Neil K. Dhingra

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EDUCATION

PhD in Electrical Engineering 2010 – 2017
University of Minnesota, Twin Cities, MN GPA: 3.7/4.0
Thesis: Optimization and control of large-scale networked systems, Advisor: Professor Mihailo R. Jovanović

BSE in Electrical Engineering, Minor in Mathematics 2006 – 2010
University of Michigan, Ann Arbor, MI, Magna Cum Laude GPA: 3.5/4.0

EXPERTISE

- Optimization algorithms for solving large convex and nonconvex problems, particularly for nondifferentiable regularized problems, using both distributed and centralized implementations
- Analysis of and structured controller design for networked linear systems (e.g., power grid, platoons of autonomous vehicle, drug therapy design, linearized Navier-Stokes fluid flow models)
- System identification and model reduction to obtain simple representations of complex systems
- Effective communication of complicated technical material via written manuscripts and public presentations

Software: Matlab, Simulink, LabVIEW, SPICE, VHDL, Verilog, MS Visual Studio: Visual Basic, C, C#, C++, MPI for distributed computing, ASP.NET, AutoLISP, IC Station, VBA for Word, Excel & Access, Photoshop

RESEARCH AND WORK EXPERIENCE

University of Minnesota, Control and Dynamical Systems Group Minneapolis, MN
Research Assistant with Professor Mihailo R. Jovanović 2010 - 2017

- Developed efficient, scaleable, and distributable algorithms for solving regularized optimization problems
- Used regularization to develop tools for designing structured controllers for linear systems
- Identified and exploited convex classes of structured optimal control problems: optimal sensor/actuator selection, decentralized control of positive systems, convex structured controller design via symmetry
- Supervised 3 undergraduate and 4 graduate students in research leading to publications and successful Undergraduate Senior Honors and Masters theses
- Worked on writing successful application to the National Science Foundation resulting in a $389,673 grant

NASA Armstrong Flight Research Center *(formerly Dryden)* Edwards, CA
Graduate Fellow 2012 - 2013

- Developed algorithms for optimal sensor selection and placement to ensure early onset detection of destructive flutter instabilities in light-weight flexible aircraft
- Exploited problem structure to write algorithms whose computational complexity scales with model dimension instead of the number of sensors, allowing for joint analysis of many potential sensors
- Evaluated algorithms on models of the X-56 and UMN aeroelastic testbed aircraft

NASA Jet Propulsion Laboratory, Autonomous Systems Division Pasadena, CA
Space Grant Intern June - August 2010

- Developed *Automated Target Recognition (ATR)* systems to identify and locate targets in images and video
- Designed and tested ATR systems which use machine learning algorithms (Support Vector Machines, Neural Networks) to train classifiers on data preconditioned by k-means clustering

Wireless Integrated Microsystems ERC Ann Arbor, MI
Undergraduate Research Assistant May 2008 - June 2010

- Analyzed effect of carbon nanotube coating on electrode site impedance using frequency response data for system identification and comparison with analytic model (Randles model)
- Designed, verified (in Spice), and tested (in lab) VLSI circuits to control probe stimulation/recording
- Integrated multiple ASIC chips with computer LabVIEW interface for bidirectional wireless interface

Campus Automated Rich Media Archive Ann Arbor, MI
Undergraduate Research Assistant May 2009 - August 2009

- Developed techniques to track and record a moving lecturer in a classroom with an autonomous video camera
- Implemented technology to triangulate speaker location using delay of lecturer speech or ultrasonic pulses from a lapel-mounted microphone/transmitter to microphones/receivers around the classroom

INVIA Medical Imaging Solutions Ann Arbor, MI
Database programmer August 2007 - August 2008

- Designed and implemented Web, MS Access and .NET Interfaces for management and editing of customer data, including software key generation, error tracking and sales information
- Formulated architecture and developed framework for database used to store customer data records

ThyssenKrupp Krause, Inc. Auburn Hills, MI
Database programmer May 2005 - August 2007

- Developed .NET applications, macros, and AutoLISP scripts to improve processes and aid designers
- Designed database architecture for Engineering Change Notification (ECN) system and developd suite of applications for engineers to create/edit ECNs, and for managers to track ECN statistics and trends
- Trained and managed the group of interns who replaced me when I left the company

LEADERSHIP AND MANAGEMENT

MnDRIVE Graduate Scholars Program Fellowship Outreach Minneapolis, MN
Graduate Fellow 2014 - 2016

- Initiated, coordinated, and volunteered with outreach programs: FIRST Lego League Team Mentor, Tech Camp leader, Minnesota Academy of Science State Science Fair Judge
- Organized partnership with Abamath robotics to fund low-income students in a robotics league

Teaching Science, Math and Research Technology Minneapolis, MN
School Coordinator and Session Leader 2013 - 2016

- Led groups of volunteers in teaching interactive science/math lessons to elementary/middle school kids in order to increase STEM interest, e.g. basic circuits/soldering to make a small robot, extracting DNA from strawberries, elementary probability and how to win at Monopoly
- Arranged the use of university outreach grants to fund lessons for schools in low-income areas

Intl Assn for the Exchange of Students for Technical Experience Ann Arbor, MI
Reception Coordinator, Social Chair 2008 - 2010

- Reception Coordinator - Coordinated housing, employment and arrival of interns from abroad
- Social Chair - Organized social activities to foster friendship and expose international interns to US culture

TEACHING EXPERIENCE

Electrical and Computer Engineering, University of Minnesota

Guest lecturer,	(EE 8215) *Nonlinear Systems,*	Spring 2016
Recitation instructor,	(EE 3015) *Signals and Systems,*	Spring 2016, Fall 2016
Teaching assistant,	(EE 3006) *Fundamentals of Electrical Engineering Laboratory,*	Fall 2010, Spring 2011

SELECTED HONORS AND AWARDS

Doctoral Dissertation Fellowship, University of Minnesota	2015 - 2016
MnDRIVE Graduate Scholars Fellowship, MnDRIVE Initiative	2014 - 2016
Harriet G. Jenkins Predoctoral Fellowship, NASA	2011 - 2014
ECE Departmental Fellowship, University of Minnesota	2010 - 2011
Best presentation in session, American Control Conference	2016
Student Travel Grants, American Control Conference and Doctoral Dissertation Fellowship	2016
Space Grant Award Recipient, Michigan Space Grant Consortium	2010

PUBLICATIONS

JOURNAL PAPERS

1. N. K. Dhingra, S. Z. Khong, and M. R. Jovanović. *A second-order primal-dual algorithm for nonsmooth composite minimization.* IEEE Trans. Automat. Control, 2017, *note: submitted.*
2. N. K. Dhingra, M. Colombino, and M. R. Jovanović. *Structured decentralized control of positive systems with applications to combination drug therapy and leader selection in directed networks.* IEEE Trans. Control Netw. Syst., 2017, *note: submitted.*
3. N. K. Dhingra, S. Z. Khong, and M. R. Jovanović. *The proximal augmented Lagrangian and for nonsmooth composite optimization.* IEEE Trans. Automat. Control, 2016, *note: submitted.*
4. N. K. Dhingra, M. Colombino, M. R. Jovanović, A. Rantzer, and R. S. Smith. *On the optimal control problem for a class of monotone bilinear systems.* Syst. Control Lett., 2016, *note: submitted.*
5. M. R. Jovanović and N. K. Dhingra. *Controller architectures: tradeoffs between performance and structure.* Eur. J. Control, 30:76-91, 2016.

REFEREED CONFERENCE PAPERS

6. N. K. Dhingra, S. Z. Khong, and M. R. Jovanović. *A second order primal-dual algorithm for non-smooth convex composite optimization.* In Proceedings of the 56th IEEE Conference on Decision and Control, Melbourne, Australia, *note: to appear.*
7. A. Zare, N. K. Dhingra, M. R. Jovanović, and T. T. Georgiou. *Structured covariance completion via proximal algorithms.* In Proceedings of the 56th IEEE Conference on Decision and Control, Melbourne, Australia, *note: to appear.*
8. N. K. Dhingra, M. Colombino, and M. R. Jovanović. *Leader selection in directed networks.* In Proceedings of the 55th IEEE Conference on Decision and Control, Las Vegas, NV, pages 2715-2720, 2016.
9. M. Colombino, N. K. Dhingra, M. R. Jovanović, and Roy S. Smith. *Convex Reformulation of a Robust Optimal Control Problem for a Class of Positive Systems.* In Proceedings of the 55th IEEE Conference on Decision and Control, Las Vegas, NV, pages 5263-5268, 2016.
10. S. Hassan-Moghaddam, N. K. Dhingra, and M. R. Jovanović. *Topology identification of undirected consensus networks via sparse inverse covariance estimation.* In Proceedings of the 55th IEEE Conference on Decision and Control, Las Vegas, NV, pages 4624-4629, 2016.
11. N. K. Dhingra, Xiaofan Wu, and M. R. Jovanović, *Sparsity-promoting optimal control of systems with invariances and symmetries*, in Proceedings of the 10th IFAC Symposium on Nonlinear Control Systems, Monterey, CA, pages 648-653, 2016.
12. M. Colombino, N.K. Dhingra, M.R. Jovanović, A. Rantzer, and R.S. Smith. *On the optimal control problem for a class of monotone bilinear systems.* In Proceedings of the 22nd International Symposium on Mathematical Theory of Networks and Systems, Minneapolis, MN, pages 411-413, 2016.
13. N. K. Dhingra, M. Colombino and M. R. Jovanović, *On the convexity of a class of structured optimal control problems for positive systems.* In Proceedings of the 2016 European Control Conference, Aalborg, Denmark, pages 825-830, 2016.
14. N. K. Dhingra, and M. R. Jovanović, *A method of multipliers algorithm for sparsity-promoting optimal control.* In Proceedings of the 2016 American Control Conference, Boston, MA, pages 1942-1947, 2016.
15. N. K. Dhingra, and M. R. Jovanović, *Convex synthesis of symmetric modifications to linear systems.* In Proceedings of the 2015 American Control Conference, Chicago, IL, pages 3583-3588, 2015.
16. N. K. Dhingra, M. R. Jovanović, and Z. Q. Luo, *Optimal sensor and actuator selection for large-scale dynamical systems*,. In Proceedings of the 49th Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, 2015.

17. N. K. Dhingra, M. R. Jovanović, and Z. Q. Luo, *An ADMM algorithm for optimal sensor and actuator selection.* In Proceedings of the 53rd IEEE Conference on Decision and Control, Los Angeles, CA, pages 4039-4044, 2014.
18. David Zoltowski, N. K. Dhingra, F. Lin, and M. R. Jovanović, *Sparsity-promoting optimal control of spatially-invariant systems.* In Proceedings of the 2014 American Control Conference, Portland, OR, pages 1261-1266, 2014.
19. N. K. Dhingra, F. Lin, M. Fardad and M. R. Jovanović, *On identifying sparse representations of consensus networks.* In Proceedings of the 3rd IFAC Workshop on Distributed Estimation and Control in Networked Systems, Santa Barbara, CA, pages 305-310, 2012.
20. M. Scholten, N. K. Dhingra, T.T. Lu and T.H. Chao, *Optimization of support vector machine (SVM) for object classification.* In SPIE Defense, Security, and Sensing, pages 839806-1–839806-9, International Society for Optics and Photonics, 2012.

ABSTRACTS

1. N. K. Dhingra, M. R. Jovanović, P. J. Schmid, *Identification of spatially-localized flow structures via sparse proper orthogonal decomposition*, American Physical Society (APS) Division of Fluid Dynamics, Pittsburgh, PA, 2013.
2. Sr. M.E. Merriam, M. Roberts, Y. Zhang, N. K. Dhingra, A.J. Hart, K.D. Wise, *CNT-modified electrode sites for in vitro and in vivo silicon probe studies.* Biomedical Engineering Society (BMES) Conference, Austin, TX, 2010.

PRESENTATIONS AND POSTER SESSIONS

1. *Leader selection in directed networks*,
55th IEEE Conference on Decision and Controls, Las Vegas, NV, December 2016.
2. *Structured decentralized control of positive systems*,
Los Alamos National Laboratory, Invited Talk, Los Alamos, NM, September 2016.
3. *Sparsity-Promoting Optimal Control of Systems with Invariances and Symmetries*,
NOLCOS 2016, 10th IFAC Symposium on Nonlinear Control Systems, Monterey, CA, August 2016.
4. *On the Optimal Control Problem for a Class of Monotone Bilinear Systems*,
22nd Int'l Symposium on Mathematical Theory of Networks and Systems, Minneapolis, MN, July 2016.
5. *A method of multipliers algorithm for sparsity-promoting optimal control*,
2016 American Control Conference, Boston, MA, July 2016.
(Best presentation in session award)
6. *On the convexity of a class of structured optimal control problems for positive systems*,
2016 European Control Conference, Aalborg, Denmark, June 2016.
7. *Convex design of combination drug therapy*,
IMA Annual Program Year Workshop on Biological Systems and Networks, Minneapolis, MN, 2015.
8. *Optimal sensor and actuator selection for large-scale dynamical systems*,
49th Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, 2015.
9. *Convex synthesis of symmetric modifications to linear systems*,
2015 American Control Conference, Chicago, IL, 2015.
10. *An ADMM algorithm for optimal sensor and actuator selection*,
53rd IEEE Conference on Decision and Control, Los Angeles, CA, 2015.
11. *Optimal sensor and actuator selection for large-scale systems*,
MnDRIVE Robotics, Sensors, and Advanced Manufacturing Kickoff, Minneapolis, MN, April 2014.
12. *Identification of spatially-localized flow structures via sparse proper orthogonal decomposition*,
66th Annual Meeting of the APS Division of Fluid Dynamics, Pittsburgh, PA, November 2013.

13. *On identifying sparse representations of consensus networks*,
3rd IFAC Workshop on Distributed Estimation and Control in Networked Systems, Santa Barbara, CA, September 2012.

14. *Machine Learning for Automatic Target Recognition*,
Jet Propulsion Laboratory Summer Student Seminar, Pasadena, CA, August 2010.

15. *CNT-Modified Electrode Sites for In Vitro and In Vivo Silicon Probe Studies*,
WIMS ERC Industrial Advisory Board Meeting Poster Session, May 2010.

16. *A 3-D Bidirectional Interface System for Neural Mapping Studies*,
WIMS ERC Industrial Advisory Board Meeting Poster Session, May 2009.

17. *A 3-D Bidirectional Interface System for Neural Mapping Studies*,
WIMS ERC Industrial Advisory Board Meeting Poster Session, October 2008.

PROFESSIONAL SERVICE AND ACTIVITIES

Reviewer

IEEE Transactions on Automatic Control.	2013 - present
American Control Conference.	2013 - present
Elsevier Neurocomputing.	2015 - present
Elsevier Automatica.	2016 - present
IEEE Conference on Decision and Control.	2016 - present
IFAC World Congress.	2016 - present

Membership

Institute of Electrical and Electronics Engineers, Control Systems Society.	September 2010 - present
American Physical Society, Physics.	September 2013 - present

Council of Graduate Students Travel Grant Award Reviewer Spring 2013