Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Aleksei Shcherbak

PhD Program: Computational and Data Science and Engineering

Title of Thesis: Diagnosis of the human neurological movement disorders based on the analysis of heterogeneous data using ML methods

Supervisor: Associate Professor Andrey Somov

Name of the Reviewer: Prof. Ahmed Bouridane

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Date: 10-11-2024**

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

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

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

The motivations and objectives of the thesis are described appropriately. The proposed techniques are novel as demonstrated by their analysis including the peer-reviewed papers published as part of the research programme.

The research is concerned with an important topic and the findings can also be applied to other related medical problems.

It is noted that the candidate has published two papers a 1st author, two as 2nd authors and several as another. I am not sure if the work of the 8th paper relates to this thesis. In addition, two patents have been filed. This clearly demonstrates the scientific significance of the work carried out by the candidate.

However, the methodology of each contribution is not well articulated to highlight/describe the novelty in a way that can capture the significance and scientific rigor. Rather the candidate dives directly into the tools and methods used in the experimental results. Another concern is that the findings are not compared to some (2 or 3) existing and similar works (if any). Such an analysis would enhance the quality of the thesis and the contributions made.

Some chapters can be combined. Example Chapter 7 can be combined with Chapter 5 and Chapter 6 to make it more informative and larger one.

The comments below can be carried out after the viva voce.

Comments on the thesis:

It is preferable not to use “I” (or “We”) I the thesis. A better way is to use passive form style. The thesis should be re-edited as it contains a large number of typos and grammatical mistakes.

Abstract: It is too long. As written, it does not showcase the several contributions. Needs to be re-written to clearly target the contributions of the thesis. The key finding of each should be highlighted.

Page 1 of the thesis should start on Page 16.

Chapter 1:

Contributions should be described briefly (I suggest as bullet points of 5-8 lines showing the novelty rather than with a single bullet point. Highlight the performances of each.

Outline of the thesis not given.

Chapter 2:

The style should be re-visited in my opinion. The narrative is long and is diluted. I suggest that some images/diagrams/Tables are added to show the evolution of the works for each type of works.

Normally, for each investigation research gaps should be identified and highlighted to link them to the current investigation.

Chapter 3:

No title is given. No motivations/objectives?

Methods section is too early.

An introduction section (current 3.1 subsection) is needed followed by the Theoretical formulation, then experimental setup, then the methods used. The evaluation part is short, and it needs be supported. How confident are you with results? Have you analyzed against similar methods etc.?

The formulation on Page 49 is too simplistic and needs attention. Define all parameters and clearly relate them to what is needed. Can you prove this against your assumptions?

The results look like what you have obtained and lack a detailed analysis. A comparative analysis using various parameters would enhance the quality of the findings. A discussion of the results will be useful.

Are there issues when the results are not actually good? When will these happen? When won't your method work?

Chapter 4: same comments as in Chapter 3.

Same as in Chapter 3. Motivations and Objectives are required here. A mathematical modelling is necessary. What are you capturing (feature extraction) and analyzing (feature selection)? What are you looking for? What are the metrics used? Are you combining (fusing) the results together for a better outcome? If not why not?

Again, an analysis of the results is necessary? How confident are you with the results? Are they repetitive?

Chapter 5: same comments as above

Re-structure the chapter as highlighted in Chapter 3.

Same comments as in previous chapters about the results and their analysis.

Chapter 6:

The chapter need be re-edited to clearly show the contribution using a mathematical model. Which features have been chosen and give reasons for the problem at hand. Feature selection is also needed.

Contribution need be clearly described.

Results and their analysis need be revisited, too.

Chapter 7:

This can be combined with Chapter 5 and Chapter 6. The results will then be discussed as one solution.

Conclusion Chapter: it is too short. It does not clearly showcase the findings obtained. This chapter should be re-visited by clearly discussing the contributions made. A short section of future work would be a good idea, too.

Provisional Recommendation

X *I recommend that the candidate should defend the thesis by means of a formal thesis defense*
☐ *I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report*
☐ *The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense*