

Curriculum Vitae

Christopher G. Brinton, PhD

CONTACT INFORMATION

Zoomi Inc.
Department of Advanced Research
101 Lindenwood Drive
Malvern, PA 19355

Email: chris.g.brinton@gmail.com
Phone: (908) 723-3710
Homepage: www.cbrinton.net

PROFESSIONAL EXPERIENCE AND APPOINTMENTS

Zoomi Inc., Malvern, PA (www.zoomiinc.com)

Head of Advanced Research

May 2016 – Present

Consulting Head of Research

Feb 2014 – May 2016

Co-founder

Jun 2013 – Present

Research Intern

Jun 2013 – Aug 2013

- Zoomi is a learning technology company that empowers client courses with predictive analytics and content personalization, currently serving the corporate training, private tutoring, and higher education spaces.
- I co-founded Zoomi in early 2013. Many of my algorithms for big learning data analytics, social learning networks, and individualization have been and are being incorporated in Zoomi platforms.
- In addition to directing the team of researchers, I also play substantial roles in customer engagement, messaging, investor demonstrations, and product design/development.

The College of New Jersey, Ewing, NJ

Adjunct Professor of Engineering

Aug 2016 – Present

- Teach Advanced Engineering Math II, a course on probability, statistics, and partial differential equations.

EDUCATION

Princeton University, Princeton, NJ

Doctor of Philosophy in Electrical Engineering

May 2016

- Research on improving the quality of student learning has resulted in several papers, published in venues like IEEE Transactions on Learning Technologies (TLT), Transactions on Signal Processing (TSP), and Conference on Computer Communications (INFOCOM), patents, and invited talks. Thesis won the *2016 Bede Liu Best Dissertation Award in Electrical Engineering*.
- First author of textbook *The Power of Networks: Six Principles That Connect Our Lives*, which was featured in TIME and is being used to teach courses around the world.
- Co-instructor of an online course to over 250,000 students since 2012, and lead TA of a Princeton course led to *Outstanding Teaching Assistant Award*.

Masters Degree in Electrical Engineering – GPA 3.86/4.00

May 2013

- Optimization/Probability Courses: Linear Optimization, Linear Systems Theory, Advanced Optimization, Computational Stochastic Optimization, Random Processes in Information Systems
- Networking/Communications Courses: Advanced Computer Networks, Advanced Topics in Social / Technical / Economic Networks, Lightwave Communications

The College of New Jersey, Ewing, NJ

Bachelor of Science in Electrical Engineering – GPA 3.98/4.00

May 2011

- Valedictorian of the School of Engineering, Summa Cum Laude

RESEARCH EXPERIENCE

PhD Research

May 2013 - May 2016

The focus of my PhD research was developing methods and systems to improve the quality of student learning. In particular, I have pursued the following three thrusts:

- *Big Learning Data Analytics (BLDA)*: Learning technology platforms today have the ability to collect a plethora of behavioral data about students as they interact with course material. Using “big” datasets generated from hundreds of thousands of students in Massive Open Online Courses (MOOCs) that I co-instruct, I have analyzed learner behavior to extract patterns associated with performance, and used the results to design prediction algorithms based on machine learning for early detection. The identified patterns help to dispel ambiguity about which types of behaviors are associated with efficacy.
- *Social Learning Networks (SLN)*: Social learning is a critical component of the educational process, especially when teacher-to-student ratios are small. I have studied SLN formation across several dozens of MOOC forums, with data obtained through coding appropriate web-crawling infrastructure. I have also designed a method for quantifying the efficiency of information propagation in an SLN, comparing the observed network to a benchmark of maximum utility obtained through optimization. To evaluate this, I developed “big” algorithms to optimize over millions of variables, and witnessed that much can be gained through SLN optimization.
- *Integrated and Individualized Courses (IIC)*: Integrating multiple modes of learning into a course platform allows for cognitive reinforcement from different perspectives. It also yields more information by which learning behavior can be modeled. I have taken part in the design and development of (i) a platform for IIC course delivery to students, with a machine learning individualization engine based on user behavior, and (ii) a dashboard for visualizing analytics of user behavior to the respective IIC instructors. I have conducted user trials on MOOC, and witnessed improved learner engagement in an IIC compared to a control group.

Masters Research

Sept 2011 - May 2013

For my master’s degree research, I worked primarily on network topology optimization:

- *Cache Placement for CDNs*: The proliferation of video traffic has resulted in network congestion. Together with SES America, I investigated a satellite-based overlay to terrestrial Content Delivery Networks (CDNs), with cache placement in the CDN at various hops from end users, to leverage global and local popularity of video content. I evaluated the effect of cache location and cache update algorithm on the hit rate and network bandwidth savings.
- *Topology Optimization for Smart Grid Networks*: One major limitation of renewable energy is its cost. In an effort to counteract this, I formulated and solved problems to minimize the transmission cost associated with power flow in a network by finding the optimal placement and sizing of renewable energy generators. These optimization problems are non-convex and stochastic, which required development of efficient techniques to solve them.

Undergraduate Research

Jun 2009 - May 2011

As an undergraduate, I researched methods for signal quality improvement in different types of systems:

- *Optical Networks*: Working in an optical communications systems lab, I took part in modifications to TDM Passive Optical Networks (PON) for extended commercial reach, and in demonstrating a cost-effective broadcast overlay for WDM PON. I also designed an RF pre-compensator circuit to correct for a poor modulation response.
- *Digital Filtering for SNR Improvement*: I compared the efficacy of various digital filtering algorithms (*e.g.*, adaptive, moving average) in improving the Signal to Noise Ratio (SNR) for magnetic resonance instrumentation.
- *Reverse IMD Mitigation*: I took part in investigating the sensitivity of different types of power amplifiers to Reverse Intermodulation Distortion (IMD), and in developing techniques for mitigating the resulting distortion.

PUBLICATIONS, PATENTS, AND TALKS

Books

- C. Brinton, M. Chiang. The Power of Networks: Six Principles that Connect our Lives. *Princeton University Press*, 2016.
- C. Brinton, M. Chiang. Networks Illustrated: 8 Principles Without Calculus. *EdWiser Scholastic Press*, 2013.

Journal Papers

- T. Yang, C. Brinton, C. Joe-Wong, M. Chiang. Behavior-Based Grade Prediction for MOOCs via Time Series Neural Networks. To appear, *IEEE Journal of Selected Topics in Signal Processing: Special Issue on Machine Learning for Education*, 2017.
- C. Brinton, S. Buccapatnam, M. Chiang, H. V. Poor. Mining MOOC Clickstreams: Video-Watching Behavior versus In-Video Quiz Performance. *IEEE Transactions on Signal Processing*, Vol. 64, No. 14, p. 3677-3692, 2016.
- C. Brinton, R. Rill, S. Ha, M. Chiang, R. Smith, W. Ju. Individualization for Education at Scale: MIIC Design and Preliminary Evaluation. *IEEE Transactions on Learning Technologies*, Vol. 8, No. 1, p. 136-148, 2015.
- C. Brinton, M. Chiang, S. Jain, H. Lam, Z. Liu, F. Wong. Learning about social learning in MOOCs: From statistical analysis to generative model. *IEEE Transactions on Learning Technologies*, Vol. 7, No. 4, p. 346-359, 2014.
- K. Reichmann, P. Iannone, C. Brinton, et al. A Symmetric-Rate, Extended-Reach 40Gb/s CWDM-TDM PON with Downstream and Upstream SOA-Raman Amplification. *IEEE Journal of Lightwave Technology*, Vol. 30, No. 4, p. 479-485, 2012.
- C. Brinton, M. Wharton, A. Katz. Design and Demonstration of a Passive, Broadband Equalizer for an SLED. *IEEE Microwave Journal*, 2012.
- C. Brinton, D. Hirsh. Sensitivity Enhancement in Continuous-Wave Electron Paramagnetic Resonance: Adaptive Signal Averaging versus a Moving Average. *Review of Scientific Instruments*, Vol. 81, No. 2, 2010.

Conference Papers

- A. Lan, C. Brinton, T. Yang, M. Chiang. Behavior-Based Latent Variable Model for Learner Engagement. *International Conference on Educational Data Mining (EDM)*, 2017.
- W. Chen, C. Brinton, D. Cao, M. Chiang. Behavior in Social Learning Networks: Early Detection for Online Short-Courses. *IEEE INFOCOM*, 2017.
- L. Zheng, C. Joe-Wong, J. Chen, C. Brinton, C. Tan, M. Chiang. Economic Viability of a Virtual ISP. *IEEE INFOCOM*, 2017.
- C. Brinton, S. Buccapatnam, F. Wong, M. Chiang, H. V. Poor. Social Learning Networks: Efficiency Optimization in MOOC Forums. *IEEE INFOCOM*, 2016.
- L. Zheng, C. Joe-Wong, C. Brinton, C. Tan, S. Ha, M. Chiang. On the Viability of a Cloud Virtual Service Provider. *ACM SIGMETRICS*, 2016.
- C. Brinton, M. Chiang. MOOC Performance Prediction via Clickstream Data and Social Learning Networks. *IEEE International Conference on Computer Communications (INFOCOM)*, 2015.
- C. Brinton, M. Chiang. Social Learning Networks: A Brief Survey. *48 Annual Conference on Information Science and Systems (CISS)*, 2014.
- C. Brinton, E. Aryafar, S. Corda, S. Russo, R. Renoso, M. Chiang. An Intelligent Satellite Multicast and Caching Overlay for CDNs to Improve Performance in Video Applications. *31st AIAA International Communications Satellite Systems Conference (ICSSC)*, 2013.

P. Iannone, K. Reichmann, C. Brinton, et al. Experimental Demonstration of a Cost-Effective Broadcast Overlay for a Commercial WDM PON. *National Fiber Optic Engineers Conference (NFOEC)*, 2011.

P. Iannone, K. Reichmann, C. Brinton, et al. Bi-Directionally Amplified Extended Reach 40Gb/s CWDM-TDM PON with Burst-Mode Upstream Transmission. *Optical Fiber Communication Conference (OFC)*, 2011.

A. Katz, D. Magee, C. Brinton, and J. Qiu. Sensitivity and Mitigation of Reverse IMD in High Power Amplifiers. *2011 IEEE Topical Conference on Power Amplifiers for Wireless and Radio Applications (PAWR)*, 2011.

Patent Applications

C. Brinton, R. Rill, M. Chiang, S. Ha, W. Ju, J. Walker, D. Cao, W. Chen. Systems and Methods for Integrating an eLearning Course Delivery Platform with an Enterprise Social Network. *U.S. Patent #14/876,239*. Filed Oct 2015.

C. Brinton, M. Chiang, S. Ha, W. Ju, R. Rill, J. Walker. Systems and Methods for Authoring an Integrated and Individualized Course or Textbook. *U.S. Patent #14/829,202*. Filed Aug 2015.

C. Brinton, M. Chiang, S. Ha, W. Ju, R. Rill, J. Walker. Systems and Methods to Assist an Instructor of a Course. *U.S. Patent #14/712,108*. Filed May 2015.

M. Chiang, S. Ha, R. Rill, C. Brinton, W. Ju. Methods and Systems for Creating, Delivering, Using, and Leveraging Integrated Teaching and Learning. *U.S. Patent #14/063,289*. Filed Oct. 2013.

Research Proposals

“Big Data Analytics for 4G/5G Networks and Applications,” Submitted to Global Research Laboratory (GRL) Program, 2015. (PI: J. Hong, M. Chiang)

“Social Learning Networks,” Submitted to Networking Technology and Systems (NeTS), 2014. (PI: M. Chiang)

“Social Learning Networks: From Data Analytics to Active Sensing.” Awarded, Army Research Office (ARO) grant W911NF-14-1-0190, 2014. (PI: M. Chiang)

“Individualization for Effective Learning at Scale: Promoting STEM Education and Outreach,” Submitted to Office of Naval Research, 2013. (PI: M. Chiang, C. Brinton)

“Individualization for Effective Learning at Massive Scale,” Submitted to The Eric and Wendy Schmidt Transformative Technology Fund, 2013. (PI: M. Chiang)

“DIP: From Online Courses to Personalized Education,” Submitted to the National Science Foundation (NSF), 2013. (PI: M. Chiang)

Invited Talks, Panels, and Demos

“Utilizing Data Science as a Strategy.” Panelist. Data Science for eLearning, Udemy, San Francisco, CA. Apr 2017.

“The Power of Networks: What Facebook, Cell Phones, and Online Courses Have in Common.” Engineering Week Keynote Lecture, The College of New Jersey, Ewing, NJ. Feb 2017.

“Beyond Assessment Scores: How Behavior Can Give Insight into Knowledge Transfer.” Invited talk. NIPS Workshop on Machine Learning for Education, Barcelona, Spain. Dec 2016.

“The Next Generation of Learning Technologies.” Invited talk. Trenton Computer Festival, Ewing, NJ. Mar 2016.

“Pedagogy and Technology: Leveraging Big Data to Enhance the Quality of Human Learning.” Invited talk. Bell Labs, Murray Hill, NJ. Nov 2015.

“Education Innovation Panel: Pedagogy and Technology.” Panelist. Keller Center 10th Anniversary Symposium, Princeton University, Princeton, NJ. Oct 2015.

“Improving the Quality of Massively Scaled (Human) Learning Through Machine Learning.” Invited Seminar. Department of Computer and Information Sciences, University of Delaware, Newark, DE. May 2015.

“MOOC Performance Prediction via Clickstream Data and Social Learning Networks.” Paper presentation. IEEE INFOCOM, Hong Kong, China. Apr 2015.

“Social Learning Networks: Enhancing the Engagement and Efficacy of Learning.” Invited talk. Applied Communication Sciences, Basking Ridge, NJ. Apr 2015.

“The Importance of Mentoring in my Career and Life.” Panelist. 5th Annual TCNJ School of Engineering Reunion Event, The College of New Jersey, Ewing, NJ. Feb 2015.

“WiFi CSMA: Throughput Derivation via 2D Markov Chain.” Guest lecture. ELE/COS 381: Networks: Friends, Money, and Bytes, Princeton University, Princeton, NJ. Dec 2014.

“Google PageRank: Some Advanced Material and Linear Algebra Review.” Guest lecture. ELE/COS 381: Networks: Friends, Money, and Bytes, Princeton University, Princeton, NJ. Oct 2014.

“Massive Open Online Courses: Reflections, Challenges, and Opportunities.” Panelist. 65th Annual United Nations DPI / NGO Conference (Program: Recovering Stolen Childhoods Through Education: Utilizing the Tools of the Digital Age), New York City, NY. Aug 2014.

“From MOOC to MIIC: Enhancing the Efficacy of Massively Scalable Learning.” Invited Seminar. TCNJ IEEE Student Organization, The College of New Jersey, Ewing, NJ. Apr 2014.

“Applying to Graduate School.” Invited talk. TCNJ Tau Beta Pi Induction Ceremony, The College of New Jersey, Ewing, NJ. Nov 2013.

“Online Courses: Issues and Opportunities.” Panelist. The MOOC Experience: Faculty Reflections, William Patterson University, Wayne, NJ. Oct 2013.

“An Intelligent Satellite Multicast Caching Topology Overlay to CDNs for Improved Performance in Video Applications.” Paper presentation. 31st AIAA ICSSC, Florence, Italy. Oct 2013.

“Practical Issues Dealing with Online Courses / Flipped Courses.” Panelist. The Role of Technology in Postsecondary Education, Princeton University, Princeton, NJ. May 2013.

“Learning Technologies: 3ND and MIIC.” Demo presentation. EDGE Lab Open House, Princeton University, Princeton, NJ. May 2013.

“Analysis and Design of Network Topologies.” Invited Seminar. TCNJ IEEE Student Organization, The College of New Jersey, Ewing, NJ. Apr 2013.

“Sensitivity and Mitigation of Reverse IMD in Power Amplifiers.” Paper presentation. 2011 IEEE PAWR, Phoenix, AZ. Jan 2011.

TEACHING EXPERIENCE

Advanced Engineering Math II (TCNJ)

Aug 2016 - Present

This course covers a range of topics in probability/statistics and partial differential equations. As the instructor for this course, my responsibilities include: Creating and delivering lectures; Creating and delivering exams and homeworks; Grading; and Holding office hours.

Networks Illustrated: Principles Without Calculus (MOOC)

Jun 2013 - Present

This course explains the fundamental principles behind social, economic, and technical networks. Offered on Coursera, it is based on the textbook *The Power of Networks: Six Principles That Connect our Lives* that I co-authored. Relying on analogies, anecdotes, animations, and examples as pedagogical tools, it has no mathematical prerequisites.

- Over 70,000 students have enrolled over three offerings since 2013.
- As an instructor for this course, my responsibilities include: Creating the lecture videos, responding to student questions on the forums, making the homeworks/exams, and offering virtual office hours.

Networks: Friends, Money, and Bytes (MOOC)

Sept 2012 - Present

This is the Massive Open Online Course (MOOC) version of Networks: Friends, Money, and Bytes, on Coursera.

- This was one of the first six MOOCs offered by Princeton. Over 180,000 students have enrolled over six offerings since 2012.
- As the assistant instructor, my responsibilities include: Responding to all student questions on the discussion forums, making the machine-gradable homeworks/exams, and offering virtual office hours.

Networks: Friends, Money, and Bytes (Princeton)

Sept 2012 - Jan 2013

This course teaches social, economic, and technical networks at a level geared towards junior or senior level undergraduates. It is an interdisciplinary elective course, cross listed in EE and CS.

- This was the first-ever offering of a STEM course in “flipped classroom” format at Princeton, meaning that part of the homework was to watch the pre-recorded lecture videos before coming to class, and class time was instead used for discussion. 30 undergraduate students across EE, CS, Math, Economics, and Politics enrolled.
- As the lead TA, my responsibilities included: Managing Q&A sessions and setting up real-time demonstrations during class, making and grading homeworks/exams, and mentoring 10 students in their final course projects.

Fundamentals of Engineering Review: Signal Processing (TCNJ)

Feb 2012, Feb 2013

I instructed a review session in signal processing for undergraduate engineering seniors at The College of New Jersey to help them prepare for the Fundamentals of Engineering (FE) Exam.

MENTORING EXPERIENCE**Senior Thesis**

The Princeton EE Department requires undergraduates to undertake one year of independent study on a coherent theme or project, which forms the senior thesis. I have mentored three of these since 2012:

Ankit Buddhiraju (Sept 2014 - May 2015): *Dynamic Centrality Measures for Financial Contagion: New Paradigms for Modeling Dynamic Graphs across Disciplines*

George Touloumes (Sept 2013 - May 2014): *Visualizing Instructor Feedback for Video-Based Online Courses in Real-Time*

Jian Min Sim (Sept 2012 - May 2013): *Investigation of Information Propagation in Social Search*

Junior/Senior Independent Work

The EE and CS Departments at Princeton encourage their undergraduates to participate in semester or year-long independent work projects in their junior and/or senior years. I have mentored at least seven of these since 2012:

Ankit Buddhiraju (Sept 2013 - May 2014): *The Mercury Model: A Unified Approach to Studying Dynamic Networks*

Harvest Zhang (Sept 2012 - May 2013): *Profiling and Visualizing Student Performance in MOOCs to Enable Adaptation of Course Material*

Rohan Sharma (Sept 2012 - May 2013): *Evaluating Amazon's Ranking Algorithm*

Pranav Ghokale (Sept 2014 - Jan 2015): *TypeAway: Development of a Gesture-Based Typing System*

Vaidhy Murti (Sept 2014 - Jan 2015): *Mod-omate: Automated Moderation on Anonymous Social Media Apps*

Neeta Patel (Sept 2014 - Jan 2015): *Data Analysis of MOOC Video Clickstream Logs*

Ethan Berl (Feb 2013 - May 2013): *Algorithms for Recommending Sequences of Courses for College Students*

Zoomi Research

I direct and supervise work done by the Research team at Zoomi Inc. I have mentored seven people's work so far, three full-time employees and four summer interns:

Amanda Mason-Singh (Feb 2017 - Present): Lead Data Scientist
 Joseph Urciuoli (Sept 2016 - Present): Lead Data Engineer
 Weiyu Chen (Jul 2015 - Present): Lead Data Scientist
 Da Cao (Mar 2015 - Present): Algorithm Engineer
 Advait Chauhan, Derrick Xin, Sean Yun (Jun 2015 - Aug 2015): Undergraduate Summer Interns
 Charlton Lu (Jun 2016 - Aug 2016): High School Summer Intern

AWARDS AND HONORS

Bede Liu Best Dissertation Award in Electrical Engineering (May 2016): Awarded to one graduating PhD student in Princeton's EE Department each year.

INFOCOM Best-in-Session Presentation Award (Apr 2016): Awarded for having the highest rated presentation in the Online Social Networks II Session at INFOCOM 2016.

Yan Huo '94 Graduate Fellowship in Electrical Engineering (Dec 2015): Awarded to three graduate students in Princeton's EE Department each year.

Outstanding Teaching Assistant Award (Sept 2013): Awarded after being an assistant instructor for ELE/COS 381, both at Princeton (in-class) and on Coursera (online).

Princeton University Research Assistantship (Jun 2012 - Present): Awarded full tuition and stipend by Princeton for my PhD research.

Princeton University First Year Fellowship (Sept 2011 - May 2012): Awarded full tuition and additional compensation for my first year of graduate studies at Princeton.

TCNJ School of Engineering Banner Bearer (May 2011): Awarded at graduation for obtaining the highest GPA of all graduating engineers from TCNJ in 2011.

Engineer in Training (Sept 2011): Awarded for passing the Fundamentals of Engineering (FE) exam in 2011.

TCNJ Fred O. Armstrong Scholars Award in Electrical Engineering: Obtained the highest-in-class GPA of Electrical Engineers. Received each year during my undergraduate studies.

TCNJ Merit Scholarship: Award amounting to payment of half tuition throughout my undergraduate studies.

LEADERSHIP ACTIVITIES AND ACADEMIC SERVICES

Organizer / TPC Member

Workshop on Advancing Education with Data. ACM SIGKDD, Aug 2017.

Peer Reviewer

IEEE Transactions on Networking 2016 - Present

IEEE Transactions on Learning technologies 2014 - Present

IEEE Transactions on Emerging Topics in Computing 2015 - Present

Elsevier Computers & Education 2015 - Present

Alumni Interviewer, Princeton University 2016 - Present

- Interview undergraduate applicants and submit reports to aid admissions decisions.

Chief Coordinator and Co-Founder, 3 Nights and Done (3ND) 2012 - Present

- I co-founded 3ND, an open online education platform hosted by Princeton's Edge Lab.
- I coordinated with instructors on course content, and lead outreach efforts to potential students and instructors.

Alumni Mentor, TCNJ School of Engineering *2011 - Present*

- I have mentored roughly 10 TCNJ Electrical Engineering undergraduates since I started graduate school.

President and Co-Founder, TCNJ Engineering Honor Society (now Tau Beta Pi) *2010 - 2011*

- I served as the second President of the TCNJ Engineering Honor Society (EHS), where I established an engineering tutoring program required for all new members prior to initiation.
- I helped in the process of transforming TCNJ EHS to the NJ Zeta Chapter of Tau Beta Pi in 2013.

Vice President, TCNJ IEEE Student Organization *2009 - 2010*

OTHER RESEARCH POSITIONS

Undergraduate Internships

AT&T Labs, Optical Systems Research Group, Middletown, NJ *Jun 2010 - Aug 2010*

Linearizer Technology, RF Research Group, Hamilton, NJ *May 2009 - Dec 2009*

AT&T, Transport Field Technical Support, Bedminster, NJ *Jun 2008 - Aug 2008*

Undergraduate Assistantships

The College of New Jersey, MUSE Research Program, Ewing, NJ *Jun 2009 - Aug 2009*

AFFILIATIONS

IEEE

Member *2016 - Present*

Student Member *2008 - 2016*

Member, Tau Beta Pi (NJ Zeta) Engineering Honor Society *2013 - Present*

Member, Phi Kappa Phi Honor Society *2011 - Present*

Student Member, IEEE Professional Organization *2008 - Present*

CV last updated: April 16, 2017