Brandt L. Springman

blspringman@gmail.com (628) 264 8640 moving to San Francisco, California

Profile: Machine learning engineer / data scientist with strong mathematics and software skills.

- Creative, collaborative researcher with a business outlook and a track record of consistently delving into new areas for the organization and innovating key results. This includes developing machine learning algorithms at two successful startups (time series radio channel data) to move quickly through opportunities in the commercial wireless market**.**
- With previous experience analyzing engineering data am now looking for a starting role working with the broader machine learning business data applications and tools including business analytics, deep learning, Attention, RNNs with LSTMs, CNNs, clustering, SVMs, graphical methods, random forests, gradient boosting, recommenders, ranking …

Mathematics background: linear algebra, statistics, probability and information theory, calculus, signal processing theory, iterative solutions, and optimization.

Software development skills: Python, NumPy, pandas, TensorFlow, Keras, scikit-learn, C / C++ (real-time embedded), Linux, Git, Subversion, Jira, Perforce, Jupyter Notebooks.

Work summary: 5+ years machine learning, 10+ software development (for other detail please see addendum)

- Supervised and unsupervised learning. Statistical predictive modeling. Classification.
- LMS based parameter learning. Stochastic and batch gradient descent.
- Sequential data models. Time series data. Iterative Bayesian estimation. Hidden Markov models. Loopy belief propagation in a Bayesian network.
- Principal component analysis (PCA). Dimensionality reduction. Centroids, clustering.
- Performance evaluation of models. Bias - variance tradeoff. Hyperparameter selection.
- Signal detection. Spectral analysis. Autoregression. Bayes filters, blending in new info.

Education: **Deep Learning w/Keras and Tensorflow** 5 courses by deeplearning.ai, Sep - Nov 2019.

- Art generation with neural style transfer (CNN). Car detection (CNN / you only look once).
- Removing bias (word embeddings / subspace method). Gesture classification (ResNet50).
- Dinosaur name generation (RNN) (character based language modeling).
- Shakespearean poetry (RNN w/ LSTM) (word based language modeling).
- NLP - sentiment detection on text (LSTM).
- Translation using Attention (NMT w/ LSTM). Trigger word detection (RNN w/ GRU).

Recommender Systems by University of Minnesota on Coursera, audited Oct 2019.

Machine Learning by Stanford University on Coursera, 2016. Linear regr., logistic regr., regularization, kernels, SVMs, clustering, PCA, anomaly detection, recommender systems.

George Washington University Washington, D.C.

- M.S.E.E. coursework in wireless communications, 1993-95. Grade point average 4.0 / 4.0.
- Probability theory incl. Bayesian view. Stochastic processes. Information, communication theory. Statistical estimation prediction. Signal detection in additive white Gaussian noise.
- Linear block codes, encoding, decoding, ensemble statistics, n-dimensional sphere hardening (curse of dimensionality). Convolutional codes, maximum likelihood sequence estimation.
- Pseudo-random noise, code division multiple access (CDMA) signaling.
- Synchronization in noise, design of phase tracking loops, optimization of loop bandwidth.

Massachusetts Institute of Technology Cambridge, Massachusetts

- S.B.E.E. degree, Department of Electrical Engineering and Computer Science, May 1990.
- Overall grade point average 4.3 / 5.0. Senior year GPA 4.7 / 5.0.
- Thesis: "Identification of equipment using frequency domain detection of 'turn on' transient signatures." Group goal–use of signal processing to save energy in large buildings.

Personal: Soccer. Flying (FAA licensed private pilot). Aerodynamics. Weather analysis. Business analysis. Sailing, swimming, hiking. Biology, Economics. Geography. History.

Work history: **Algorithm Science Inc.** Riverton, Wyoming moving to San Francisco, California
Machine learning engineer / data scientist
May 2009 – Present: Combination of study, time caring for my late father, contract software.

Online courses taken 2014-2019:

- **Natural Language Processing in TensorFlow**, by deeplearning.ai, (in progress).
- **Deep Learning w/Keras, TensorFlow, 5 course specialization,** deeplearning.ai, Nov 2019
  1. *Neural Networks and Deep Learning*. Initialization. Activations: ReLU, leaky ReLU, tanh, sigmoid. Forward prop, error attribution, back prop, SGD, batches, mini-batches.
  2. *Hyperparameter tuning, regularization.* λ, L_1, $L_{2\ ,F}$ norms, dropout. Adam optimizer.
  3. *Structuring Machine Language Projects.* Data set split, bias - variance tradeoff.
  4. *Convolutional Neural Nets.* Edge detection, pooling over volume, ResNets, Inception Net, transfer learning, object localization & detection.
  5. *Sequence Models*. RNNs, BRNNs, LSTMs, GRUs. Backpropagation through time. NLP. Language modeling. Deep RNNs. Word embeddings. Negative sampling. Removing bias between pairs. Beam search. Bleu score. Attention model.
- **Recommender Systems** by University of Minnesota on Coursera, Oct 2019, (audited).
- **Machine Learning** by Stanford University on Coursera, 2016.
- **Algorithms: Design and Analysis, Pts 1 and 2** Stanford University on Coursera, 2016.
- **Digital Signal Processing** École Polytechnique Fédérale de Lausanne, Coursera, 2014.

Studying Christopher M. Bishop's "Pattern Recognition and Machine Learning" 2018-19: Kernels, SVMs, Bayesian Networks, Markov random fields, Trees, Mixture models, Expectation-maximization, Variational inference, Sampling Methods.

[Helping take care of my father, 2013-2018].

Ubiquisys – Cisco, 2009 – 2013 (contract): development of real-time embedded software for 'Femtocells' which are now Cisco's wireless base stations for home and office known as 'Small Cells' [C++, Linux, Subversion, Jira].

Icera (startup, became NVIDIA Mobile Communications) Bristol, England
Physical Layer Algorithms Team Leader Dec 2003 - Apr 2009

Joined the wireless semiconductor startup as the 4th employee on the wireless side. Researched the Wideband CDMA 3GPP wireless standard and designed adaptive signal processing algorithms including time series machine learning algorithms for our software modem. Invented the maximum likelihood sequence estimation (MLSE) scheme that was a key breakthrough in the design of our first modem.

Designed and implemented the processing algorithms for several of the control channels. Designed the fading simulation of the dynamic mobile radio channel impulse responses and used it to evolve our supervised adaptive equalization strategy (minimum mean square error). Our modem was the first consumer product to be able to learn and follow (track) the WCDMA dynamic channels and demodulate their high speed 3.6 Mbps downlink signal waveform [single instruction multiple data (SIMD) assembly, C, Linux, Perforce].

Responsible as team leader for our modem's Adaptive Wireless™ physical layer which we took live on Softbank's network in Japan and used to connect laptops and PCs to the internet 4 months before Qualcomm could. Our modems also delivered better performance (higher data throughput vs. interference levels) than Qualcomm's did. Having won the worldwide race for WCDMA our annual sales grew to more than $70 million worldwide (via AT&T in the U.S.) and this led NVIDIA to purchase our company for $367 million.

Ubinetics (startup, later acquired by Cambridge Silicon Radio) Cambridge, England
Digital Signal Processing Team Leader Oct 2002 - Nov 2003

Led the team through the design of the TM500 Wideband CDMA test mobile using two alternative methods to learn the radio channel parameters and adaptively equalize the received signal. The first method is a sliding window equalizer (minimum mean square error) and the second is a normalized least mean squares equalizer using on-line stochastic gradient descent. These features gave cellular network operators an early ability to explore how the next generation of mobiles would interact with their base stations and made the TM500 the first test mobile to be able to demodulate and process the 3.6 Mbps high speed downlink of the WCDMA standard [MATLAB, C].

Spread Spectrum Arlington, Virginia
Senior Technical Architect Jan 2002 - Oct 2002

Designed the demodulator unit for Globalstar's Simplex Data Service. The demodulator has to estimate and remove the Doppler frequency shift(s) between each sender and one or more of the 48 low earth orbit satellites travelling at 15,000+ mph [System View, C].

Hughes Network Systems Gaithersburg, Maryland
Digital Signal Processing Consultant Sep 1995 - Dec 2001
Thuraya Cellular Satellite Project

Specified the fax (facsimile) relay used by the Thuraya satellite and Ericsson ground station to provide personal and business phone service [C++].

Co-inventor of intellectual property used in the design of fax systems for cellular as well as commercial satellite networks using traditional audio fax signals - U.S. Patents 6411689 and 6603577.

Specified the 3D stochastic fading distribution for the Thuraya radio link testbed. Led a team during the radio link performance testing to eliminate a 1.5 dB shortfall by resolving three issues of about .5dB each [MATLAB, C]. This allowed RF performance to meet tight requirements for speech, fax and data calls. Revenue to date exceeds $2 Billion.

Air Reach Project - Fixed location (home and business) cell telephone service (with fax)
Modeled the existing demodulation re-modulation fax signal relay and assessed its floating point performance in base stations and its fixed point performance in the household cell phone based subscriber units. Re-designed the phase locked loop and the stochastic gradient descent adaptive linear filter to train successfully on the audio signals (complex) from the fax models in use across India and the Czech Republic, and also while under the CCITT copper wire telephone landline impairments [MATLAB, C, ATT 1610 DSP (Fixed Point), Texas Instruments C31 DSP (Floating Point), 8-PSK and 16-QAM demodulation].

Raytheon – Wireless Research Group Fairfax, Virginia
Communications System Architect May 1990 - Aug 1995
Direction Finding System

Designed the direction finding module of a passive phase based communications radar system using the Multiple Signal Classification (MUSIC) algorithm. Modeled the antenna array's amplitude and phase response over a combination of radio frequencies and azimuth angles. Used principal component analysis of MUSIC on the array manifold in MATLAB to derive simulated line of bearing estimates in noise, including to multiple simultaneous transmitters on the same frequency. Optimized the sensor configuration and corresponding MUSIC manifold to improve the spatial spectral resolution.