

Curriculum Vitæ

Victor Amelkin

PhD Candidate, Computer Science
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My broad *research area* is **analysis, modeling, and control of dynamic processes in networks** using the tools from machine learning and data mining, combinatorial algorithms, linear algebra, and dynamical systems. Among various network processes, I focus on competing opinion formation and spread in online social networks, and dynamics of collaboration in organizational networks. My *current research* involves

- ◇ modeling formation and dynamics of competing opinions in online social networks;
- ◇ mechanism design for making online social networks resilient to external control; and
- ◇ modeling collaboration in economic networks.

EDUCATION

- 09/2011–06/2018 PhD, University of California, Santa Barbara, US
Field: Computer Science, *GPA:* 3.93
Research Advisor: [Ambuj K. Singh](#)
Doctoral Committee: [Ambuj K. Singh](#), [Francesco Bullo](#), [John R. Gilbert](#), [Xifeng Yan](#)
- 09/2006–06/2008 MSc, Tula State University, Tula, Russia
Major: Applied Mathematics and Computer Science, *GPA:* 3.8
Research Advisor: [Valeriy Ivanov](#)
- 09/2002–06/2006 BSc, Tula State University, Tula, Russia
Major: Applied Mathematics and Computer Science, *GPA:* 3.7

SKILLS

- *Fundamentals:* algorithms, network science, graph theory, social networks, linear algebra, dynamical systems, machine learning, data mining, statistics, scientific computing, select topics in sociology
- *Programming Languages:* Python (numpy, pandas, scikit), MATLAB, C++, C#, SQL, JavaScript, shell
- *Natural Languages:* English, Russian

RESEARCH EXPERIENCE

2013-17 *Graduate Student Researcher*, University of California, Santa Barbara, CA

Advisor: [Ambuj K. Singh](#)

My work on analysis, modeling, and control of dynamic processes in networks at UC Santa Barbara includes the following projects.

▷ **Modeling performance-driven collaboration among stock traders. Ongoing work.**

A day trading firm is comprised of traders engaged in two intertwined processes: (i) trading stock and, thereby, generating profit and (ii) collaborating (sharing knowledge) with other traders. Assuming that collaboration among traders facilitates their performance, and, vice versa, traders' performance determines their collaboration strategies, the goal is to design a collaboration model, theoretically study its behavior and efficiency, and fit it to real-world financial data.

▷ **Mechanism design for protecting online social networks against (malicious) external control.**

Collaborators: [Ambuj K. Singh](#)

Existing socio-psychological studies show that social network users form their opinions relying on the opinions of their neighbors. According to DeGroot opinion formation model, one value of particular importance is the asymptotic consensus value $\langle \pi, x \rangle$ —the sum of user opinions x_i weighted by the users' eigenvector centralities π_i . It plays the role of an attractor for the opinions in the network and is a lucrative target for external influence. However, since any potentially malicious control of the opinion distribution in a social network is undesirable, it is important to design methods to prevent external attacks upon the asymptotic consensus value. In this work, we assume that the adversary wants to change the asymptotic consensus value by altering the opinions of some users in the network. We, then, state DIVER—an NP-hard problem of disabling such external influence attempts via strategically adding a limited number of edges to the network. Relying on the theory of Markov chains, we provide perturbation analysis that shows how eigenvector centrality and, hence, DIVER's objective function change in response to an edge's addition to the network. The latter leads to the design of a pseudo-linear-time heuristic for DIVER, that relies on efficient estimation of mean first passage times in a Markov chain.

§ **AMELKIN, V.**, SINGH, A.K. “Disabling External Influence in Social Networks via Edge Recommendation”, *In submission (2018)*, [\[arxiv\]](#)

▷ **Non-linear models for polar opinion formation in social networks.**

Collaborators: [Francesco Bullo](#), [Ambuj K. Singh](#)

This project is dedicated to the development of a model for opinion formation that would allow the opinion adoption behavior of the users of a social network to change based on their current beliefs. Such a non-linear model is suitable when multiple competing opinions spread in the network (e.g., Democrats vs. Republicans or iOS vs. Android). In this work, we bring out the non-smooth dynamical system analysis tools suitable for the analysis of non-linear opinion formation models, and make findings regarding how users' resilience to persuasion affects formation of polar opinions in a social network.

§ **AMELKIN, V.**, BULLO, F., SINGH, A.K. “Polar Opinion Dynamics in Social Networks”, *IEEE Transactions on Automatic Control (61) 11, 2017*, [\[pdf\]](#), [\[poster\]](#), [\[slides\]](#)

▷ **Dynamics of Collective Performance in Collaboration Networks.**

Collaborators: Omid Askarisichani, Young Ji Kim (MIT), Tom Malone (MIT), Ambuj K. Singh

We extend the existing body of research on team process and prediction models of team performance. Specifically, we analyze the dynamics of historical team performance over a series of tasks as well as the fine-grained patterns of collaboration between team members, and formally connect these dynamics to the team performance in the predictive models. Our major qualitative finding is that higher performing teams have well-connected collaboration networks—as indicated by the topological and spectral properties of the latter—which are more robust to perturbations, and where network processes spread more efficiently. Our major quantitative finding is that our predictive models deliver accurate team performance predictions—with a relative prediction error of 15-25%—on a variety of tasks. We also show how to use our models in an application, for the purposes of optimal online planning of workload distribution in an organization.

§ AMELKIN, V., ASKARISICHANI, O., KIM Y.J., MALONE T.W., SINGH, A.K., “Dynamics of Collective Performance in Collaboration Networks”, *In submission to PLOS ONE (May, 2017)*, [[slides](#)]

▷ **A Distance Measure for the Analysis of Polar Opinion Dynamics in Social Networks.**

Collaborators: Petko Bogdanov (SUNY), Ambuj K. Singh

Modeling and predicting people’s opinions plays an important role in today’s life. For viral marketing and political strategy design, it is particularly important to be able to analyze competing opinions, such as pro-Democrat vs. pro-Republican. While observing the evolution of polar opinions in a social network over time, can we tell when the network “behaved” abnormally? Furthermore, can we predict how the opinions of individual users will change in the future? To answer such questions, it is insufficient to study individual user behavior, since opinions spread beyond users’ ego-networks. Instead, we need to consider the opinion dynamics of all users simultaneously. In this work, we introduce the Social Network Distance (SND)—a distance measure that quantifies the likelihood of evolution of one snapshot of a social network into another snapshot under a chosen opinion dynamics model. SND has a rich semantics of a transportation problem, yet, is computable in pseudo-linear time, thereby, being applicable to large-scale social networks analysis. We demonstrate the effectiveness of SND in experiments with Twitter data.

§ AMELKIN, V., BOGDANOV, P., SINGH, A.K. “A Distance Measure for the Analysis of Polar Opinion Dynamics in Social Networks (Extended Paper)”, *In submission (2018)*

§ AMELKIN, V., BOGDANOV, P., SINGH, A.K. “A Distance Measure for the Analysis of Polar Opinion Dynamics in Social Networks”, *In Proc. of IEEE ICDE, May, 2017*, [[pdf](#)], [[poster](#)], [[slides](#)], [[code](#)]

2016 *Research Scientist Intern*, Amazon.com, Seattle, WA

Collaborators: Pietari Pilkkinen, Zheng Du

Algorithms for automatic optimization of predictive models for fraud detection.

2014 *Research Intern*, Technicolor Labs, Los Altos, CA

Collaborators: Smriti Bhagat, Udi Weinsberg

Predicting movie success based on a small number of movie features.

2012 *Research Assistant*, Lawrence Berkeley National Lab, Berkeley, CA

Collaborators: [Esmond G. Ng](#)

Theoretical analysis of parallel sparse Cholesky factorization algorithms.

PUBLICATIONS – WORKING PAPERS

- [0] AMELKIN, V., et al., “*Dynamics of opinions and social power in complex social networks*” // 2018.
- [1] AMELKIN, V., et al., “*A model for performance-driven collaboration among stock traders*” // 2018.

PUBLICATIONS – REFEREED JOURNALS AND CONFERENCES

- [2] AMELKIN, V., BOGDANOV, P., SINGH, A.K., “*A Distance Measure for the Analysis of Polar Opinion Dynamics in Social Networks (Extended Paper)*” // In submission.
- [3] AMELKIN, V., SINGH, A.K., “*Disabling External Influence in Social Networks via Edge Recommendation*” // In submission, [[arxiv](#)], [[supplement](#)], [[poster](#)].
- [4] AMELKIN, V., BULLO, F., SINGH, A.K., “*Polar Opinion Dynamics in Social Networks*” // IEEE Transactions on Automatic Control (61) 11, 2017, [[pdf](#)], [[doi](#)], [[poster](#)], [[slides](#)].
- [5] AMELKIN, V., ASKARISICHANI, O., KIM Y.J., MALONE T.W., SINGH, A.K., “*Dynamics of Collective Performance in Collaboration Networks*” // In submission to PLOS ONE (May, 2017), [[slides](#)].
- [6] AMELKIN, V., BOGDANOV, P., SINGH, A.K., “*A Distance Measure for the Analysis of Polar Opinion Dynamics in Social Networks*” // In Proc. of IEEE ICDE, May, 2017, [[pdf](#)], [[doi](#)], [[poster](#)], [[slides](#)], [[code](#)].

PUBLICATIONS – PRE-PRINTS, WORKSHOPS, TECH. REPORTS, PRESENTATIONS, THESES

- [7] AMELKIN, V., SINGH, A.K., “*Disabling External Influence in Social Networks via Edge Recommendation (Extended Paper)*” // arXiv:1709.08139 [cs.SI], Sept., 2017, [[arxiv](#)].
- [8] AMELKIN, V., BULLO, F., SINGH, A.K., “*Polar Opinion Dynamics in Social Networks*” // 32’nd Southern California Control Workshop, Caltech, April, 2017, [[slides](#)].
- [9] AMELKIN, V., ASKARISICHANI, O., SINGH, A.K., KIM Y.J., MALONE T.W., “*Dynamics of Collective Performance in Collaboration Networks*” // INSNA Sunbelt, Newport Beach, April, 2016, [[slides](#)].
- [10] AMELKIN, V., SINGH, A.K., BOGDANOV, P., “*A Distance Measure for the Analysis of Polar Opinion Dynamics in Social Networks (Extended Paper)*” // arXiv:1510.05058 [cs.SI], 2015, [[arxiv](#)].
- [11] AMELKIN, V., NG, E.G., “*Parallel Communication Analysis for Sparse Cholesky Factorization Algorithms*” // Tech. Report. Lawrence Berkeley National Laboratory, 2012, [[pdf](#)].
- [12] AMELKIN, V., “*Fejér problem for polynomials on a sphere*” // MSc Thesis, Tula State University, 2008.

TEACHING EXPERIENCE

- 10/2012–09/2013 Teaching Assistant, UC Santa Barbara, US
CS211b – *Numerical Simulation*,
CS40 – *Discrete Mathematics*,
CS32 – *Object-Oriented Design and Implementation*
- 09/2007–06/2008 Teaching Assistant, Tula State University, Tula, Russia
Assembly language programming

WORK EXPERIENCE

- 06/2013–06/2018 *Graduate Student Researcher*, University of California, Santa Barbara, CA
- 06/2016–09/2016 *Research Scientist Intern*, Amazon, Inc., Seattle, WA
- 07/2014–09/2014 *Research Intern*, Technicolor Labs, Los Altos, CA
- 07/2012–09/2012 *Research Assistant*, Lawrence Berkeley National Lab, Berkeley, CA
- 01/2012–06/2012 *Graduate Student Researcher*, University of California, Santa Barbara, CA
- 11/2008–03/2010 *Senior Software Engineer*, [DevExpress](#), Tula, Russia
- 10/2006–11/2008 *Software Engineer*, [DevExpress](#), Tula, Russia

PROFESSIONAL SERVICE

I have served as a reviewer for a number of computer science and engineering conferences and journals, including:

	KDD	SDM	WWW	ICDM	WSDM	AAAI	TKDE	SIGMOD	TNSE	TAC	Automatica	ACC	CDC
2018	•		•				•			•	•	•	
2017	•	•	•			•	•		•				•
2016	•	•		•	•	•							
2015	•						•						
2014							•	•					
2013				•									

AWARDS

- 2011-2012 \$8,000 Merit Fellowship from the Department of Computer Science at the UCSB
- 2011 \$1,500 Opportunity Grant from the US Department of State
- 2008 Best paper at the Conf. on Current Problems of Mathematics, Mechanics, Computer Science; Russia
- 2002 Tula Regional Olympiad in Applied Mathematics for high-school students, 2nd prize

REFERENCES

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