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 to address critical national security issues. 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 customers' requirements.

Work Experience

Sandia National Laboratories
Livermore, CA

PRINCIPAL MEMBER OF THE TECHNICAL STAFF
August 2011 - Current

Team Lead

- Led an embedded machine learning systems design team of five engineers to address national security problems. Adapted and fine-tuned industry standard PyTorch models, designed custom hardware housing and fixtures and selected embedded hardware. Conducted thermal analysis of designs and wrote test plan to verify the designed system meets customer requirements. Results included state-of-the-art performance on datasets of interest.
- Led multiple R&D research programs ranging from $1M to $5M, which were responsible for developing cutting edge solutions to DOE and DOD national security problems. In the process, developed working relationships within Sandia, as well as across laboratories throughout the world and academia. Achieved success by focusing on the customer's requirements while working within the constraints of existing systems and minimizing cost. One of these project became a $200M program (see next bullet).
- Component lead on $200M critial laboratory program. Managed a budget of $30M leading a team of 20 engineers and scientists. Execution included product design for manufacturability (DFM), exhaustive testing, qualification, and tester design. Wrote extensive documentation for all phases: requirements, specifications, test plans, test reports, and standard operating procedures. Successfully delivered in an unprecedented timeframe, reducing a 10+ year process to less than 18 months, and in the process changed the labs approach to agility and adaptibility.
- Led a 3-year $1.5M R&D program investigating compressed sensing and sparse representations of telemetry data. Research included applications of dictionary learning to find optimal data representations as well as using auto-encoders for sparse feature extraction. The project resulted in showing that different techniques are ideal depending on the applications of the reconstructed signal.

Researcher

- Adapted existing automatic data annotation tools for use on a national security program. The tool saved tens to hundreds of man-hours depending on the size of the data set. Required the use of fine-tuned models written in PyTorch with Docker and Nuclio interfaces.
- Performed modeling, analysis and design of free-space optical communication systems. Performance analysis via Monte Carlo simulation of Mie and Rayleigh scattering for SNR of short range mid-UV communication channels as a function of wavelength. Adapted and analyzed performance of LDPC and polar codes for the use in asymmetric channel models. Analyses proved feasibility and led to the funding of a prototype system.
- Won a 2-year $250K early-career R&D effort investigating jam resistant communications via modulation design focusing on lattice-based techniques. Performed Monte Carlo simulations for probabilistic lattice constructions of modulation constellations to maximize a desired metric. Proposed and solved a variant problem as a semidefinite program. Led to explicit performance results for fixed low dimensional schemes.
- Developed probabilistic models for intrusion detection problems. Optimized sensor fusion detection algorithms in these models to maximize detection probability under various false alarm constraints. Led to algorithms with performance guarantees under the models considered.

Northrop Grumman
San Diego, CA

SYSTEMS ENGINEER
June 2010 - April 2011

- Developed RF signal direction finding algorithm and prototype system incorporating real-time and off-line digital signal processing written in MATLAB and LabView.

Qualcomm
San Diego, CA

SYSTEMS ENGINEER
June 2006 - December 2006

- Simulated cellular network traffic of video data and designed end-to-end rate adaption algorithm optimizing QoS for uplink and downlink mobile-to-mobile real-time video transfer.

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.

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 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