Sergey Voronin, Ph.D. | Northern Virginia (U.S. citizen)
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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.

Work Experience (Industry and Academia)

Intel Corporation, Fairfax, VA.

Research Scientist, Software and Advanced Technology Group, April 2022 – Nov. 2024;

- Developed algorithmic and computational solutions with statistical and machine learning methods for network data analysis and abnormality detection, with a multi-stage collection, analysis, and processing system. Network data is collected with an FPGA device, analyzed with statistics and autoencoder based feature mining, and anomalies reported with respect to measurement segments, based on e.g. latency changes, DNS connections, or packet content information.
- 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 new parallel lossless compressor prototype, optimized statistical and iterative machine learning based predictors for multi-variate series data (e.g. VAR and Gaussian Processes 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.

Nov. 2024 - Present (Independent research)

- Researched and implemented components of prototype implementations for fast image segmentation and object detection, text document summarization and classification with NLP, and image segmentation and OCR based text extraction for extracting and analyzing food product information to detect potentially harmful ingredients and combinations.

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. Implementation developments including the analysis and compression of data from multi-channel acoustic systems; machine learning based system for real-time data analysis and anomaly detection from aircraft based and electrical sensor systems, approaches for enhancement of degraded and corrupted imagery; automated PTSD assessment system from audio interview data; algorithms for space-time interception modeling; waveform superposition algorithm and implementation for combining multiple small antenna array transmitters to create complex far-field waveforms.
- 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.
- Developed convolution based and re-weighted least squares algorithms for least squares optimization problems with non-smooth constraints and implemented a sparse optimization package.
- Built shared and distributed memory implementations for several numerical algorithms in optimization and integration.
- Taught statistics, high performance scientific computing, differential equations and linear algebra courses.
- Developed, analyzed, and implemented novel data clustering and compression techniques for Geophysics applications.
- Applied compression and outlier detection techniques on large scale seismic data and performed cluster based visualization.
- Created tools using MPI & OpenMP, together 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.

Princeton University, Princeton, NJ.

Graduate Research Assistant, September 2007 – September 2012.

- Developed and mathematically analyzed novel iterative algorithms for solving large matrix based optimization problems with sparsity constraints with application to large scale inverse problems from Geophysics. Well cited Ph.D. thesis on novel algorithms for sparsity constrained regularization for compressive sensing and different inverse problems.
- Developed parallelized computational resources for optimization algorithms in imaging applications with C/C++/MPI.
- Implemented custom algorithms for denoising and deconvolution on images, and moving object detection in video frames.
- Performed statistical analysis and visualization of data from general circulation climate models on large clusters.

Software, Algorithm Development, and Presentation Skills

- Experience with several programming languages and good knowledge of Linux command line tools and development libraries, R and Python machine learning libraries. Implementation experience with different numerical algorithms (integration, optimization, Wavelet transforms, etc.). Programming experience with: C / C++, Python, Java, Perl/bash scripting, R, SQL.
- 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. LSTM for time series analysis and prediction.
- Data analysis and visualization on time series, textual, imagery, audio/video, and scientific (e.g. seismogram) data.
- Select open source software packages developed (please see https://github.com/sergeyvoronin) based on novel algorithmic formulations: RSVDPACK (multi-threaded implementation of 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), PBWTpcompressor (prototype parallel lossless compressor with byte value clustering).

Effective communication skills via teaching experience, conference and seminar presentations, and journal publications.

Education and University Experience

Princeton University, Princeton, NJ. **M.A.** & **Ph.D.**, Applied and Computational Mathematics, Oct. 2009, Nov. 2012.
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.

Postdoctoral Research and Instructorship experience (**2012-2017**): CNRS, University of Colorado, Tufts University.
University teaching experience (2014 - 2017): 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).

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.