Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Evgeny Frolov

PhD Program: Computational And Data Intensive Science And Engineering

Title of Thesis: Low Rank Models For Recommender Systems With Limited Preference Information

Supervisor: Prof. Ivan Oseledets

Chair of PhD defense Jury Prof. Andrzej Cichocki   *Email*: a.cichocki@skoltech.ru
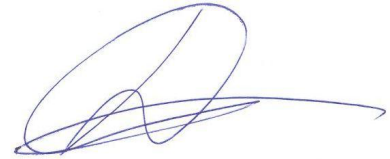
Date of Thesis Defense: 19 September 2018

Name of the Reviewer: Dmitry I. Ignatov

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	Signature: Date: 5-09-2018

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

As advised, I structure my review by the sections below:

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

The thesis (196 pages in total) contains title, abstract, the list of published papers, acknowledgements, eight chapters structured in to three parts. The structure is well balanced since it provides a necessary background material in Part I, the author's theoretical and technical contributions into the field of recommender systems by means of advances in matrix and tensor factorization in Part II along with the author's software solution in Part III. The experimental results are present in chapters 5,6, and 7. They confirm the practical value of the proposed techniques. The English used is technically reich and pleasant.

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

To my view, the title of the thesis is highly relevant to the content since it studies low rank matrix and tensor factorization models under restriction of low or absent positive signal.

- **The relevance of the methods used in the dissertation**

The author relies on matrix factorization which is a standard de facto technique in recommender systems. Thus, the methods used are relevant. One of them extends the so-called PureSVD, a highly efficient and effective algorithm. Another one is designed to generalize the model to higher order of preference expression than usual user-to-item preference matrices.

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

All the results seems to be well-validated at the international level conference in the field – ACM Conference on Recommender Systems – and published in well reputed journal – WIREs Data Mining Knowledge Discovery. All the experimental results are fairly compared with the state—of-the-art competitors, e.g. in Chapter 6 the author's method even beats Matrix Factorization machine techie which ic capable to incorporate side information about users and items as well their interaction. Special quality metrics have been devised to compare several in the experimental setting.

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

Being an expert in selected topics from Recommender Systems and quite enthusiastic in the field and applications of matrix and tensor factorization, I can confirm the relevance and importance of the proposed methods for dealing with data sparsity and cold (also warm) start problems. Their office

- **The quality of publications**

The publications are at very good international level. As it was mentioned, one of the papers is published at the main conference in the recommender systems domain– ACM Conference on Recommender Systems. Another work, actually a survey paper, is published in a well reputed international journal – WIREs Data Mining Knowledge

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

One recommendation for the defense. Please, if time allows, discuss relationship of your methods with Factorization Machines of SVD-like approaches with biases along with their added value.

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