

Tianlong Song

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SUMMARY

- Research experience with machine learning and data mining algorithms in functional brain connectivity
- Research experience with game theoretic and cryptographic techniques in wireless communications
- Industrial experience with software development and skills in Java/Python/C/C++/Scala/Matlab programming
- Internship experience with cloud computing services at Amazon Web Services (AWS)
- Knowledge of natural language processing, big data analytics, algorithm design and analysis
- Strong teamwork and interpersonal skills demonstrated by leadership/contribution in 4+ team projects
- Strong written and verbal skills demonstrated by 8+ publications and conference presentations

HIGHLIGHTED SKILLS

- Machine Learning, Data Mining, Natural Language Processing, SQL, scikit-learn, Hadoop, Spark
- Data Structures, Algorithms, Operating Systems, Java, Python, C/C++, Scala, Matlab

EXPERIENCE

Software Development Engineer Intern, Amazon, Seattle, WA

Jun 2015 - Aug 2015

Rack Order Assignment Optimization in Supply Planning at Amazon Web Services (AWS)

- Keywords: software development; Java; Scala; MySQL; Coral service framework; integer programming
- Implemented a web service that collects data and optimizes rack order assignments to minimize the total cost, using Coral service framework and Java/Scala programming
- Reduced the total cost by a big margin compared to the existing greedy solution, which is known to be nonoptimal and limited in handling varied constraints
- Gained the knowledge of software engineering practices and development life cycle, including coding standards, code reviews, source control management, testing, etc.

Research Assistant, Michigan State University, East Lansing, MI

Aug 2012 - Present

Pattern Recognition on Brain Regions via Regression Modeling

- Keywords: data mining; pattern recognition; regression; Python; feature extraction
- Performed data preprocessing by eliminating outliers in the raw data, which includes measurements on 165 brain regions for 81 subjects
- Applied forward feature selection and regularized linear regression to identify regions of interest (ROIs) towards a given target region
- Achieved a normalized MSE of $8.2e-4$ for a 5-fold cross validation, and will investigate overlap between the extracted 25 ROIs and the ground truth from literature on physiology

Alzheimer's Disease (AD) Diagnosis with Brain Connectivity Pattern Analysis

- Keywords: machine learning; classification; AdaBoost; Python; data analysis
- Constructed the feature space by applying Pearson correlation to six pairs of brain regions based on neuroimaging data
- Applied linear discriminant analysis (LDA) to extract the most distinguishable information in the selected feature space
- Performed a three-class classification using AdaBoost with 50 decision-tree classifiers, achieving an accuracy of 76% in the leave-one-out cross validation

Efficient and Secure System Design in Wireless Communications

- Keywords: game theory; cryptography; security; Matlab; optimization
- Proposed a game theoretic approach to find the optimal strategy for multichannel communications under cognitive jamming, where the jammer monitors the authorized user and adapts its jamming strategy accordingly
- Applied physical layer cryptographic techniques to enhance the security of existing 3G CDMA schemes under disguised jamming, where the jammer mimics the authorized signal using a similar transmission pattern
- Developed new efficient message-driven multicarrier schemes, which outperform existing 4G OFDM schemes in both spectral and power efficiency by up to 25%

SELECTED PROJECTS

Locating and Filling Missing Words in Sentences Based on Language Models Mar 2015 - May 2015

- Keywords: natural language processing; N-gram augmentation; word distance statistics; Python
- Developed an augmented N-gram model that locates and determines the missing word in each sentence
- Achieved missing word location accuracy of 51.47% and missing word filling accuracy of 32.15%

Large Scale Image Classification Based on a Multi-Class Logistic Regression Model Mar 2013 - May 2013

- Keywords: machine learning, image classification; multi-class logistic regression; Matlab
- Large data pool with 1,000,000 examples, which have 900 features and span a wide variety of 164 classes
- Developed a multi-class logistic regression model with random sampling in training examples for each iteration
- Achieved a mean average precision up to 50% with training time limited to only 6 hours on a regular PC

EDUCATION

Ph.D., Electrical and Computer Engineering, 4.0/4.0 Aug 2012 - Mar 2016 (expected)

Michigan State University, East Lansing, MI

M.S. with Best Thesis Award, Electrical and Computer Engineering, 88/100 Sept 2009 - Mar 2012

Beihang University, Beijing, China

B.S. with Honors, Electrical and Computer Engineering, 91/100, Top 1 of 200+ Sept 2005 - Jun 2009

Beijing University of Chemical Technology, Beijing, China

HIGHLIGHTED COURSES

- Machine Learning, Data Mining, Computing Techniques for Large Scale Data Analysis
- Natural Language Processing, Design & Analysis of Algorithms, Operating Systems

SELECTED AWARDS

- Outstanding Graduate Student Nominee, Michigan State University (3/100+) 2015
- Best Student Paper Award, IEEE GlobalSIP 2014 (4/300+) 2014
- Graduate Office Fellowship, Michigan State University 2012
- National Fellowship, Beijing University of Chemical Technology (1/200+) 2007&2008

SELECTED PUBLICATIONS

- **T. Song**, W. E. Stark, T. Li and J. K. Tugnait, “Multiband Transmission Under Jamming: A Game Theoretic Perspective”, IEEE Transactions on Communications, under review.
- **T. Song**, K. Zhou and T. Li, “CDMA System Design and Capacity Analysis under Disguised Jamming”, IEEE Transactions on Information Forensics and Security, under review.
- **T. Song**, T. Li and J. K. Tugnait, “Spectrally Efficient Multicarrier Transmission with Message-Driven Sub-carrier Selection”, IEEE Transactions on Communications, Vol. 62, No. 7, 2014, pages: 2444-2455.
- **T. Song**, Q. Chang and W. Qi, “Design of a Baseband Signal Generator in Navigation Satellite Signal Simulators”, IEICE Transactions on Communications, Vol. E95-B, No. 02, 2012, pages: 680-683.