Kevin Urban, PhD

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Profile

Highly-motivated, innovative individual with experience in data product development and transparent visualization of varied, high-dimensional data sets. Creative, analytic problem solver equipped with an intuition for trends and patterns in complex data sets, and insight into the underlying mathematical structure. Strategic and focused, interested in rapid research-to-product development. Self-motivated, collaborative personality with the understanding that a cross-functional, open-minded work environment and coupled skill sets result in efficient delivery of high-value, dependable data products. Effective written and verbal communicator.

Computing Skills

Programming / Tools: R, MatLab, Python, Interactive Data Language [IDL], UNIX, Bash (Shell Scripting), JavaScript, SQL, LaTeX, Vim, Fortran, Spark, Hive, MongoDB (shell, pymongo, rmongodb), Java, C/C++, Tableau

Analytics:

- **Structured Data** (e.g., uni/multi-variate time series, geospatial, model/simulation output, genomics data)
- **Unstructured Data** (e.g., image analysis, text mining / scrubbing web pages)
- **Sensor/Instrument Data Sets** (e.g., mining and analysis of vectorial time series data from 100's of globally-distributed geomagnetic sensors)
- **Data Pre-Processing** (detection and removal/remedy of outliers, clipped or out-of-range values, missing values; data structuring, normalization, and/or transformations)
- **Probability & Statistics** (e.g., sample statistics, inference, model identification, hypothesis testing, resampling, bootstrapping, confidence intervals, conditioning, error analysis, statistical modeling)
- **Supervised Machine Learning** (e.g., regression, classification, clustering, prediction)
- **Unsupervised Machine Learning** (e.g., PCA, SVD, hierarchical clustering, dimensionality reduction)
- **Time Series Analysis** (spectral analysis, digital signal processing, ARIMA, GARCH, prediction / forecasting, non-parametric methods)
- **Anomaly Detection** (e.g., kernel density methods, event detection, pattern recognition)
- **Statistical / Numerical Modeling** (model selection, linear/nonlinear models, dynamical systems, differential/difference equations, numerical stability, eigenvalues, Runge-Kutta methods)

Work and Professional Research Experience

Department of Physics, NJIT **Newark, NJ • January 2012 – present**

Research Scientist, Ph.D. Candidate. Advisors: Andrew Gerrard, Louis Lanzerotti, Denis Blackmore

- Through the combination of data/observationally-driven research and deep physical understanding of magnetohydrodynamics, explained decades-old problem that prevented proper understanding of the geomagnetic field's complex structure in Earth's polar regions [link]. The research involved stochastic analysis; development of novel visualization and analysis techniques [link]; collection, harmonization, and normalization of 100's of data sets [link] distributed across the Earth and solar system to model and understand the linear/nonlinear drivers of complex, physical systems.
- The product development included statistical and physical model selection, new interpretations of results commonly understood as anomalies found in the empirical spatial distribution, hypothesis testing, and development of dynamic correlation metrics which verified time-varying causal relationships [link], thus verifying the contrary hypothesis to previous understanding of the subject matter.

Department of Mathematical Sciences, NJIT **Newark, NJ • 2008 – 2012**

Research Scientist, Professor Denis Blackmore

- Investigated sources of chaos in a dimensionally-reduced parameter space of a discrete-dynamical system via Poincare map simulations in R [link]
- Numerically modeled and contrasted several representations of granular fluid systems in MatLab [link].
- Worked with numerically stiff difference equations requiring a stability analysis to understand how to minimize the propagation of numerical errors, which otherwise prevent proper quantitative analysis and visualization of the underlying dynamical system.
- Published papers [link] on granular fluid systems [link] and fractional dynamics [link]
- Gained knowledge in advanced mathematical disciplines such as dynamical systems, topological analysis, manifold theory, abstract algebra, stochastic calculus

NASA/CalTech Jet Propulsion Laboratory **Pasadena, CA • Summer 2011**

Intern, Trajectory Optimization / Design

- Participated in the development of a full-fledged spacecraft mission to the Trojan asteroids of Jupiter (from establishing and prioritizing science goals, to optimizing the science-engineering-financial parameter space, to the written proposal and presenting our mission design to the NASA review board)
- Gained an appreciation of rapid product development via concurrent engineering
- Gained understanding of the intricate interplay between the various engineering system designs, science goals, timeline requirements, and budget constraints.

Department of Physics, NJIT **Newark, NJ • August 2008 - August 2011**

Independent Research Scientist (2010-2011)

- Continued development of an operational, real-time (nowcast) of local-to-global scale geomagnetic conditions (space weather), leading to a publication of showing proof-of-concept [link]

Research Assistant (2008-2010)

- Analyzed multi-channel instrument data from a spatially-distributed network of automated observatories in Antarctica.
- Developed data metrics and associated classification scheme for events of interest in the data sets.
- Demonstrated the feasibility of a real-time detection/classification scheme in maintaining surveillance on local, regional, and global-scale geomagnetic events of interest.
- Gained practical experience in various data analysis techniques, such as digital signal processing, time series analysis, spectral analysis, statistical methods, and regression.
- In-depth experience visualizing and analyzing data in R, MatLab, and IDL
- Published Master's thesis

NASA Goddard Space Flight Center **Greenbelt, MD • June – August 2007**

Intern, Observational Cosmology Laboratory

- Developed software implementing a Stokes parameter analysis to run on simulation data for the proposed Absolute Spectrum Polarimeter [ASP] — an instrument designed to detect B-mode gravitational waves, which would provide evidence for Einstein's theory of general relativity and cosmological inflationary theory
- Gained practical experience in IDL, MatLab, and shell scripting

NASA Goddard Space Flight Center **Greenbelt, MD • June – August 2006**

Intern, Heliophysics Division

- Worked extensively in the UNIX programming environment, learning and developing Python, HTML, CSS, JavaScript, and PHP code
- Developed web content

Selected Peer-Reviewed Publications

- Penetration of solar wind hydromagnetic energy deep into the polar cap: remote detection and forecasting. Geophysical Research Letters, Submitted, 2016.
- Rethinking the polar cap: eccentric-dipole structuring of ULF power at the highest corrected geomagnetic latitudes. Journal of Geophysical Research, In Press, 2016.
- Mission to the Trojan Asteroids: lessons learned during a JPL Planetary Science Summer School mission design exercise [link], Planetary and Space Science, Vol. 76, 2013.
- Quiet-time observations of the open-closed boundary prior to the CIR-induced storm of August 9, 2008 [link]. Space Weather, Vol. 9, S11001, 2011.

Education

Ph.D., Applied Physics **May 2016**

New Jersey Institute of Technology & Rutgers University, Newark, NJ

Dissertation: The Hydromagnetic Structure of the Polar Cap and Its Interaction with the Solar Wind

M.S., Applied Physics (Minor: Applied Mathematics) **August 2010**

New Jersey Institute of Technology & Rutgers University, Newark, NJ

Thesis: Synoptic Variability of a CIR-Driven Open-Closed Boundary During Solar Minimum

B.S., Applied Physics (Minor: Applied Mathematics) **May 2008**

New Jersey Institute of Technology & Rutgers University, Newark, NJ