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Education

Northwestern University   EVANSTON, IL, USA
   Ph.D. Candidate in Computer Science   *2012 – present*
      Advisor: Prof. Alok Choudhary, GPA: 3.88

University of Michigan-Dearborn   DEARBORN, MI, USA
   Ph.D Candidate in Electrical Engineering (discontinued)   *2009 – 2012*
      Advisor: Prof. Yi Lu Murphey, GPA: 3.97

University of Michigan-Dearborn   DEARBORN, MI, USA
   Master of Science in Electrical Engineering   *2007 – 2009*
      Advisor: Prof. Yi Lu Murphey, GPA: 3.92

Fudan University   SHANGHAI, CHINA
   Bachelor of Science in Electrical Engineering   *2003 – 2007*

Experience

Northwestern University, Research Assistant at CUCIS group   Sep '12 – present

Real-life Image Classification with Deep Convolutional Neural Networks
Large, deep convolutional neural networks (based on both a self-developed library on theano and torch7) are trained to classify ~1 million real-life images from Pinterest, into 1300+ different classes. Architectures including AlexNet, VGG, GoogLeNet are experimented. We employ frequent itemset mining to group labels into superclasses, and embed this information into the loss function to improve accuracy.

Electron Backscatter Image Indexing
Deep convolutional neural networks are used for the automated indexing of electron backscatter diffraction (EBSD) patterns in greyscale images of size $60{\times}60$. The patterns in image are to be related into 3 Euler angles, each of a real valued degree between 0 and 360, describing the orientation of the crystal lattice. The accuracy achieved is ~50% better than dictionary lookup (1-NN) that is currently state-of-the-art.

Neural Learning towards Optimization of Adhesive Pattern
The problem is related to a general optimization setting: a forward model is at hand that produces y from any input pattern x, and the purpose is to find x that optimize y. While the forward model is non-differentiable and parameters non-learnable, we turn it into a neural model, which once fixed, can be transferred to have the patten x learned.

Wikipedia Activity Modeling and Use in Financial Trading
User's clicking and editing behavior on Wikipedia pages are analyzed and incorporated into a trading strategy of S&P stocks that profits. Future work is to analyze Wall Street Journal article sentiments and build correlations with stock movements.

Northwestern University, Teaching Assistant/Lecturer   Fall '14, Spring '15
Worked as the only teaching assistant for an undergrad discrete math course containing 80+ students. Also as co-instructor for a graduate-level social media mining seminar course, giving lectures as "data mining essentials" and "introduction to deep learning".

Ford Motor Company, Research Intern   May '11 – Sep '11, May '12 – Sep '12
Working as an intern in the research group of Hybrid Electric Vehicle Intelligent Control for two consecutive summers, developed prediction systems for vehicle handling maneuvers, to improve vehicle's stability in making turns.

University of Michigan-Dearborn, Research Assistant   Sep '07 – Apr '12

  Learning systems by use of neural networks and ensemble learning for the purposes of vehicle dynamic control, power management, driver awareness detection, and trip modeling.

Skills

Programming: Proficient in Python, Matlab, Lua, SQL. Experience with C/C++, Go. Parallel programming with CUDA, OpenMP and MPI.

Packages: Proficient in the use of Theano, Torch7, scikit-learn. Experience with Caffe.

Distributed Operating Systems: Hadoop, Spark.

Selected Publications

Full list and all PDFs available at `http://users.eecs.northwestern.edu/~rll943/`

- **R. Liu**, A. Agrawal, A. Choudhary, and M. De Graef, "A Convolutional Deep Learning approach for Electron Backscatter Diffraction Indexing," 2015 (in preparation).

- **R. Liu**, L. Ward, A. Krishna, V. Hegde, A. Agrawal, A. Choudhary, and C. Wolverton, "Fast, Chemically-Accurate Models for Properties of Crystalline Compounds using Voronoi Tessellations and Machine Learning", 2015 (submitted).

- **R. Liu**, Y. Yabansu, A. Agrawal, S. Kalidindi, and A. Choudhary, "Machine Learning Approaches for Elastic Localization Linkages in High Contrast Composite Materials," Integrating Materials and Manufacturing Innovation (IMMI), 2015, 4:13 doi:10.1186/s40192-015-0042-z

- **R. Liu**, A. Kumar, Z. Chen, A. Agrawal, V. Sundararaghavan, and A. Choudhary, "A Predictive Machine Learning Approach for Microstructure Optimization and Materials Design," *Nature Scientific Reports*, 5, 11551; doi: 10.1038/srep11551. 2015.

- **R. Liu**, and A. Agrawal, W. Liao, and A. Choudhary, "Search Space Preprocessing in Solving Complex Optimization Problems," In *Proceedings of the IEEE International Conference on Big Data*, October 2014.

- **R. Liu**, and A. Agrawal, W. Liao, and A. Choudhary, "Enhancing Financial Decision-Making Using Social Behavior Modeling," In *Proceedings of the 8th Workshop on Social Network Mining and Analysis*, August 2014.

- **R. Liu**, S. Xu, C. Fang, Y. Liu, Y. Murphey, and D.S. Kochhar, "Statistical Modeling and Signal Selection in Multivariate Time Series Pattern Classification," In *21st International Conference on Pattern Recognition (ICPR)*, pp.2853–2856, 11–15 November 2012.

- **R. Liu**, and Y. Murphey, "Time-series Temporal Classification Using Feature Ensemble Learning," In *the 2010 International Joint Conference on Neural Networks (IJCNN)*. pp.1–5, 18–23 July 2010.

Awards

- Best paper award, ASME 2014 International Design Engineering Technical Conferences, Computers and Information in Engineering Conference, IDETC2014-34570, August 2014.

- First place, Kaggle Competition on Driving Alertness Detection, 2011.

- Second place, EECS Student Poster Fair Award, 2015.

- Second place, poster competition at the Symposium of Multidisciplinary Computer-Aided Design and Simulation-Based Optimization - Recent Applications & Future, Evanston IL, December 2014.

- ATPESC (Argonne Training Program on Extreme-Scale Computing) Award, 2014.

- Predictive Science and Engineering Design (PS&ED) Fellowship, 2013-2014.

- BPDM (Broadening Participation in Data Mining) Scholarship, 2013.