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Report on Alexandra Burashnikova's PhD dissertation
Large-Scale Sequential Learning for Recommender and Engineering Systems

Manuscript organization The thesis of Ms Burashnikova is written in English and is organized in two parts: an introductory part explaining principal notions and detailing the present state of art, and Chapters 4-6 presenting the thesis contributions. These chapters are based on the already published papers (Chapters 4-5) and the manuscript to be submitted (Chapter 6).

Principal contributions In her thesis, Alexandra Burashnikova presents her work on two different subjects—sequential ranking algorithms for recommender systems and fault detection on graphs applied to detection in power grids. The principal motivation of Ms Burashnikova in the first part is to propose iterative algorithms for ranking systems which take into account "negative" user feedbacks and temporal structure of the data. In particular, in Chapter 4, Alexandra and coworkers propose a new SAROS algorithm for computing recommendation weights utilizing stochastic gradient descent method over data split into blocks following user interaction timeline. In this part, she provides a theoretical analysis of the algorithm and reports on the numerical study utilizing real datasets. In Chapter 5, several modifications of the proposed approach are discussed—accelerated algorithm of heavy-ball type, data selection on the basis of some stationarity criteria, etc. In this part too, the theoretical analysis is completed by the numerical study utilizing publicly available datasets.

The last chapter of the thesis, Ms Burashnikova discuss the problem of detecting and identifying faulted arcs in power grids. She advances the approach to detection based on convolutional neural nets which takes into account the network topology by including into the feature vector the state of the arcs of the network in the neighborhood of the faulted arc. Numerical study, based on the data simulated using Matlab/Simulink Power System Toolbox shows that taking into account information about the grid geometry indeed allows to improve significantly the quality of the detection inference.

I am not an expert in recommender system or neural networks. This why, I had some difficulties reading Ms Burashnikova's manuscript. For instance, it was hard to me to understand the exact problem statement and description of the SAROS algorithm (what was the loss function used, how weights ω were structured, what type of convergence is considered in Theorem 4, how "stationary components" are defined, etc). I also feel that presentation in Chapter 6 is also "too specialized," making it sometimes hard to follow the explanation (what are feature vectors x, φ and ψ, what is the rationale behind convolutional structure of the net, what is "admittance matrix", etc). Some detailed explanations of the important notions and entities used would certainly improve the readability of the manuscript for nonspecialists.

Conclusion In my opinion, this thesis contains a number of original and sound results on challenging problems of Machine Learning. In my opinion, Ms Burashnikova's thesis meets all requirements to the PhD dissertations. It shows that she possesses all relevant professional skills which qualify her as a competent researcher. Therefore, I welcome granting the PhD degree to Alexandra Burashnikova.

Anatoli Juditsky