

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Sergei Ivanov


PhD Program: Computational and Data Science and Engineering

Title of Thesis: Combinatorial and Neural Graph Vector

Representations

Supervisor: Prof. Evgeny Burnaev

Name of the Reviewer: Michael Bronstein

I confirm the absence of any conflict of interest	Signature:  Date: 19-11-2019
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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

The PhD thesis of Sergei Ivanov deals with the problems of representation learning on graphs, a novel and promising field in the domain of machine learning.

The thesis consists of four sections. Section 1 introduces the class of problems dealt with and the mathematical background. Section 2 deals with anonymous random walk embeddings of graphs and their applications to fMRI data analysis. Section 3 deals with approximation of NP-hard problems from the domain of social network analysis. Section 4 concludes the thesis.

The original contributions of the thesis appear in Section 2 and 3. The main contribution of Section 2 is the novel method for graph embeddings, named "anonymous random walk embeddings". This construction is due to a Turing awardee Silvio Micali, who showed that the distribution of anonymous random walks contains information about the connectivity of the graph. This property is used to guarantee that graph embeddings have provable complete invariance property. Results of this contribution were published in ICML, a top-level machine

learning conference. Furthermore, the proposed method is applied to problems of fMRI classification (the latter contribution was published in a workshop).

The main contribution of Section 3 is the formulation of a new setting of product recommendation in social networks (content-aware influence maximization, CAIM) and proof that this problem is NP-hard. The problem is approximately solved via a novel Explore-Update algorithm. The contributions of this section were published in a sequence of conference publications.

Overall, the thesis is well written and presents novel and significant contributions to the field. I recommend accepting the thesis.

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