Matthew **Pugh**

RESEARCHER · TEAM LEAD · MACHINE LEARNING ENGINEER

San Francisco Bay Area

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Summary

Insightful engineer who leverages a breadth of expertise to solve complex problems. Applies strong analytical skills to develop novel algorithms, adapt machine learning models, and design system architectures. Utilizes strong communication and leadership abilities to lead projects and R&D efforts in multiple disciplines. Operates with a strong focus on meeting and exceeding all customer requirements.

Skills

Programming	Python, PyTorch, Emacs, Linux, Git, Julia, LaTeX, MATLAB
DevOps	Docker
Back-end	Flask, REST API
Team Lead	Lead teams of 5 - 20 engineers and scientists. Develop relationships across laboratories and academia.

Work Experience

Sandia National Laboratories
Livermore, CA

PRINCIPAL MEMBER OF THE TECHNICAL STAFF
August 2011 - Current

Component Team Lead On Critical Laboratory Program:
- Execution of project included mechanical and electrical component design, firmware development and formal verification, tester design, testing implementation, QA, documentation, vendor qualification, budgeting, and scheduling.
- Devised new execution strategies that resulted in an unprecedented 8.5 year reduction in delivery time and led to laboratory-wide improvements in project management.
- Managed $30M budget and led team of 20 engineers and scientists.

National Security R&D Team Lead:
- Developed novel national security system exceeding customer requirements while meeting all constraints and integrating within existing system architectures.
- Resulting system became the baseline for a $300M laboratory program.
- Led team of 7 engineers and managed $5M.

Embedded ML System for Real-Time Aerial Object Detection:
- The team adapted and fine-tuned industry standard PyTorch object detection models, designed custom chassis for improved thermal performance of embedded hardware, conducted thermal analysis and simulation of embedded GPU system, and built system interface with Flask and Docker.
- Developed proof of concept system and object detection model with 98% precision.
- Led team of 5 engineers.

National Security Data Annotation:
- Integrated image annotation automation to national security program.
- Automation resulted in 95% reduction in engineering hours spent on manual data annotation.
- Image models for automated annotation written in PyTorch with a Docker and nuclio interface.

Free-Space Optical Communication System:
- Monte Carlo channel simulations of mid-UV wavelengths incorporating Mie and Rayleigh scattering.
- Design and probability error rate analysis of asymmetric channel coding schemes.
- Analyses resulted in $2M funding for prototype communication system.

Telemetry Data Analysis:
- Led 3 year $1.5M R&D program.
- Applied dictionary learning and compressed sensing for reconstruction of telemetry signals.
- Achieved 75% lossy compression of telemetry data utilizing learned sparse representations.

Intrusion Detection Algorithms:
- Developed PCA-based probabilistic signal models for multimodal sensor data.
- Designed fixed probability of error and min-max intrusion detection algorithms.
- Error quantification results led to $1.5M funding for proof-of-concept intrusion detection system.

Eavesdropper Resistant Modulation:
- Won 2-year $250K early-career research grant.
- Developed and analyzed probabilistic signal constellation constructions to maximize the probability of error for potential eavesdroppers.
- Deterministically solved low-dimensional constellation construction using semidefinite programming.

Education

University of California, San Diego

Ph.D. in Electrical and Computer Engineering

- Specializing in Communication Theory and Systems

University of California, San Diego

M.S. in Electrical and Computer Engineering

University of California, Los Angeles

B.S. in Electrical Engineering and B.S. in Applied Mathematics

Publications

A Minimax Approach to Sensor Fusion for Intrusion Detection *IEEE*

Pugh, M. *March 2015*

Sensor Applications Symposium

Sensor Fusion for Intrusion Detection Under False Alarm Constraints *IEEE*

Pugh, M., Kvam, J. and Brewer, J. *March 2015*

Sensor Applications Symposium

The Proportional Fair Sharing Algorithm Under i.i.d. Models *IEEE*

Pugh, M. *November 2012*

46th Asilomar Conference on Signals, Systems, and Computers

Diffuse Mid-UV Communication in the Presence of Obscurants *IEEE*

Young, D., Brewer, J., Chang, J., Chou, T., Kvam, J., and **Pugh, M.** *November 2012*

46th Asilomar Conference on Signals, Systems, and Computers

Feedback Reduction by Thresholding in Multi-User Broadcast Channels: Design and Limits *IEEE*

Pugh, M. and Rao, B.D. *November 2011*

45th Asilomar Conference on Signals, Systems, and Computers

Feedback Reduction in Multiuser MIMO Broadcast Channels *University of California, San Diego*

Pugh, M. *April 2011*

Ph.D. Thesis: Advisor - Bhaskar D. Rao

Distributed Quantization of Order Statistics with Applications to CSI Feedback *IEEE*

Pugh, M. and Rao, B.D. *April 2011*

Data Compression Conference

Reduced Feedback Schemes Using Random Beamforming in MIMO Broadcast Channels *IEEE*

Pugh, M. and Rao, B.D. *March 2010*

IEEE Transactions on Signal Processing

Feedback Reduction in MIMO Broadcast Channels with LMMSE Receivers *IEEE*

Pugh, M. and Rao, B.D. *March 2010*

International Conference on Acoustics, Speech and Signal Processing

On the Capacity of MIMO Broadcast Channels with Reduced Feedback by Antenna Selection *IEEE*

Pugh, M. and Rao, B.D. *November 2008*

42nd Asilomar Conference on Signals, Systems, and Computers

Committees

2012 - 2013	**Vice-Chairman,**	IEEE Oakland East Bay Signal Processing Society
2013, 2014	**Member of the Technical Program Committee,**	Globecom
2013	**Member of the Technical Program Committee,**	International Conference on Connected Vehicles & Expo