Jayaram Raghuram

Contact Information

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Expertise

Machine learning and pattern recognition, Signal processing, Statistical modeling.

Education

The Pennsylvania State University, University Park, PA

Ph.D., Electrical Engineering, August 2014 (expected) GPA: 3.74/4

Topic: Improved generative modeling for semi-supervised and domain adaptive classifier learning from labels and constraints

Advisors: Prof. David Miller and Prof. George Kesidis

The Pennsylvania State University, University Park, PA

M.S., Electrical Engineering, August 2014 GPA: 3.74/4

Topic: Adaptive forecasting of nonstationary financial time series using supplier-customer relationship information

Advisors: Prof. David Miller and Prof. George Kesidis

Anna University, India

B.E, Electronics and Communication Engineering, May 2008 GPA: 75.2/100

Programming and software

1. Proficient in C/C++ and Matlab.
2. Experienced in Perl, Python, Shell scripting, and LaTeX.
3. Experienced in parallel programming with Open-MPI, distributed computing, and multi-threading.
4. Operating system concepts, Unix, Windows.

Coursework and projects

Stochastic Processes, Neural Networks, Machine Learning, Statistical Signal Processing, Detection and Estimation theory, Information theory, Optimization theory, Real analysis, Operating systems, Algorithms and data structures (MIT ocw), Monte Carlo methods (audit), Computer Vision, Bioinformatics, Wavelets and Filter-banks.

Operating systems: (i) Implemented a basic Unix like file system from scratch which performs operations like creating, organizing, and deleting files and directories. (ii) Implemented a string processing application which uses interprocess communication and thread synchronization using semaphores. Implemented using C language.

Computer vision: (i) Implemented a method for real-time tracking of objects in a video by modelling the color distributions of the object and the background using a Gaussian mixture model. (ii) Implemented a model for detecting one of several possible activities (like walking, running, jumping) in a video sequence by modelling each activity with a Hidden Markov model. Implemented using Matlab software.

Wavelets and Filter-banks: Implemented methods for image denoising based on statistical modeling of the wavelet coefficients of the noisy image, which has superior performance compared to wavelet thresholding and denoising methods in the frequency domain.

Work Experience

Research assistant, Penn State (Aug 2010 - May 2011)
Semi-supervised classification with fine-grained modeling

Developed semi-supervised learning methods which can learn fine-grained class posterior models within individual components of a generative mixture model, thus allowing flexible models which can capture the joint class and feature vector distributions without relying on the low-density seperation or the cluster assumption. Working on extending the method to handle high dimensional feature spaces.

Comparative analysis of methods for detecting SNP interactions

Made experimental contributions in evaluating the SNP (Single Nucleotide Polymorphism) interaction detection power of a method called MECPM (Maximum Entropy Conditional Probability Modeling), as part of a comprehensive comparative analysis paper (published in BMC Genomics).

Research assistant, Penn State (Aug 2011 - May 2012)
Semi-supervised domain adaptation of classifiers

Developed a method for adapting a mixture model based supervised classifier from a source domain where plenty of labeled data is available, to a different but related target domain where labeled data is scarce and expensive to obtain. Experimented on real internet packet flow datasets. Working on extending the method to adapt discriminative and rule based classifiers like decision trees.

Research assistant, Penn State (May 2012 - May 2013)
Semi-supervised learning from pairwise sample constraints

Developed a semi-supervised learning method which can effectively utilize a small number of pairwise sample constraints (on the class labels) to achieve constraint propagation and generalization to the unconstrained samples, and can also estimate the unknown number of classes in the data. Implemented a parallel programming version of the method using the Open-MPI library in C.

Research assistant, Penn State (May 2013 - Aug 2013)
Detecting anomalous domain names by probabilistic modeling

Developed an anomaly detection method for detecting algorithmically generated domain names which are frequently associated with fast flux service networks, bot networks, malware, and phishing activity. The method is inherently low latency since it is based only on a generative probability model for the domain names strings, learned using a large collection of white-listed domain names.

Research assistant, Penn State (Aug 2013 - August 2014)
Dynamic pricing and flexible demand games for Smart Grids

Worked on the economic dispatch problem where consumers adjust their demand flexibly in response to varying supplier (generation) prices. The suppliers play a non-cooperative iterated game by adjusting prices to maximize their respective revenue based utility functions. Our goal was to study the dynamics of this problem and develop an iterative method for stabilizing the supplier prices. Currently working on the problem of predicting the availability of renewable energy sources (solar and wind based) and detecting mismatch between the predicted and actual flexible demand component in a smart grid.

Research assistant, Penn State (Jan 2014 - Mar 2014)
Adaptive prediction methods for financial time series forecasting

Developed adaptive time series prediction models based on aggregating predictors, which forecast the future daily returns of multiple companies in a market using their past returns, and also using supplier-customer relationship information between pairs of companies.

Publications

Raghuram, J., Miller, D.J., Kesidis, G., "Instance-Level Constraint Based Semi-supervised Learning With Imposed Space-Partitioning", IEEE Transactions in Neural Networks and Learning Systems (To appear), 2014. DOI: 10.1109/TNNLS.2013.2294459.

Raghuram, J., Miller, D.J., Kesidis, G., "Unsupervised, low latency anomaly detection of algorithmically generated domain names by generative probabilistic modeling", Journal of Advanced Research (2014). DOI: 10.1016/j.jare.2014.01.001.

Raghuram, J., Kesidis, G., Miller, D.J., Levitt, K., Rowe, J., Scaglione, A., "Generation bidding game with flexible demand", 9th International workshop on feedback computing, 2014.

Raghuram, J., Miller, D.J., Kesidis, G., "Semisupervised domain adaptation for mixture model based classifiers", Proceedings of the 46th annual Conference on Information Science and Systems (CISS), 2012. DOI: 10.1109/CISS.2012.6310708.

Miller, D.J., Raghuram, J., Kesidis, G., and Collins, C.M., "Improved generative semisupervised learning based on finely grained component-conditional class labeling", Neural Computation, Vol 24(7), 1926–1966, 2012. DOI: 10.1162/NECO_a_00284.

Celik, Z.B., Raghuram, J., Kesidis, G., and Miller, D.J., "Salting public traces with attack traffic to test flow classifiers", Proceedings of the 4th conference on Cyber Security Experimentation and Test (CSET), 2011.

Chen, Li, et.al., "Comparative analysis of methods for detecting interacting loci", BMC Genomics, Vol 12(1), 2011. DOI: 10.1186/1471-2164-12-344.

Professional activities

Reviewer for IEEE Transactions in Neural Networks and Learning Systems, IEEE Transactions on Image Processing, and IEEE Transactions in Smart Grids (PES).
Student member, IEEE.

References

1. Dr. David Miller
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2. Dr. George Kesidis
Professor of Electrical and Computer Science Engineering, Penn State University,
Email: kesidis@engr.psu.edu