Sergey Voronin, Ph.D. | sergey.voronin@outlook.com | https://svoronin.neocities.org | N. Virginia | U.S. Citizen

Background in applied and computational mathematics, large scale data analysis, parallel computing, machine learning. M.A., Ph.D. and 12+ years work in academia and industry. Experience as researcher & developer and small teams lead. Developed multiple computational solutions with a mix of statistical and machine learning based approaches for different applications. Successfully prepared grant proposals and led several funded project efforts. Good experience with C/C++/Python/R and Linux based tools. Multiple publications (www.researchgate.net/profile/Sergey-Voronin-4) and open source software (www.github.com/sergeyvoronin).

Professional Experience (Academia & Industry)

Personal Projects, Fairfax, VA. Nov. 2024 – Present.

- Implemented multivariate time series predictors using VAR, ARIMAX, MLP and LSTM based methods with parameter optimization and technical indicator computations and analysis for financial and weather data.
- Worked on some classification and regression challenges, implementing a multi label per instance text document classification engine with NLP using NLTK and Transformer models and a weather data regression engine with Scikit-learn and Gaussian Process Regression (GPR). Performed model parameter tuning and evaluated various metrics for different ensemble models.
- Researched and implemented image segmentation and OCR based text extraction and processing from food product label images with Python computer vision libraries.

Intel Corporation, Fairfax, VA.
Research Scientist, Software and Advanced Technology Group, April 2022 – Nov. 2024;

- Developed a streaming network data analysis system with an FPGA device. Network statistics and select packets are collected with the device, analyzed with statistics and autoencoder based feature mining, and anomalies reported with respect to measurement segments (e.g. 5 min), based on e.g. latency changes, DNS connections, or packet content information. Network analysis results are displayed in a dynamic HTML environment for review.
- Developed parallelized software for data compression, multi-variate time series analysis and prediction, and parallel sorting. This included the development of a parallel Burrows Wheeler transform implementation with Arithmetic coding and byte value histogram clustering for a parallel lossless compressor prototype, statistical and iterative machine learning based predictors for multi-variate series data (e.g. GPR with R, multi-stage LSTM implementation with Keras in Python), and a parallel merge sort implementation in C++ for sorting the unified host and network data sets.

Intelligent Automation, Inc. Rockville, MD.
Research Scientist / Sr. Scientist. June 2017 – April 2022.

- Developed algorithmic and computational solutions in areas of data compression, imagery analysis, anomaly detection, and machine learning based classification and regression. Utilized multi-core and GPU acceleration (e.g. parallel kernel evaluations and parameter optimization engines). Multiple time series, anomaly detection, and audio/video analysis developments.
- Authored multiple technical proposals and won SBIR grants on data compression, acoustics, antenna array systems, electrical fault analysis from DOE (FY ‘21 SBIR award), MDA (17-004), ARMY (18B-T009), NAVY (181-067, 192-097, 211-003), Air Force (AF19C-T009) and others (please see https://www.sbir.gov/awards). Led awarded projects as Principal Investigator with small teams and prepared technical reports and meeting materials. Presented work updates and deliverables to contracting office and prepared working software demos for onsite presentations.

Tufts University, Medford, MA; **University of Colorado Boulder**, Boulder, CO;
University of Nice Sophia Antipolis, France.
Norbert Wiener Assistant Professor; Postdoctoral Research Associate / Instructor, October 2012 – June 2017.

- Designed and analyzed novel numerical linear algebra algorithms with randomization for efficiently computing large scale matrix factorizations (low rank ID/CUR/SVD) for data mining, feature extraction and classification. Created RSVDPACK high performance matrix factorization package with shared memory CPU and GPU parallelism.
- Taught statistics, high performance scientific computing, differential equations and linear algebra courses.
- Developed compression and outlier detection techniques for large scale Geophysical data and used cluster based visualization.
- Created tools using MPI & OpenMP, with developed blocking and projection techniques, for performing large scale optimization based seismic inversion using complex constraints. Implemented Wavelet transforms on a cubed sphere grid for Earth models.

Education

Princeton University, Princeton, NJ. **M.A.** & **Ph.D.**, Applied and Computational Mathematics, Oct. 2009, Nov. 2012.
Developed and mathematically analyzed novel iterative algorithms for solving large matrix based optimization problems with sparsity constraints with application to Compressive Sensing and large scale inverse problems from Geophysics.
Fu Foundation School of Engineering and Applied Science, Columbia University, New York, NY. **B.S.**, Applied Mathematics (Computer Science minor), May 2007, GPA: 3.67.

Software development & data analysis experience

- Programming experience with: C / C++, Python, R, SQL, Java, Perl/bash scripting, Linux.

- P-threads/OpenMP/MPI shared/distributed memory programming experience and GPU computing with CUDA.
- Machine learning / deep learning development experience with: Scikit-learn, Keras in Python and Java Weka. NLP for text analysis and feature extraction. Implementations with ARIMAX, GPR and LSTM for time series analysis and prediction.
- Data analysis and visualization on time series, textual, imagery, audio/video, and various scientific data. Experience with different numerical algorithms (integration, optimization, Wavelet transforms, time series, etc.).
- Open source software packages developed including: RSVDPACK (randomized algorithms for dimensionality reduction), SparseOptimizationPack (iterative algorithms for sparsity inducing optimization), ParallelMatVecServer (server-side service for select BLAS/LAPACK ops with large inputs), MultiResolutionAudioClassification (wavelet based decomposition and ensemble scheme for audio classification).

UNIVERSITY TEACHING / PRESENTATION EXPERIENCE

Multiple courses and seminars given at Universities. Full semester courses taught to undergraduate and graduate students including Intro Statistics with R (2 semesters), Differential Equations and Linear Algebra (3 semesters), Calculus 2 and 3 (2 semesters), High Performance Scientific Computing (1 semester). Designed and led seminars on the use of cluster computing systems and data analysis and machine learning tools. Prepared and oversaw multiple technical presentations to project sponsors for SBIR/STTR projects.

SELECT PUBLICATIONS AUTHORED (additional content at https://www.researchgate.net/profile/Sergey-Voronin-4):

Voronin, S. SAR image compression with int-int transforms and dimensionality reduction, J. of Comp. and Comm., 2022.

Voronin, S., Borovikov, E., Hasan, R. Clustering and presorting for parallel Burrows-Wheeler compression, IJMSSC, 2021.

Nigam, N., Mohseni, S., Valverde, J., Voronin, S., Alonso, J. A Toolset For Creation of Multi-Fidelity Probabilistic Aerodynamic Databases. AIAA Scitech Forum, 2021.

Voronin, S. Numerical approaches for heat transfer problems, Intech Pub., 2020.

Koc, B., Arnavut, Z., Voronin, S., Koçak, H. Near-lossless Image Compression with Parity Reduction. IEEE, 2020.

Voronin, S., Multi-channel similarity based compression. J. CIS, 2020.

Erichson, B., Voronin ,S., et al. Randomized matrix decompositions using R. J. Stat Soft, 2019.

Voronin, S., Multi-stage image restoration with high noise/blur. J. CIS, 2019.

Voronin, S., Xiao, L., Mei, G., Xu, R. Multi-resolution classification techniques for PTSD detection, ISSPIT IEEE, 2018.

Voronin, S., Zaroli, C. Survey of computational methods for inverse problems, Intech Pub. (chap.), 2018.

Voronin, S., Zaroli, C., Cuntoor, N. Conjugate gradient based acceleration for inverse problems. Int. J. on Geomath, 2017.

Voronin, S., Martinsson, P.G. Efficient Algorithms for CUR and Interpolative Matrix Decomposition, J. of Applied and Computational Mathematics, 2016.

Voronin, S., Daubechies, I. An Iteratively Reweighted Least Squares Algorithm for Sparse Regularization, Contemporary Math., 2016.

Voronin, S., Martinsson, P.G. RSVDPACK: An implementation of randomized algorithms for computing the singular value, interpolative, and CUR decompositions of matrices on multi-core and GPU architectures, 2016.

Martinsson, P.G. and Voronin, S. A randomized blocked algorithm for efficiently computing rank-revealing factorizations of matrices. SIAM Journal on Scientific Computing, 2016.

Lodhi, M., Voronin, S., Bajwa, W. YAMPA: Yet another matching pursuit algorithm for compressive sensing. SPIE, 2016.

Voronin, S., Nolet, G., Mikesell, T. Compression Approaches for the Regularized Solutions of Linear Systems from Large-Scale Inverse Problems. Int. J. on Geomath, 2015.

Voronin, S., Mikesell, T., Slezak, I., Nolet, G. Solving large tomographic linear systems: size reduction and error estimation. Geophysical Journal International, 2014.

Voronin, S., Chartrand, R. A new generalized thresholding algorithm for inverse problems with sparsity constraints. ICASSP, 2013.

Charlety, J., Voronin, S., et al. Seismic tomography with a sparsity constraint: comparison with smoothing and damping regularization. J. Geophys Res., 2013.

Voronin, S., Woerdeman, H. A new iterative firm-thresholding algorithm for inverse problems with sparsity constraints. Applied and Computational Harmonic Analysis, 2013.

Voronin, S. Regularization of Linear Systems with Sparsity Constraints with Applications to Large Scale Inverse Problems. Ph.D. thesis, 2012.

Simons, F., Loris, I., Nolet, G., Daubechies, I., Voronin, S., Judd, S., Vetter, P., Charléty, J., and Vonesch, C. "Solving or resolving global tomographic models with spherical wavelets, and the scale and sparsity of seismic heterogeneity." Geophysical Journal International 187, no. 2, 2011.

Gerber, E.P., Voronin, S., Polvani, L. Testing the annular mode autocorrelation timescale in simple atmospheric general circulation models, Mon. Weather Review, 2008.

Voronin, S., Matthewman, J., Charlton, A., Polvani, L., Esler, G. A New Web Based Resource for Studying Major Mid-Winter Stratospheric Sudden Warmings, Stratospheric Processes and Their Role, Climate Newsletter, Vol. 27, 2006.