

ALBERT G. BOULANGER

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Pioneer in far-reaching energy R&D involving intelligent systems and machine learning in electrical power, renewable energy, smart buildings, smart grids and smart cities for over 20 years.

EDUCATION

B.S. Physics, University of Florida
M.S. Computer Science, University of Illinois

EXPERTISE

Skills: data science, machine learning, pattern recognition, forecasting, time series analysis, causal inference, geostatistics, exploratory data analysis, data mining, algorithms, data analysis, computer science, artificial intelligence, program management, programming, software engineering, mathematical modeling, simulations, high performance computing, software development, statistics, knowledge engineering, modeling, system architecture, research, R&D, project management, strategic planning, SQL, Lisp, Python, R, databases, strategic thinking, leadership, management, coherent optical processing, lasers, holography, sustainability, energy, power grids, smart grids, microgrids, smart cities, smart buildings and cleantech.

Special skills: Systems integration, expert and knowledge-based systems, machine learning including the interface between numerical and symbolic algorithms, parallel computing, pattern recognition applied to 4D seismic data, computer representations of complex scientific and engineering objects, visualization, distributed systems, and interoperability. Specialties are complex systems integration and intelligent computational reasoning that interacts with humans within large-scale systems

EXPERIENCE

2005-Present World Team Now, Malibu California.
VP & Director of Technical Strategy (nonprofit, volunteer)

Serves as a board member, VP, and Director of Technical Strategy of the nonprofit environmental and social organization, World Team Now and a partner in a related company, World Team-Building, LLC. Advise, leveraging 30+ years of expertise in science, technology, and energy, on big-picture technical

matters and technical implementation decisions. Lead the Platform Launching Alternative & New Technology & Energy (PLANET) unit within World Team Now which seeks and catalyzes the incubation of technology core to World Team project's mission.

**2005-2017 Center for Computational Learning Systems,
Columbia University New York, New York
Senior Staff Associate**

Employed as Senior Staff Associate with the Center for Computational Learning Systems (CCLS) of Columbia University. Involved in far-reaching energy research and development involving intelligent systems in electrical power, renewable energy, smart buildings, smart grids, and smart cities. Involved in over 15+ industry-sponsored R&D projects resulting in a startup, CALM Energy, and licensing of patents.

Acted as Director of the Smart-X {Cites, Buildings, & Grids} group at CCLS. Recent projects included a reinforcement learning based microgrid controller for Africa villages, and optimal placement of inductive charging stations for electric buses. For Con Edison, recent projects included image processing using deep learning of thermal images to look for trouble in manholes and using causal inference and machine learning to produce a cost vs. benefit study of reliability improvement programs. As part of a partnership with the Rudin Management Company and Selex ES, the Smart-X group developed the machine learning based forecasting and recommendation capability for a commercial product, the Di-BOSS Smart Building Solution.

**1994-2005 Lamont-Doherty Earth Observatory,
Columbia University, Palisades New York.
Senior Staff Associate, 4-D Group**

Worked as Senior Staff Associate in the 4-D Group at the Lamont-Doherty Earth Observatory of Columbia University. Focused on new business development within Roger Anderson's group at Lamont. Also worked on introducing machine learning concepts in asset management of power grids and oil and gas.

Involved in a variety of computer science initiatives within industry consortia, including visualization, system integration, advanced computation, databases, and interoperability. Visualized portfolio management data and results for the industry-sponsored portfolio management consortium. Worked on pattern recognition methods for identifying and tracking changes in oil and gas reservoirs by making use of multiple seismic surveys shot over time. The culmination was the formation of vPatch Inc., which commercialized groundbreaking technology the team developed and prior to that, the licensing the IP to 4D Technology Inc. and Baker Hughes.

2000-2002 CTO, vPatch Technologies Inc., Houston Texas.

Served as CTO for vPatch Technologies, Inc. during a leave of absence from Columbia. vPatch's business focus was to implement wired processes that connect business decision-making and hydrocarbon reservoirs in real time to enable the use of portfolio management, real-options, EVA and other modern techniques to plan and execute enterprise optimization.

**1992-1994 BBN Laboratories Division, BBN Systems and Technologies
Corporation, Cambridge, Massachusetts
Scientist Applied Physics Department.**

Readied the acoustic modeling system PRISM, implemented in Lisp, for beta test. The goal of PRISM was to support engineering acoustics design. Also led the design and integration of image management and

manipulation functions for an Army project called MIDAS. MIDAS integrated database technology with image analysis and acoustic modeling functions.

**1982-1992 BBN Laboratories Division, BBN Systems and Technologies Corporation, Cambridge, Massachusetts
Scientist, Intelligent Systems Department**

Worked on several intelligent systems, expert systems, and machine learning applications and frameworks: the Steamer intelligent tutoring system; DesigNet, an intelligent CAD tool for designing packet switching networks and a tool for automated network management; the FLEX rule base system framework and applications of it including a human factors simulation of radar operators, a wind shear adviser for pilots, and an expert system for audit selection for the IRS; teaching AI to clients; AI tools for parallel processors; a parallel rule base system for a manufacturing-process simulation/diagnostic demonstration; a machine learning framework called Beginner under internal funding; and the application of Beginner to relating biological indicators of rivers to their health

Within the Speech Department, investigated methods using unsupervised clustering to automate the analysis of recorded conversations of ground-control to plane conversations and was the systems integrator and implemented the GUI for the resulting demonstration system called Gister.

Previous work experience

Previous work experience included 6 years part-time work in high school and college at the National Hurricane and Experimental Meteorology Laboratory, Coral Gables, Florida. Was a co-principle investigator on a study of the effect of cloud seeding on lightning

HONORS

Member of the winning team of a GE Ecomagination Challenge Innovation Prize in 2010 to apply machine learning to optimize electric delivery truck charging schedules:
<http://engineering.columbia.edu/smart-grid-project-wins-ge-grant>.

American Association of Artificial Intelligence certificate of recognition for the conference paper: P. Gross, A. Boulanger, M. Arias, D. Waltz, P. Long, C. Lawson, R. Anderson, M. Koenig, M. Mastrocinque, W. Fairechio, J. Johnson, S. Lee, F. Doherty, and A. Kressner, "Predicting electricity distribution feeder failures using machine learning susceptibility analysis," in *Proceedings of the 21st National Conference on Artificial Intelligence - Volume 1*, 2006, pp. 1705–1711.

Three Special Achievement Awards from the National Hurricane and Experimental Meteorology Laboratory for accomplishments in programming and work on lightning.

Co-winner of the Max A. Eaton prize for the best student paper at the 11th Technical Conference on Hurricanes and Tropical Meteorology.

ENTREPRENEURIAL

Co-founder and CTO of vPatch Inc to commercialize 4D seismic reservoir modeling software.
<http://tiger.aboulanger.com/web/vpatch/>

Co-founder and partner of CES Enterprise LLC. Incubator for advanced business/technology solutions for the Oil and Gas Industry <http://ces-enterprise.com/>

Co-founder CALM Energy Inc. startup from Columbia University Ventures.
<http://www.calmenergyinc.com/>

Co-founder and partner of World Team- Building, LLC to conduct the for-profit aspects of the World Team project <http://worldteamnow.org/blog/wtn-ev/>

BOOKS

- Computer-Aided Lean Management for the Energy Industry, Roger N. Anderson, Albert Boulanger, John A. Johnson, Arthur Kressner, PennWell Books, 2008

PUBLICATIONS

1. "An Innovative Approach to Vehicle Electrification for Smart Cities." Promiti Dutta, Albert Boulanger, Roger Anderson and Leon Wu. Handbook of Research on Social, Economic, and Environmental Sustainability in the Development of Smart Cities. IGI Global, 2015. 193-212.
2. "Di-BOSS: Research, Development & Deployment of the World's First Digital Building Operating System," Roger Anderson, Albert Boulanger, Vaibhav Bhandari, Jessica Forde, Ashish Gagneja, Arthur Kressner, Ashwath Rajan, Vivek Rathod, Doug Riecken, David Solomon, Leon Wu, John Gilbert, Eugene Boniberger, Mattia Cavanna, Willem Neiuwkerk, Bruce Sher, Nate Maloney in Automated Diagnostics and Analytics for Buildings, Fairmont Press, 9/2014
3. "Game theoretic approach to offering participation incentives for electric vehicle-to-vehicle charge sharing," Promiti Dutta, Albert Boulanger, Transportation Electrification Conference and Expo (ITEC), 2014 IEEE, vol., no., pp.1,5, 15-18 June 2014
4. "Cost-optimal, robust charging of electrically-fueled commercial vehicle fleets via machine learning," Systems Conference (SysCon), Jigar Shah, Matthew Nielsen, Andrew Reid, Conner Shane, Kirk Mathews, David Doerge, Richard Piel, Roger Anderson, Albert Boulanger, Leon Wu, Vaibhav Bhandari, Ashish Gagneja, Arthur Kressner, Xiaohu Li, and Somnath Sarkar, 2014 8th Annual IEEE , vol., no., pp.65,71, March 31 2014-April 3 2014
5. "A Robust Solution to the Load Curtailment Problem," Hugo P. Simão, Hyun Bin Jeong, Boris Defourny, Warren B. Powell, Albert Boulanger, Ashish Gagneja, Leon Wu, Roger N. Anderson, IEEE Transactions on Smart Grid, vol.4, no.4, pp.2209,2219, Dec. 2013
6. "Di-BOSS™: Digital Building Operating System Solution," Jessica Forde, Vivek Rathod, Hooshmand Shookri, Vaibhav Bandari, Ashwath Rajan, John Min, Ariel Fan, Leon Wu, Ashish Gagneja, Doug Riecken, David Solomon, Lauren Hannah, Albert Boulanger, Roger Anderson," 2013 Conference on Neural Information Processing Systems (NIPS 2013), Demonstration 12/6/2013
7. "Improving efficiency and reliability of building systems using machine learning and automated online evaluation," Leon Wu, Gail Kaiser, David Solomon, Rebecca Winter, Albert Boulanger, Roger Anderson, Systems, Applications and Technology Conference (LISAT), 2012 IEEE Long Island, vol., no., pp.1,6, 4-4 May 2012
8. "Machine Learning for the New York City Power Grid," Cynthia Rudin, David Waltz, Roger Anderson, Albert Boulanger, Ansaif Salleb-Aouissi, Maggie Chow, Haimonti Dutta, Philip Gross,

Bert Huang, and Steve Ierome, Transactions on Pattern Analysis and Machine Intelligence
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10. "Using Support Vector Machine to Forecast Energy Usage of a Manhattan Skyscraper," Rebecca Winter, Albert Boulanger, Roger Anderson, Leon Wu, AGU Fall Meeting Abstracts 1, 0984, 2011
11. "Vehicle Electrification: Status and Issues," Albert Boulanger, Andy Chu, Suzanne Maxx, and David Waltz, Proceedings of the IEEE, vol.99, no.6, pp.1116-1138, June 2011
12. "Adaptive Stochastic Control for the Smart Grid," Roger Anderson, Albert Boulanger, Warren Powell, and Warren Scott, Proceedings of the IEEE, vol.99, no.6, pp.1098-1115, June 2011
13. "Estimation of System Reliability Using a Semiparametric Model," Leon Wu, Timothy Teravainen, Gail Kaiser, Roger Anderson, Albert Boulanger, and Cynthia Rudin, Proceedings of IEEE EnergyTech, 2011.
14. "Evaluating Machine Learning for Improving Power Grid Reliability," Leon Wu, Gail Kaiser, Cynthia Rudin, David Waltz, Roger Anderson, Albert Boulanger, Ansaf Salleb-Aouissi, Haimonti Dutta, and Manoj Poolery, Proceedings of the ICML 2011 workshop on Machine Learning for Global Challenges, International Conference on Machine Learning, 2011.
15. "Seizure Detection from Multiple Frequency Bands of Intra-cranial EEG using High Dimensional Clustering," Haimonti Dutta, David Waltz, Karthik M Ramasamy, Phil Gross, Ansaf Salleb-Aouissi, Hatim Diab, Manoj Pooleery, Albert Boulanger, Catherine Schevon and Ronald Emerson, Poster at the Fourth International Workshop on Seizure Prediction ISPW4, Kansas City, MO, June 2009.
16. "Estimating the Time Between Failures of Electrical Feeders in the New York Power Grid," Haimonti Dutta, David Waltz, Alessandro Moschitti, Daniele Pighin, Philip Gross, Claire Monteleoni, Ansaf Salleb-Aouissi, Albert Boulanger, Manoj Pooleery and Roger Anderson, Next Generation Data Mining Summit, NGDM 2009, Columbia MD.
17. "Ranking Electrical Feeders on the New York Power Grid," Phil Gross, Ansaf Salleb-Aouissi, Haimonti Dutta and Albert Boulanger, ICMLA, 2009, Miami, FL.
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24. "LEAN ENERGY MANAGEMENT-9: Boosting, support vector machines and reinforcement learning in computer-aided lean management," Roger Anderson, Albert Boulanger, Philip Gross, Philip M. Long, David Waltz, Oil&Gas Journal May 9, 2005

25. "LEAN ENERGY MANAGEMENT-8: Use of matrices in computer-aided lean energy management," Anderson, R., A. Boulanger, Oil&Gas Journal March 7, 2005
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27. "LEAN ENERGY MANAGEMENT-6: Ultradeep offshore suitability matrix for estimating value of Lean Processes," Anderson, R., A. Boulanger, Oil&Gas Journal June 28, 2004
28. "LEAN ENERGY MANAGEMENT-5: Enterprise-wide systems integration needed in ultradeepwater operations," Anderson, R., A. Boulanger, Oil&Gas Journal November 24, 2003
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51. "4-D Seismic Monitoring Technologies and Their Applications to the Eugene Island 330 field of Offshore Louisiana," R.N. Anderson, A. Boulanger, W. He, L. Xu, Session - AAPG 5/22 1996: Development Geophysics: Seismic Stratigraphic Analysis of Reservoirs, Case Studies of AVO Analysis, 4-D Seismic
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53. "4D Seismic Helps Track Drainage, Pressure Compartmentalization, Gulf of Mexico Management -- 1," Roger N. Anderson, Albert Boulanger, Wei He, Y.F. Sun, David Sibley, John Austin, Richard Woodhams, Liqing Xu, Richard Andre, and Kent Reinhart), *Oil & Gas Journal*, 93, no. 13, March 27, 1995
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56. "Gisting Conversational Speech", R. Rohlicek, D. Ayuso, M. Bates, A. Boulanger, P. Jeanrenaud, M. Meteer and M. Siu, *Proc. International Conference on Acoustics, Speech and Signal Processing*, volume 2, pages 113-116, 1992.
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64. "Butterfly Expert Systems Execution Environment: A Functional Specification. Version 1.0" (with others), BBN Report #6225, August 1986.
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PATENTS & PATENT APPLICATIONS

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2. "Forecasting system using machine learning and ensemble methods." Roger N. Anderson, Albert Boulanger, Leon L. Wu, Viabhav Bhandari, Somnath Sarkar, and Ashish Gagneja. U.S. Patent Application 14/707,809, filed May 8, 2015.

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