Kristen A Severson

Contact Information

Department of Chemical Engineering
Massachusetts Institute of Technology
77 Massachusetts Ave, Rm. E19-555
Cambridge, MA 02139

Email: kseverso@mit.edu
Website: kseverso.github.io

Research Interests

Machine learning and data mining, semi-supervised learning, time series analysis, causal inference, graphical models, interpretable predictive modeling, process monitoring, one-class classification, anomaly detection

Application areas: process monitoring, biological assay data, energy systems, electronic healthcare records

Education

Massachusetts Institute of Technology, Cambridge, MA
PhD, Chemical Engineering, minor in Applied Mathematics — Sep 2013 – Expected Spring 2018
GPA: 4.7/5.0

Carnegie Mellon University, Pittsburgh, PA
BS, Chemical Engineering with University Honors — Sep 2007 – May 2011
Additional Major in French and Francophone Studies
GPA: 4.0/4.0

Research Experience

Massachusetts Institute of Technology, Cambridge, MA
Research Assistant — Jan 2014 – Present
Improve prediction accuracy and decision making via novel and adapted machine learning algorithms. A primary focus has been on methods that result in interpretable models, either using visualizations or parsimonious models, and can be applied to real datasets, such as my work on model building in the presence of missing data.

Carnegie Mellon University, Pittsburgh, PA
Undergraduate researcher — Sept 2010 – May 2011
Optimized the design of a process for a biodiesel production facility with four possible reaction technologies while simultaneously performing heat integration.

Professional Experience

ExxonMobil, Fairfax, VA
Pricing Analyst — Jul 2011 – Jul 2013
Responsible for managing pricing for three lines of business in two countries with a production of 290k barrels per day. Performed market studies to predict pricing from substitutes including re-refined, "green" and replacement technologies.

Asphalt Planning Intern — Summer 2010
Conducted a global market study of margins and developed a database for automated storage of market information where the results were used to evaluate contracting practices for the Mediterranean export market.

Honors

Computing and System Technology Director's Student Presentation Award, Finalist — Fall 2017
AIChE Computing and System Technology Director's Award — Fall 2015
BioMan Summit Poster Competition 3rd place — Fall 2015
David H. Koch Graduate Fellowship — Fall 2013 – Spring 2014
National Science Foundation Graduate Fellowship Honorable Mention — Spring 2013
Undergraduate Environmental Research Award, Carnegie Mellon University — Spring 2011

Richard Schoenwald Phi Beta Kappa Prize, Carnegie Mellon University — Spring 2011
AIChE-Pittsburgh 2011 Professional Promise Award — Spring 2011
AIChE 2009 Donald F. Othmer Sophomore Academic Excellence Award — Fall 2009
Andrew Carnegie Scholarship — Fall 2007 – Spring 2011
National Merit Scholar — Fall 2007 – Spring 2011

PUBLICATIONS

M.S. Hong, K. Severson, M. Jiang, A.E. Lu, J.C. Love, and R.D. Braatz. Challenges and opportunities in biopharmaceutical manufacturing control. *Computers & Chemical Engineering*, submitted.

M. Jiang†, K.A. Severson†, J.C. Love, H. Madden, P. Swan, L. Zang, and R.D. Braatz. Opportunities and challenges of real-time release testing for biopharmaceutical manufacturing. *Biotechnology & Bioengineering*, accepted.

K.A. Severson, M.C. Molaro, and R.D. Braatz. Methods for applying principal component analysis to process datasets with missing values. Special Issue on Process Data Analytics, *Processes*, 5:38, 2017.

K.A. Severson, J.G. VanAntwerp, V. Natarajan, C. Antoniou, J. Thömmes, and R.D. Braatz. A systematic approach to process data analytics in pharmaceutical manufacturing: The data analytics triangle and its application to the manufacturing of a monoclonal antibody. In *Multivariate Analysis in the Pharmaceutical Industry*, edited by A. P. Ferreira, J. C. Menezes, and M. Tobyn, Elsevier, in press.

K.A. Severson, B. Monian, J.C. Love, and R.D. Braatz. A method for learning a sparse classifier in the presence of missing data for high-dimensional biological datasets. *Bioinformatics*, in press. doi: 10.1093/bioinformatics/btx224

K. Severson, P. Chaiwatanodom, and R. D. Braatz. Perspectives on process monitoring of industrial systems. *Annual Reviews in Control*, 42:190-200, 2016.

K. Severson, J.G. Van Antwerp, V. Natarajan, C. Antoniou, J. Thömmes, and R.D. Braatz. Elastic net with Monte Carlo sampling for data-based modeling in biopharmaceutical manufacturing facilities. *Computers & Chemical Engineering*, 80:30-36, 2015.

K. Severson, A. Martínez, and M. Martín. PTC Mathcad® for Chemical Engineering. In *Introduction to Software for Chemical Engineers*, edited by M. Martín, Taylor and Francis, Boca Raton, Florida, Chapter 5, 2014.

K. Severson, M. Martín, and I.E. Grossmann. Optimal integration for biodiesel production using bioethanol. *AIChE Journal*, 59:834-844, 2012.

C. Baker, J. Mathews, L. McKee, K. Severson, R. Bradley, N. Kolluri, A. McCloskey, M. Walters, M. Martín, and I.E. Grossmann. *Conceptual Design of the Supply Chain and Production Facility of Lignocellulosic Bioethanol via Hydrolysis*. CACHE Design Case Study Vol. 10, CACHE, Austin, Texas, 2011.

† Indicates shared first author

PROFESSIONAL SERVICE

Graduate Student Advisory Board, Massachusetts Institute of Technology — Mar 2014 – Present
Elected class representative. Participate in a committee to advise the department of graduate student body concerns. Created a professional development series focusing on connecting current students with alumni. Served on the review panel for Dow-sponsored Travel Awards for ten cycles.

Reviewer for various journals and conferences including Journal of Process Control, Computers & Chemical Engineering, Processes, IEEE Conference on Decision and Control, World Congress of the International Federation of Automatic Control

PRESENTATIONS

K.A. Severson. Invited. *2017 Smith School Distinguished Junior Researchers Seminar*, Ithaca, November 2017, to be presented.

K.A. Severson, P. Chaiwatanodom, M.C. Molaro, and R.D. Braatz. Semi-supervised anomaly detection for production oil wells, *AIChE Annual Meeting,* Minneapolis, October 2017, to be presented.

K.A. Severson and R.D. Braatz. The data analytics triangle. Invited. *AIChE Spring Meeting, 3rd Big Data Analytics*, San Antonio, March, 2017.

K. Severson, B. Monian, J. C. Love, and R. D. Braatz. A method for learning a sparse classifier in the presence of missing data for high-dimensional biological datasets, *AIChE Annual Meeting*, San Francisco, November 2016.

K. Severson, J. G. VanAntwerp, V. Natarajan, C. Antoniou, J. Thömmes, and R. D. Braatz. Elastic net with Monte Carlo sampling for data-based modeling in biopharmaceutical manufacturing facilities, *AIChE Annual Meeting*, Salt Lake City, November 2015.

K. Severson, J. G. VanAntwerp, V. Natarajan, C. Antoniou, J. Thömmes, and R. D. Braatz. A case study of data analytics for the manufacture of a monoclonal antibody, *AIChE Annual Meeting*, Salt Lake City, November 2015.

K. Severson, M. Martín, I. E. Grossmann. Simultaneous optimization and heat integration for the production of algae-based biodiesel using bioethanol. *AIChE Annual Meeting*, Pittsburgh, October 2012.

Teaching & Mentorship

Massachusetts Institute of Technology — Fall 2015
Teaching Assistant – Numerical Methods
Created content for weekly recitations for a class of fifty graduate students in chemical engineering. Supported discussion forums, online and in person, as well as managed course materials.

Massachusetts Institute of Technology — Fall 2015 – Present
First-year graduate student mentor
Meet and advise first-year students concerning issues pertaining to the first year of graduate school.

Massachusetts Institute of Technology — Summer 2017
Summer research advisor
Advised an undergraduate computer science student on a project to use data-driven modeling using incremental capacity analysis data for lithium-ion batteries.

Skills

Proficient in Matlab, Python, R, Julia, GAMS, Git, SQL, Mathcad

Leadership

Graduate Women at MIT, Massachusetts Institute of Technology — Apr 2015 – Present
Department representative. Advertise programming for graduate women at MIT.

Women's Interest Network, ExxonMobil — Jan 2013 – Jul 2013
Treasurer. Managed the budget for the women's employee resource group at ExxonMobil.

Society of Women Engineers, Carnegie Mellon University — Jan 2009 – Nov 2010
Co-chair, technical career fair. Co-organized a two-day career fair for over 200 companies.

Society Memberships

American Institute of Chemical Engineers (AIChE)