Center for Financial Studies
Workshop 2018
Artificial Intelligence and Machine Learning in Financial Services

April 27, 2018
Center for Biotechnology and Interdisciplinary Studies Auditorium,
Rensselaer Polytechnic Institute

Workshop Chair
Professor Chanaka Edirisinghe, Kay and Jackson Tai ’72 Chair Professor
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Register on our site at lallyschool.rpi.edu/center-financial-studies or https://www.eventbrite.com/e/april-27-center-for-financial-studies-workshop-2018-tickets-43102557911?aff=ebdssbcitybrowse
## Agenda

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<th>Time</th>
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<td>8:00–8:30 a.m.</td>
<td>Pick up registration material and Breakfast</td>
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<td>8:30–8:45 a.m.</td>
<td>Professor Chanaka Edirisinghe welcome and Dean Tom Begley introduction</td>
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<td>8:45–9:00 a.m.</td>
<td>Opening Remarks by Dr. Shirley Ann Jackson, President, Rensselaer Polytechnic Institute; Professor of Physics, Applied Physics &amp; Astronomy; Professor of Engineering Sciences</td>
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| 9:00–10:00 a.m.| Reinert Lecture: Trends and developments in AI for financial applications  
                      Dr. Kathryn Guarini, VP Research Strategy, IBM  
                      Session Chair: Dean Tom Begley, Lally School of Management, RPI |
| 10:00–11:00 a.m.| Dr. Marco Enriquez, Securities and Exchange Commission  
                          Title: Just Don’t Call it “Robocop”: Machine Learning Pipelines for Analyzing SEC Filings  
                          Professor Agostino Capponi, Columbia University  
                          Title: Human/Machine Interface for Robo-Advising  
                          Session Chair: Professor Chanaka Edirisinghe, Lally School of Management, RPI |
| 11:00–11:15 a.m.| Coffee break (provided for registered attendees)                     |
| 11:15 a.m.–12:15 p.m.| Dr. Akhtar Siddique, Deputy Director, Enterprise Risk and Analysis Division, OCC  
                          Title: Risk Measurement with Machine Learning Techniques  
                          Session Chair: Professor Brian Clark, Lally School of Management, RPI |
| 12:15–1:30 p.m.| Lunch (brown bag provided for registered attendees)                  |
| 1:30–2:30 p.m.| Panel Discussion  
                          AI/ML Trends in Financial Applications  
                          Ms. Anna Kircher, Lendable Marketplace; Dr. Kumar Bhaskaran, IBM; and  
                          Dr. Amanda Stent, Bloomberg  
                          Session Chair: Mr. James Savage (Head, Data Science, Lendable) |
| 2:30–3:30 p.m.| Professor Murray Frank, University of Minnesota  
                          Title: Using Machine Learning to Measure Corporate Productivity  
                          Dr. Paul Goldsmith-Pinkham, Federal Reserve Bank of NY  
                          Title: Effects of Machine Learning on Credit Markets and Lending  
                          Session Chair: Professor Bill Francis, Lally School of Management, RPI |
| 3:30–3:45 p.m.| Coffee break (provided for registered attendees)                     |
| 3:45–4:45 p.m.| Professor John Christian, School of Engineering (SOE), RPI: AI and Space Exploration  
                          Professor Rich Radke, SOE, RPI: Building Occupant-Aware Environments  
                          Professor Qiang Ji, SOE, RPI: Human-centered AI for Enhanced Human Behavior Understanding and Interactions  
                          Session Chair: Dean Shekhar Garde, School of Engineering, RPI |
| 4:45–5:00 p.m.| Lally Finance Research featuring Professors Brian Clark, Aparna Gupta, and Tom Shohfi |
| 5:00–5:15 p.m.| Concluding remarks by Chair                                         |
| 6:00–9:00 p.m.| Dinner at Heffner Alumni House – for registered attendees only.       |
Speakers and Panelists

Reinert Lecture - 9:00–10:00 a.m.

Trends and developments in AI for financial applications

Dr. Kathryn Guarini
Vice President, Research Strategy, IBM

Dr. Kathryn Guarini is Vice President for IBM Research Strategy, where she drives technology strategy for the global research community at IBM. Her focus includes forward-looking technology vision as well as cross-research strategic initiatives such as IBM’s Global Technology Outlook. She is also responsible for establishing and driving the IBM Industry Research agenda for Financial Services. Previously, Kathryn was IBM Vice President, Offering Management for z Systems and LinuxONE, where she drove mainframe platform growth focus areas including Cloud, Analytics, Mobile, Security, Linux, and Industry Solutions. In 2015 her team launched LinuxONE, a trusted, efficient, and powerful platform for enterprise-grade Linux.

Kathryn has held various technical, management, and executive positions in research, development, and business. She has led large global teams to deliver complex solutions that meet the ever-changing needs of IT customers. From requirements gathering through innovative design implementation to customer support, Kathryn has played important product development leadership roles including enterprise microprocessor design and systems technology development. She is also experienced in technical strategy and leadership development.

Kathryn’s innovative technical research in semiconductor device integration and nanotechnology has been recognized with various industry awards. She holds more than 65 U.S. patents and she is a prolific writer with over 60 technical publications. Kathryn received a Ph.D. from Stanford University and a B.S. degree from Yale University, both in applied physics. She is active in mentoring, inspiring, and recruiting scientists and engineers of all ages, especially women.

Speakers - 10:00–11:00 a.m.

Just Don’t Call it “Robocop”: Machine Learning Pipelines for Analyzing SEC Filings

Dr. Marco Enriquez
Securities and Exchange Commission, Washington, D.C.

Marco is an Applied Mathematician in the Division of Economic and Risk Analysis (DERA) at the Securities and Exchange Commission (SEC). At DERA, he runs multiple programs which involve the utilization of machine learning algorithms to aid detection of market misconduct. Prior to joining the SEC, Marco was employed at MITRE, where he analyzed large-scale aviation datasets for trends and outliers. During his time at MITRE, he also authored award-winning articles on topics ranging from clustering flight trajectory time-series data to text-mining transcribed air traffic controller speeches. Marco holds a M.A. and Ph.D. in computational and applied mathematics from Rice University, and a B.S. in computer engineering and mathematics from Tufts University.
Speakers - 10:00–11:00 a.m. (continued)

Human/Machine Interface for Robo-Advising

Professor Agostino Capponi
Assistant Professor, Industrial Engineering and Operations Research, Columbia University

Agostino’s research interests are in systemic risk and financial stability, economics of clearinghouses, market microstructure, and human-machine interaction systems. He serves as an External Consultant at the U.S. Commodity Futures Trading Commission, Office of the Chief Economist, on topics related to clearinghouse collateral requirements and financial stability. His research has been funded by the NSF, DARPA, the Institute for New Economic Thinking, and the Global Risk Institute. He is a recipient of the NSF CAREER award, a prize from the MIT Center for Finance and Policy and the Harvard Crowd Innovation Laboratory, and the Bar-Ilan prize for general research in financial mathematics.

Agostino serves on the editorial boards of Mathematical Finance, Applied Mathematical Finance, Operations Research Letters, and as the Department Editor of the Institute of Industrial Engineering Transactions. He also serves as the program director of the SIAM activity group in Financial Mathematics and Engineering. Agostino received his Master’s degree and Ph.D. in computer science and applied and computational mathematics from the California Institute of Technology, respectively in 2006 and 2009.

Lecture - 11:15 a.m.–12:15 p.m.

Risk Measurement with Machine Learning Techniques

Dr. Akhtar Siddique
Deputy Director, Enterprise Risk and Analysis Division, Office of the Comptroller of the Currency

Dr. Akhtar Siddique taught at the McDonough School of Business at Georgetown University after his Ph.D. in finance from Duke University. His research has spanned financial econometrics, financial institutions, capital adequacy, stress testing, asset pricing, corporate finance and numerical methods/optimization. He has authored numerous papers published in peer-reviewed journals such as the Journal of Finance, Review of Financial Studies, Management Science, Journal of Accounting Research, Naval Research Logistics, etc., and has been cited in the New York Times, Forbes, USA Today, etc. He has edited (and written several chapters of) a book on stress testing published by Risk books, Stress Testing: Approaches Methods and Applications, parts of which are used as readings for certification programs in risk management such as the FRM.

Currently he works at the Office of the Comptroller of the Currency (OCC), where he helps manage a staff of Ph.D. financial economists who work on bank supervision, research, and policy along with his own work in the same areas. He has continued to be involved in research and teaching in finance, for example as a Research Professor at University College Dublin and teaching at the IMF Institute. His current research interests include methods to analyze big data such as machine learning and new methodologies in financial econometrics.
Panel Discussion - 1:30–2:30 p.m.
AI/ML Trends in Financial Applications

Ms. Anna Sofia Kircher
Data Scientist, Lendable Marketplace
Anna Sofia Kircher is a data scientist at Lendable. She holds a Master’s degree in Mathematics in Economics and Statistics from the Technical University of Vienna. In her work at Lendable, she utilizes data and improves data science tools to help alternative lenders in Eastern Africa to raise money to finance their lending. Prior to joining Lendable she worked in the field of renewable energy where she was modelling energy markets and monitoring wind turbines with special focus on icing events. Kircher is very interested in developing sophisticated methods that are combining statistical models and machine learning tools.

Dr. Kumar Bhaskaran
Program Director, IBM Industry Research
Dr. Kumar Bhaskaran is a research scientist in industry solutions, systems and technologies. His current areas of focus are in applying AI, Blockchain, IoT, and Quantum Computing to the Financial Services Industry. He has 30+ years of experience in leading R&D teams worldwide. More recently he was the Lab Director in Singapore and the Chief Strategist for IBM Research in the Growth Markets.

Kumar is a mechanical and industrial engineer by training and has a Ph.D. from Rensselaer Polytechnic Institute. More details on Kumar can be seen here: https://www.linkedin.com/in/kbhaskaran.

Dr. Amanda Stent
NLP Researcher at Bloomberg
Amanda Stent is a Natural Language Processing (NLP) architect at Bloomberg LP. Previously, she was a director of research and principal research scientist at Yahoo Labs, a principal member of technical staff at AT&T Labs - Research, and an associate professor in the Computer Science Department at Stony Brook University. Her research interests center on natural language processing and its applications, in particular topics related to text analytics, discourse, dialog and natural language generation. She holds a Ph.D. in computer science from the University of Rochester. She is co-editor of the book Natural Language Generation in Interactive Systems (Cambridge University Press), has authored over 90 papers on natural language processing, and is co-inventor on over twenty patents and patent applications. She is president emeritus of the ACL/ISCA Special Interest Group on Discourse and Dialog, treasurer of the ACL Special Interest Group on Natural Language Generation, and one of the rotating editors of the journal Dialogue & Discourse. She is also a board member of CRA-W, where she co-edits the newsletter.

Moderator
Mr. James Savage
Head of Data Science at Lendable
Jim Savage is the head of data science at Lendable, a technology-driven frontier markets lender. Before that, he was an economist at the Grattan Institute, an Australian think tank, and in the macro-econometric modeling unit at the Australian Treasury. In 2014, he was also a fellow at the University of Chicago’s Data Science for Social Good fellowship. He works in Bayesian workflow, discrete-choice modeling, Bayesian agent-based time-series models, causal inference, and machine learning.
Using Machine Learning to Measure Corporate Productivity

Abstract: Corporate productivity estimation is a major current econometric challenge. In this paper we adopt ML methods including the Lasso and Stochastic Gradient Boosting to study this problem. The resulting estimates of corporate-level total factor productivity (TFP) help to account for debt and equity issuing (and repurchasing) decisions by firms. Given the efficacy of the ML methods, they are likely to become widely adopted in corporate finance research in the near future.

Professor Murray Frank
Professor of Finance, University of Minnesota

Professor Murray Zed Frank is Professor of Finance at University of Minnesota since 2005 and President of the Midwest Finance Association 2017-2018. He has a long-term interest in the use of machine learning and natural language methods in finance, starting with “Is All That Talk Just Noise? The Information Content of Internet Stock Message Boards,” 2004 Journal of Finance (with W. Antweiler), and continuing through “How Does the Stock Market Absorb Shock?” forthcoming, Journal of Financial Economics (with A. Sanati). He was the winner of the Citations of Excellence Award 2014 (with V. Goyal) for one of the most heavily cited papers over the past 15 years in all of management and business.

He is also Special Term Professor, Shanghai Advanced Institute of Finance, Shanghai Jiao Tong University since 2014, Professor, UBC 1992-2005, and a former associate editor of the Review of Financial Studies. Professor Frank received his Ph.D. in economics from Queens University in 1985 and his master's in economics from the University of Alberta in 1981.

Effects of Machine Learning on Credit Markets and Lending

Dr. Paul Goldsmith-Pinkham
Economist, Federal Reserve Bank of New York

Paul Goldsmith-Pinkham is a Financial Economist in the Research and Statistics Group of the Federal Reserve Bank of New York, where he has worked since 2015. His research interests include consumer and corporate finance, econometrics, and social networks. His current work focuses on assessing the costs and benefits of debtor protection policies and understanding the role that consumer debt plays in the macro-economy. Paul completed his Ph.D. in economics from Harvard in 2015.

Speakers - 3:45–4:45 p.m.

Professor John Christian
Assistant Professor, Dept. of Mechanical, Aerospace, and Nuclear Engineering, Rensselaer Polytechnic Institute

Dr. John Christian directs RPI’s Sensing, Estimation, and Automation Laboratory (SEAL) and pursues a research program focused on autonomous spacecraft navigation, computer vision, planetary science, and spacecraft design. Previously, Dr. Christian was on the faculty at West Virginia University (WVU). Before joining academia, he worked as an engineer in the Guidance, Navigation, and Control (GNC) Autonomous Flight Systems Branch at the NASA Johnson Space Center (JSC) in Houston, Texas. Dr. Christian holds a B.S. and M.S. from the Georgia Institute of Technology and a Ph.D. from the University of Texas at Austin.
Professor Richard J. Radke  
*Professor, Dept. of Electrical, Computer, and Systems Engineering, Rensselaer Polytechnic Institute*

Professor Radke's research involves computer vision problems related to human-scale, occupant-aware environments, such as person tracking and re-identification with cameras and range sensors. He received an NSF CAREER award in March 2003 and was a member of the 2007 DARPA Computer Science Study Group. Dr. Radke is a Senior Member of the IEEE and a Senior Area Editor of IEEE Transactions on Image Processing. He is the author of the textbook *Computer Vision for Visual Effects*, published by Cambridge University Press in 2012. He has B.A. and M.A. degrees in computational and applied mathematics from Rice University, and M.A. and Ph.D. degrees in electrical engineering from Princeton University.

Professor Qiang Ji  
*Professor, Dept. of Electrical, Computer, and Systems Engineering, Rensselaer Polytechnic Institute*

Professor Ji's research interests are in computer vision, probabilistic machine learning, and their applications. He was a program director at the NSF, where he managed NSF's computer vision and machine learning programs. He has published over 230 papers, received multiple awards for his work, serves in several journal editorial boards, and he is a fellow of the IEEE and the IAPR. He also held teaching and research positions at University of Illinois at Urbana-Champaign, Carnegie Mellon University, and University of Nevada at Reno. He received his Ph.D. degree in electrical engineering from the University of Washington.

Speakers - 3:45–4:45 p.m. (continued)

**Speakers - 4:45–5:00 p.m.**

*Lally faculty research that intersects learning technologies and financial applications*

**Professors Brian Clark, Aparna Gupta, and Tom Shohfi**  
*Accounting and Finance, Lally School of Management, RPI*

This joint presentation highlights financial applications of textual analytics where topic models for feature selection is used for clustering, as well as understanding how behavior of analysts during conference calls may be impacted due to the deployment of ML. Moreover, the use of ML techniques for developing network-based measures of systemic risk are addressed, which are invaluable in the understanding of financial system stability.

About Rensselaer Polytechnic Institute

Rensselaer Polytechnic Institute, founded in 1824, is America's first technological research university. For nearly 200 years, Rensselaer has been defining the scientific and technological advances of our world. Rensselaer faculty and alumni represent 86 members of the National Academy of Engineering, 17 members of the National Academy of Sciences, 25 members of the American Academy of Arts and Sciences, 8 members of the National Academy of Medicine, 8 members of the National Academy of Inventors, and 5 members of the National Inventors Hall of Fame, as well as 6 National Medal of Technology winners, 5 National Medal of Science winners, and a Nobel Prize winner in Physics. With 7,000 students and nearly 100,000 living alumni, Rensselaer is addressing the global challenges facing the 21st century—to change lives, to advance society, and to change the world. To learn more, go to www.rpi.edu.