

Jury Member Report – Doctor of Philosophy thesis.


Name of Candidate: Alexander Menshchikov

PhD Program: Computational and Data Science and Engineering

Title of Thesis: Mathematical Modelling and Analysis of Intelligent Monitoring Platform for Precision Agriculture

Supervisor: Assistant Professor Andrey Somov

Name of the Reviewer: Prof. Ivan Oseledets

<p>I confirm the absence of any conflict of interest</p> <p>(Alternatively, Reviewer can formulate a possible conflict)</p>	<p>Signature:</p>  <p>Date: 04-09-2020</p>
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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 presented thesis is devoted to the practical task: creation of an intelligent platform for precision agriculture on the basis of general concepts of mathematical modelling and analysis. The results are published in 4 papers, several conference presentations and 1 patent. The specific feature of this thesis is a significant engineering part, combined with machine learning (ML) and modelling techniques.

Thesis has misprints and its organization should be improved.

Section organization could be improved. For example:

Section 3.1 "Development of embedded system with AI capabilities" describes a useful testing of a CNN model on two embedded devices. It is followed by Section 3.2 "detection of seeds during germination", which is an application and does not logically follow from the previous section (no connection). Section 3.2.1 seems to be a copy-paste from the paper "In this section the methodology used in the present work is described."

On page 60, the Movidius is described again, however it was already studied in 3.1. No need to discuss it again.

Section 3.3. is "detection of plants in greenhouses" without any connection to 3.2. It is a separate story. It is better to define all concepts in one place, and not discuss general concepts of AI again.

Section 3.4: It is about hogweed detection on UAV.

Table 3.11 again studies embedded devices, but why we need to do it again?

Section 3.5 is Morphing Wing. I agree that these are useful results, but better structure is obviously needed. By the way, I have no idea what is eVTOL. The content of Section 3.5 falls outside the topic of the thesis. It talks about Navier-Stokes, meshes, grids, etc. These are serious research topics, that is not good to present in 3-4 pages. Correct formulation of the 3.7 - 3.13 requires, at least, boundary conditions to be specified as well as functions in (3.12) and (3.13). Numerical simulations should be done on grids being refined in order to estimate the quality of obtained numerical solutions. It is also not mentioned, what software have been used for this particular modelling.

I think, this thesis should be restructured. It is now written as "state-of-the art" -> methodology, but it will much better perceived if it is structured by topics (which also correspond to the papers) + notations and basic studies. The results are presented in Section 3, which could be split into chapters, and also basic notations/facts chapter introduced, which contains the definitions, the study of performance of different mobile platforms and prospective applications. I have doubts the the wind tunnel part is actually needed in this thesis, since it falls outside the general concept.

Minor comments.

on p. 50 there is an unfinished sentence

p.55: ??

p.60 Nural network -> neural network.

p.72: ??

p.79, Platfrom

Provisional Recommendation

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