

Catherine Huang, Ph.D.

Research Scientist

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RESEARCH INTERESTS

Machine Learning, Big Data Analytics, Signal Processing, Brain Computer Interfaces, CyberSecurity Analytics

OVERVIEW

- Extensive research experience in machine learning and Big Data analytics
- Co-chair of cross-Intel Analytic Technical Steering Committee
- Significant research was featured in the News on IEEE Spectrum Online 2008 and OPB News 2011
<http://www.spectrum.ieee.org/biomedical/imaging/a-brainy-approach-to-image-sorting>
<http://www.opb.org/news/article/brainwaves-power-new-ohsu-invention-disabled/>
- 30+ publications in book chapters, peer-reviewed journals and proceedings with hundreds of citations
- Technical Committee member of IEEE Machine Learning for Signal Processing (MLSP) Technical Committee and IEEE Intelligent System Application Technical Committee
- Special Session Chair for IEEE MLSP 2015, Industrial Liaison Chair for IEEE WCCI 2014, Data Competition Chair for IEEE MLSP 2013

EDUCATION

- Ph.D. in Electrical and Computer Engineering, Oregon Health & Science University 2010
- M.S. in Electrical and Computer Engineering, University of New Brunswick, Canada 2005
- B.S. in Electrical Engineering, South China University of Technology, China 1990

EXPERIENCE

Research Scientist, Security & Privacy Research, Intel Labs, Hillsboro, OR 06/2014-Present

- Developed machine learning solution for user separation detection using mobile phone sensor data for Contextual Authentication Technology. Built population model offline and test individual in real-time. Extract time domain features and frequency domain features. The PoC was demoed to Intel True Key.
- Transferred the Situational Awareness machine learning pipeline from UC Berkeley to Intel. The pipeline was built on Spark and included active learning and human in the loop. Validated the pipeline over a dozen of experiments on over millions of Virus Total data.
- Organized cross-Intel Special Session on Cybersecurity Analytics, identified findings and provided recommendations to Intel Security CTO Office. Security Researchers presented 24 topics across 3 domains including threat intelligence, Identity and data protection to an average attendance of 43.
- Co-Chair cross-Intel Analytic Technical Steering Committee to create Data Science Center of Excellence, excite Intel analytic community with 150 members and deliver cross-platform use cases.

Catherine Huang

Research Scientist, Big Data Analytics (BDA), DSD, DCG, Hillsboro, OR

09/2013-05/2014

- Developed end-to-end Machine Learning for Big Data solutions for clients, from receipt of real-world data, data quality check, modeling, performance evaluation to the final model reports to clients.
- Developed large bipartite graphical models using Loopy Belief Propagation algorithm on Hadoop for two McAfee Network Security Proof of Concepts (PoCs). The prototype is implemented into Intel Analytics Toolkit and Tribeca Platform product.
- Designed graph construction pipeline and implemented large-scale parallel algorithms in MapReduce on 16 Xeon servers to process 13TB data with the graph of 7 billion vertices and 15 billion edges.

Research Scientist, Energy Sustainability Lab, Intel Labs, Hillsboro, OR

08/2011-08/2013

- Developed Personal Office Energy Monitor (POEM) prototype on Intel sensing platform for personalized sensing in office buildings. Designed POEM analytics and fusion framework enabling real-time two-way communications for occupants and building manager via MongoDB and MySQL DB and McAfee e-Policy Orchestrator. Deployed POEM into France and Japan on 73 PC users and 21 printers. Performed data analysis on user comfort, energy and occupancy inference. POEM was commercialized with SSG. POEM won Best Technical Development of Wireless Sensor Networks Award in 2012.
- Developed supervised learning algorithms for Building Energy Sensing Technology (BEST) to effectively disaggregate major appliances using voltage signatures. Designed Linear Logistic Classifier, time domain features and online learning for BEST analytics on residential homes and commercial buildings. BEST passed Intel Labs Design Review and commercialized with ISG into Banjo Canyon.
- Proposed a decentralized analytic framework on Ambient Intelligent Platform (AIP) for Internet of Things (IoT) edge and server analytics.
- Implemented E.ON Intelligent Secondary Substation Solution (i2SubST) for Substation load forecasting using Neural Networks for ISG.
- Chaired two grants \$100K from Intel Labs URO on analytics solutions for POEM and BEST

Postdoctoral Researcher, Neurotechnology Lab, Oregon Health & Science University (OHSU), 2010-2011

- Developed Machine Learning for Signal Processing algorithms in cognitive neuroscience to understand human brain function. Assisted grant proposals and advised one Ph.D. student.

Research Assistant, Adaptive System Lab, Oregon Graduate Institute & OHSU, Portland, OR 2005-2010

- Developed Neurotechnology for Intelligence Analysts for Honeywell Labs funded by DARPA. Designed Brain Computer Interfaces to decode human thoughts to improve efficiency of image search. Performed experimental design, data collection and data analysis on large-scale high-dimensional data. Developed incremental learning scheme and feature dimension reduction to dramatically reduce computational cost. Developed a hybrid Fisher Kernel Support Vector Machines framework for brain signature detection to significantly improve the performance. Developed a novel mixed effect model to discover the statistical representations of brain evoked responses.
- Developed Behavioral Assessment & Intervention Consortium for Intel Digital Health Group to enable independent living technology for aging using ubiquitous computing. Designed time-series predictions using Neural Networks and Support Vector Machines with feature ranking for early cognitive loss of Alzheimer patients based on user's behavior data.

Catherine Huang

Research Assistant, University of New Brunswick, Fredericton, New Brunswick, Canada

2002-2005

- Developed an advanced myoelectric control system for powered upper limb prostheses based on Gaussian Mixture Model classification scheme for user intent detection and limb motion classification.

Sr. Software Engineer, Associate Director, China Construction Bank, Nanning, Guangxi, China 1990-2000

- Managed a team of 22 members to develop 16 provincial banking systems for 105 banking offices
- Developed and maintained 8 provincial bank systems using C and SQL in Unix including planning, design, implementation, integration, testing, installation and maintenance

AWARDS

- Selected by Intel CTO to attend Intel Science Talent Search Innovation Dinner and Gala Award, 2013
- Two Intel Labs KUDOS for excellent BEST analytics development in critical design reviews, 2012
- Best Technical Development of Wireless Sensor Networks Award for POEM, IDTechEx & WSN, 2012
- Intel Labs Teamwork Award for ESB/POEM, Intel Labs, 2011
- Student Travel Grant, International Conference on Acoustics, Speech and Signal Processing, 2008
- Excellence in Neural Engineering Travel Award, Intl. IEEE EMBS Neural Engineering Conf., 2007
- Best Topic Paper Award, Augmented Cognition International Society, 2006
- *Postgraduate* Scholarships, Natural Sciences and Engineering Research Council of Canada, 2005-2007
- Governors Tuition Award, University of New Brunswick, Canada, 2005
- Project Leadership Prize, China Construction Bank, China, 2000
- Technology Development Award, Provincial Economic Commission, China, 1998
- Software Development Award, China Construction Bank, China, 1996

PROFESSIONAL SERVICE

- IEEE Senior Member
- Technical Committee member for IEEE SPS MLSP 2014-2016
- Special Session Chair for IEEE MLSP 2015
- Industry Liaison Chair for IEEE WCCI 2014
- Technical Committee member for IEEE CIS ISATC 2012-2015
- Industrial Advisory Board 2013 for Oregon State University School of EECS
- Data Competition Committee Chair for IEEE MLSP 2012 & 2013
- Technical Program Committee (TPC) for IEEE Smart Grid Communication 2013
- TPC for IEEE Digital Signal Processing & Signal Processing Education (DSP&SPE)Workshop 2013
- IEEE CIS Graduates of the Last Decade (GOLD) Subcommittee 2012
- TPC for IEEE SPS Signal Processing Theory and Methods 2012
- TPC for International Conference on Data Mining (DMIN) 2011
- IEEE Computer Society Member 2012, 2013
- IEEE Computational Intelligence Society (CIS) Member 2012, 2013
- IEEE Women in Engineering (WIE) Member 2012- 2014
- IEEE Signal Processing Society (SPS) Member 2012- 2014
- ACM Mobility of Systems, Users, Data and Computing (SIGMOBIL) Member 2012, 2013

Catherine Huang

- ACM Knowledge Discovery in Data (SIGKDD) Member 2012, 2013
- ACM Computer-Human Interaction(SIGCHI) Member 2012, 2013
- IEEE Engineering in Medicine and Biology Society (EMBS) Member, 2005-2010

Reviewer for journals and conferences

- IEEE Transactions on Neural Networks, IEEE Transactions on Signal Processing, IEEE of Signal Processing Systems, IEEE Pervasive Computing, IEEE Signal Processing Letters, Computational Intelligence and Neuroscience, Journal of Neuroscience Methods, Physics in Medicine and Biology, Journal of Neurocomputing, Neural Processing Letters,
- IEEE Smart Grid Communication 2013, IEEE DSP & SPE Workshop 2013, 2007- 2016 IEEE Acoustics, Speech and Signal Processing (ICASSP), 2008, 2009, 2012-2015 IEEE Workshop on Machine Learning for Signal Processing (MLSP), 2011 the 7th International Conference on Data Mining (DMIN), the 5th International IEEE EMBS Conference on Neural Engineering (EMBC NE 2011), Mentor for Women in Machine Learning Workshop (WiML 2010), 2009 Intl. Conf. of IEEE Engineering in Medicine and Biology Society (EMBS)

PROGRAMMING

- **Languages:** Python, Matlab, Spark, Hadoop, MapReduce, Pig, SQL, MongoDB, C/C++, Assembly, shell
- **Operating Systems:** Linux, Windows, Unix, DOS

PUBLICATIONS

In the News

1. POEM was feature in the news on *MarketWatch of the Wall Street Journal*, 2012, entitled as “Autonomics and Intel Ink Collaboration Agreement, Enhancing Accuracy & Personalization for ANSA Power Management Software,” (<http://www.autonomic-software.com/press-releases.php?id=6>) .
2. POEM was published in *Lexmark annual Corporation Social Responsibility report*, 2011
3. *Brain Computer Interfaces* was feature on *the OPB News*, 2011, entitle as Brain Waves Power New OHSU Invention for Disabled (<http://www.opb.org/news/article/brainwaves-power-new-ohsu-invention-disabled/>).
4. *Neurotechnology for Intelligence Analysts* was featured in the news on *IEEE Spectrum Online*, 2008, entitled as “A Brainy approach to Image Sorting,” (<http://www.spectrum.ieee.org/biomedical/imaging/a-brainy-approach-to-image-sorting>)

Peer Reviewed Journal Papers and Book Chapters

1. **Y. Huang**, D. Erdogmus, M. Pavel, S. Mathan, and K. E. Hild, “A framework for visual image search using single-trial brain responses,” *the Journal of Neurocomputing*, vol.74 (12-13), pp2041-2051, June 2011.
2. S. Mathan, K. E. Hild, **Y. Huang**, and M. Pavel, “Characterizing the Performance Limits of High Speed Image Triage using Bayesian Search Theory”, book chapter in *Lecture Notes in Computer Science*, 2011, Vol 6780, pp 95-103, Foundations of Augmented Cognition. Directing the future of Adaptive systems, D.D. Schmorow, C.M. Fidopiasstis(Eds), Springer-Verlag Berlin, Heidelberg, 2011.

Catherine Huang

3. S. Mathan, D. Erdogmus, K. E. Hild, **Y. Huang**, M. Pavel, J. S. P. Macdonald and N. Yeung, "User-Sensitive Rapid Serial Visual Presentation for Complex Image Analysis" in review with *IEEE Transactions on Neural Systems & Rehabilitation Eng.*
4. **Y. Huang**, D. Erdogmus, K. E. Hild, M. Pavel, and S. Mathan, "Mixed effects models for single-trial ERP detection in noninvasive brain computer interface design," book chapter in *Recent Advances in Biomedical Signal Processing*, J.M. Górriz, Elmar W. Lang, Javier Ramírez (Eds), Bentham Science Publishers, July 2011.
5. **Y. Huang**, K. Englehart, B. Hudgins, and A.D.C Chan, "A Gaussian mixture model based classification scheme for myoelectric control of powered upper limb prostheses," *IEEE Transactions on Biomedical Engineering*, vol. 52, no. 11, pp. 1801-1811, Nov. 2005.

Peer Reviewed Conference Papers

6. **Y.Huang** and P Greve, "Large Scale Graph Mining for Web Reputation Inference", *IEEE MLSP 2015, Boston, MA*
7. Z. You, R. Raich and **Y. Huang**, "Mixture modeling and inference for recognition of multiple recurring unknown patterns", *IEEE WCCI 2014*.
8. H. Hu, **Y. Huang**, M. Milenkovic, C. Miller and U. Hanebutte, "Personalized sensing towards building energy efficiency and thermal comfort," *IEEE WCCI 2014*.
9. Z. You, R. Raich and **Y. Huang**, "An inference framework for detection of home appliance activation from voltage measurements", *IEEE ICASSP 2014*.
10. F. Briggs, **Y.Huang**, R. Raich, K. Eftaxia, Z. Lei, W. Cukierski et. al, "The 9th annual MLSP competition: new methods for acoustic classification of multiple simultaneous bird species in a noisy environment", *IEEE MLSP, Southampton, UK*, Sept. 2013.
11. **Y.Huang**, F. Briggs, R. Raich, K. Eftaxias and Z. Lei, "The ninth annual MLSP competition", *IEEE MLSP, Southampton, UK*, Sept. 2013.
12. H. Hu, G. Jenks, **Y. Huang**, M. Milenkovic, U. Hanebutte, "Information and communications technology based solutions in achieving building energy efficiency", *IEEE SusTech 2013, Portland, OR*, 2013
13. M. Milenkovic, U. Hanebutte, **Y. Huang**, D. Prendergast, and H. Pham, "Improving user comfort and office energy efficiency with POEM (personal office energy monitor)" *Proceeding of ACM CHI'13*, p1455-1460, Paris, France, 2013.
14. M. Milenkovic, T. Dang, U. Hanebutte, **Y. Huang**, "Platform-integrated sensors and personalized sensing in smart buildings" *Proceeding of Sensornets 2013, Barcelona, Spain*, 2013.
15. **Y. Huang**, K. Hild, M. Pavel, S. Mathan and D. Erdogmus, "Neural correlates of visual perception in rapid serial visual presentation paradigms" *IEEE MLSP, Santander Spain*, 2012.
16. K. Montanez, W. Liu, V. Calhoun, **Y. Huang**, K. E. Hild II, "The eighth annual MLSP competition: overview", *IEEE MLSP, Santander Spain*, 2012.
17. K. E. Hild, S. Mathan, **Y. Huang**, D. Erdogmus and M. Pavel, "Optimal set of EEG electrodes for rapid serial visual presentation", *Proceedings of IEEE EMBC*, Buenos Aires, Argentina, Sept., 2010.
18. **Y. Huang**, D. Erdogmus, M. Pavel, K. E. Hild, S. Mathan, "A hybrid generative/discriminative method for EEG evoked potential detection," *Proceedings of IEEE EMBS CNE*, Antalya, Turkey, 2009.
19. **Y. Huang**, D. Erdogmus, M. Pavel, K. E. Hild and S. Mathan, "Target detection using incremental learning on single-trial evoked response," *Proceedings of IEEE ICASSP*, Taipei, Taiwan, 481-484, 2009.

20. T. Lan, **Y. Huang** and D. Erdogmus, "A comparison of temporal windowing schemes for single-trial ERP detection," *Proceedings of IEEE EMBS CNE*, Turkey, 2009.
21. **Y. Huang**, D. Erdogmus, M. Pavel, S. Mathan, "Mixed effects models for EEG evoked response detection," *Proceedings of IEEE MLSP*, pp. 91-96, Cancun, Mexico, 2008.
22. **Y. Huang**, D. Erdogmus, S. Mathan, M. Pavel, "Detecting EEG evoked responses for target image search with mixed effect models," *Proceedings of IEEE EMBC*, 4988-4991, Vancouver, Canada, 2008.
23. **Y. Huang**, D. Erdogmus, Z. Lu, T.K. Leen, "Detecting mild cognitive loss with continuous monitoring of medication adherence," *Proceedings of IEEE ICASSP*, Las Vegas, NV, pp. 609-612, 2008.
24. **Y. Huang**, D. Erdogmus, S. Mathan, M. Pavel, "Large-scale image database triage via EEG evoked responses," *Proceedings of IEEE ICASSP*, Las Vegas, NV, pp. 429-432, 2008.
25. Z. Lu, T. Leen, **Y. Huang**, D. Erdogmus, "A reproducing kernel Hilbert space framework for pairwise time series distances," *Proceedings of the ICML*, Helsinki, Finland, 624-631, 2008.
26. S. Mathan, D. Erdogmus, **Y. Huang**, M. Pavel, P. Ververs, J. Carciofini, M. Dorneich, S. Whitlow, "Rapid image analysis using neural signals," *Proceedings of the 26th Conf. on Human Factors in Computing System (CHI)*, 3309-3314, Italy, 2008.
27. **Y. Huang**, D. Erdogmus, S. Mathan, M. Pavel, "A fusion approach for image triage using single-trial ERP detection," *Proceedings of IEEE EMBS CNE*, pp. 473-476, Kohala Coast, Hawaii, 2007.
28. **Y. Huang**, D. Erdogmus, S. Mathan, M. Pavel, "Boosting linear logistic regression for single-trial ERP detection in rapid serial visual presentation tasks," *Proceedings of IEEE EMBC*, 3369-3372, New York, 2006.
29. T. Lan, **Y. Huang**, D. Erdogmus, "A comparison of linear ICA and local linear ICA for mutual information based feature ranking," *Proceedings of the Intl. Conf. ICABSS*, Charleston, SC, pp. 823-830, 2006.
30. T. Lan, D. Erdogmus, U. Ozertem and **Y. Huang**, "Estimating mutual information using Gaussian mixture model for feature ranking and selection," *Proceedings of IEEE WCCI*, Vancouver, Canada, pp. 5034-5039, 2006.
31. S. Mathan, P. Ververs, M. Dorneich, S. Whitlow, J. Carciofini, D. Erdogmus, M. Pavel, **C. Huang**, T. Lan, A. Adami, "Neurotechnology for image analysis: searching for needles in haystacks efficiently," *Proceedings of Augmented Cognition Intl. Conf.*, San Francisco, CA, 2006.
32. **Y. Huang**, K. Englehart, B. Hudgins, and A.D.C Chan, "Optimized Gaussian mixture models for upper limb motion classification," *Proceedings of the Intl. IEEE EMBC*, San Francisco, CA, pp. 72-75, 2004.
33. **Y. Huang**, K. Englehart, B. Hudgins, and A.D.C Chan, "Robust upper limb motion classification using Gaussian mixture models," *Proceedings of the 28th Conf. of the Canadian Medical and Biological Engineering Society*, Quebec, Canada, pp. 149-152, 2004.

Invited Talks, Abstracts, Demos and Posters

34. U.R. Hanebutte, M. Milenkovic, **Y. Huang**, S. Parthasarathy, T. Wei, 2013, "Improving User Comfort and Office Energy Efficiency with POEM (Personal Office Energy Monitor), Intel SW Professional Conference, Folsom CA 2013
35. M. Milenkovic, U.R. Hanebutte, **Y. Huang**, "Personal Office energy Monitor", Intel Developer Forum, Beijing China, 2013

36. M. Milenkovic and **Y. Huang**, 2012, “Personal Office energy Monitor (POEM)” Intel Lab Country Fair, Hillsboro, OR, 2012
37. M. Milenkovic, U.R. Hanebutte, **Y. Huang** , Personal Office energy Monitor, Research @ Intel, San Francisco, CA, 2012
38. M. Milenkovic, P. Gandhi, U.R. Hanebutte and **Y. Huang**, “SUMvE, a software agent to estimate platform power and energy” Intel Power Summit, Santa Clara, CA, 2011.
39. M. Milenkovic, U.R. Hanebutte, T. Dang, and **Y. Huang**, “Smart-Building Energy Efficiency: Reimagined IT”, Intel Lab Country Fair, Hillsboro, OR, 2011.
40. **Y. Huang**, “Event-related Potentials in Electroencephalography: Characteristics and Single-trial Detection for Rapid Object Search,” MGH Harvard Medical School, Boston, MA 2010
41. **Y. Huang**, “Brain Computer Interfaces for Rapid Object Search,” Stanford Medical School, Stanford, SC 2010
42. **Y. Huang**, D. Erdogmus, M. Pavel, K. E. Hild and S. Mathan, “A hybrid generative/discriminative method for single-trial evoked potential detection,” *Women in Machine Learning Workshop*, Vancouver, BC, Canada, 2010.
43. M. Pavel, **Y. Huang**, K. E. Hild, S. Mathan, and D. Erdogmus, “ The dynamics of visual detection processes in RSVP paradigms,” *the Society of Neuroscience (SFN)*, Chicago, IL, 2009.
44. **Y. Huang**, K. Englehart, B. Hudgins, and A.D.C Chan, “A Gaussian mixture model based classification scheme for myoelectric control of powered upper limb prostheses,” *the XVth Congress of Intl Electrophysiology & Kinesiology Society*, Boston, MA, pp67, 2004.
45. **Y. Huang**, K. Englehart, B. Hudgins, and A.D.C Chan, “Classification of myoelectric signals using Gaussian mixture models,” *the Mathematics of Information Technology and Complex Systems 5th Annual Conf*, Halifax, NS, Canada, p31, 2004.