

	FORM FOR PROPOSING A TOPIC IN THE SECOND CYCLE OF STUDIES	Oznaka	SAO-FENS.4.24.0-ENG
		Datum usvajanja	05.03.2019
		Datum/Br. revizije	-
		Stranica	1/1

Department	IT
Master thesis title:	Sparse SVD with Applications in Biology
Mentor/professor - contact:	Saida Sultanic

Thesis background:	<p>SVD (singular value decomposition) is used in data analysis in many scientific areas. Classical SVD methods do not take into account sparsity or appearances of patterns in data matrix, which does not present a problem when dealing with smaller data sets, but with larger data sets it is imperative that both of these issues are recognised.</p>
Thesis objective:	<p>Explore the methods and uses of sparse SVD with applications in biology.</p>
Literature:	<p>Group-sparse SVD Models and Their Applications in Biological Data, by Wenwen Min, Juan Liu and Shihua Zhang</p> <p>P. Singh and G. J. Gordon, "A unified view of matrix factorization models," in Machine Learning and Knowledge Discovery in Databases (ECML/PKDD), 2008, pp. 358–373</p> <p>J. Huang, T. Zhang, and D. Metaxas, "Learning with structured sparsity," Journal of Machine Learning Research, vol. 12, no. Nov, pp. 3371–3412, 2011.</p>

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Department	IT
Master thesis title:	Markov Models for Network-Behavior Modeling
Mentor/professor - contact:	Saida Sultanic

Thesis background:	<p>This work would be based on studying the Markov processes, which have been used for modeling problems for network based dynamics.</p>
Thesis objective:	<p>This research would follow recent work done by authors of <i>Using higher-order Markov models to reveal flow-based communities in networks</i></p>
Literature:	<p>Salnikov, V., Schaub, M. T. & Lambiotte, R. Using higher-order markov models to reveal flow-based communities in networks. <i>Scientific reports</i> 6, 23194 (2016).</p> <p>Schaub, M. T., Delvenne, J.-C., Yaliraki, S. N. & Barahona, M. Markov Dynamics as a Zooming Lens for Multiscale Community Detection: Non Clique-Like Communities and the Field-of-View Limit. <i>PLoS ONE</i> 7, e32210 (2012)</p>

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Department	IT
Master thesis title:	Non-negative Matrix Factorization for Data Analytics
Mentor/professor - contact:	Saida Sultanic

Thesis background:	Basic matrix factorization (decomposition) algorithms include algorithms like LU, QR, SVD decompositions which although simple algorithms are powerful tools in computations in linear algebra. Nonnegative matrix factorization (NMF) methods are used for decomposition of data matrices into low-rank latent factor matrices with nonnegativity constraints.
Thesis objective:	Explore the methods and uses of NMF in data analytics.
Literature:	<p>Nonnegative Matrix Factorization for Signal and Data Analytics: [Identifiability, Algorithms, and Applications], by <i>Xiao Fu, Kejun Huang, Nicholas D. Sidiropoulos, and Wing-Kin Ma</i></p> <p>Non-negative matrix factorization revisited: Uniqueness and algorithm for symmetric decomposition,” <i>IEEE Trans. Signal Process.</i>, vol. 62, no. 1, pp. 211–224, 2014, by K. Huang, N. Sidiropoulos, and A. Swami</p> <p>On identifiability of nonnegative matrix factorization, <i>IEEE Signal Process. Lett.</i>, vol. 25, no. 3, pp. 328–332, 2018, by X. Fu, K. Huang, and N. D. Sidiropoulos</p> <p>Daniel D Lee and H Sebastian Seung. Algorithms for non-negative matrix factorization. In NIPS’01, pages 556–562, 2001.</p>

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Department	IT
Master thesis title:	Low rank matrix factorization and approximation
Mentor/professor - contact:	Saida Sultanic

Thesis background:	<p>Low rank matrix factorization methods are used for dimension reduction or for compressed representation of data.</p>
Thesis objective:	<p>Explore the methods and uses of sparse low-rank factorization and approximation and its uses</p>
Literature:	<p>Yuan Lu, Jie Yang, Notes on Low-rank Matrix Factorization</p> <p>Daniel D Lee and H Sebastian Seung. Algorithms for non-negative matrix factorization. In NIPS'01, pages 556–562, 2001.</p> <p>Ankit Parekh and Ivan W. Selesnick. Enhanced Low-Rank Matrix Approximation</p>

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Department	IT
Master thesis title:	Casual paths in time series data on networks
Mentor/professor - contact:	Saida Sultanic

Thesis background:	<p>Graphs are an important foundation for data mining and machine learning tasks in relational data. Many tools of network analysis rely on the links which capture influence, and the paths that represent possible indirect influence.</p>
Thesis objective:	<p>This research would follow recent work done by authors of <i>Counting Causal Paths in Big Times Series Data on Networks</i>, from 2019</p>
Literature:	<p>Counting Causal Paths in Big Times Series Data on Networks, by Luka V. Petrovic and Ingo Scholtes</p> <p>Scholtes, I. et al. Causality-driven slow-down and speed-up of diffusion in non-markovian temporal networks. <i>Nat. Comm.</i> 5, 5024 (2014).</p>