4. What is the advantage of cross tensor approximation to the other random tensor approximation (e.g., random tensor t-SVD)?
5. The author uses tensor singular value thresholding. Its calculation depend on the parameter beta, see formula (7) in the Appendix. However, it is not clear from the results of the experiments whether they are robust w.r.t. this value. Any comments on this issue?

Provisional Recommendation

☒ *I recommend that the candidate should defend the thesis by means of a formal thesis defense*