# Dale T. Smith, Ph.D.          Vita

CONTACT
INFORMATION

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RESEARCH
INTERESTS

- Data Provenance and Analytics on a Blockchain
- Tensor Methods in Machine Learning, Deep Learning, and Optimization
- High Performance Machine Learning
- Opening the Black Box – Stakeholder Acceptance and the Why of Predictive Models

ACADEMIC
APPOINTMENTS

- **Adjunct Assistant Professor, Computer Science Department, Georgetown University**, Fall Semester 1999. Taught a course in computer networking.

- **Adjunct Assistant Professor, Department of Mathematics, Agnes Scott College**, January 1993 - May 1993. Taught a course in finite mathematics (mathematics of finance, descriptive statistics, and linear programming).

- **Instructor, DeKalb College, Department of Mathematics**, April 1992 - December 1992. Taught courses in college algebra.

- **Visiting Assistant Professor of Mathematics, University of North Texas**, September 1990 - May 1991. Taught calculus.

- **Visiting Instructor in Mathematics, Wake Forest University**, September 1989 - May 1990. Taught calculus and differential equations.

PUBLICATIONS

- With Geronimo, J.S. and W. Van Assche, Strong Asymptotics of Polynomials with Regular and Slowly Varying Recurrence Coefficients, Journal of Approximation Theory, 1993, v. 72, p. 141–158. doi:10.1006/jath.1993.1012
- With Geronimo, J. S., WKB (Liouville-Green) analysis of second order difference equations and applications, Journal of Approximation Theory, 1992, v. 69, p. 269–301. doi:10.1016/0021-9045(92)90003-7
- Exponential Decay of Resolvents and Discrete Eigenfunctions of Banded Infinite Matrices, Journal of Approximation Theory, 1991, v. 66, p. 83–97. doi:10.1016/0021-9045(91)90058-I
- On the Spectral Analysis of Self-Adjoint Operators Generated by Second Order Difference Equations, Proceedings of the Royal Society of Edinburgh (Series A), 1991, Volume 188A, p. 139–151. doi:10.1017/S0308210500028973
- Inflation in China, KWR International Newsletter, October 2007.
- Review of "Vietnam: The New Asian Dragon An Investment Guide to Vietnam" by Kenneth Pounds, KWR International Newsletter, February 2009.
- Review of "China: Fragile Superpower" by Susan Shirk, KWR International Newsletter, October 2007.
- Review of "Will the Boat Sink the Water: The Life of China's Peasants" by Chen Guidi and Wu Chuntao, KWR International Newsletter, August 2007.
- Non-Academic Employment in Finance for Ph.D. Students, January 2013.

UNPUBLISHED
MANUSCRIPTS

- Emerging Market Bonds and Risk Management, July 2004.
- Comparing Stochastic Volatility and GARCH Models of Volatility, July 2004.
- Interest Rate Term-Structure Models and Interest Rate Derivatives, July 2004.
- Economic Statistics and their Meaning, February 1993.
- Asymptotics of Solutions of First Order Systems of Nonlinear Differential and Difference Equations, November 1992.
- Spectral Analysis of Second Order Difference Equations, April 1992.

- Nonlinear Analysis and Oscillation Problems in Suspension Bridges, October 1991.
- On a Transient Problem for a Hyperbolic Equation with a Discontinuous Coefficient Function, December 1986.

TALKS
- Tensor Decomposition and Machine Learning, MLconf, September 2015.
- Theory of Prepayment Modeling, Fiserv Conference, June 2014.
- Bank Capital Models and Bivariate Normal Probability Calculations, Joint Mathematics Meetings, January 2013.
- AMS Conversation on Non-Academic Employment, Joint Mathematics Meetings, January 2013.
- AMS Conversation on Non-Academic Employment, Joint Mathematics Meetings, January 2010.

EDUCATION

**The Georgia Institute of Technology**, Atlanta, GA

Ph.D., School of Mathematics
- Dissertation: Exponential Decay of Resolvents of Banded Infinite Matrices and Asymptotics of Solutions of Linear Difference Equations
- Adviser: Professor Evans M. Harrell II
- Area of Study: Differential and Difference Equations, Mathematical Physics, Special Functions

M.S. in Applied Mathematics, School of Mathematics.

**The University of Alabama in Birmingham**, Birmingham, AL

B.S., Department of Mathematics.

PROFESSIONAL
EXPERIENCE

**Data Scientist, FraudScope LLC**, Atlanta, GA, February 2017 – August 2017
- Parallel processing of machine learning algorithms to fulfill the company's objectives: find fraudulent claims.
- Prototyped and evaluated machine learning models in C++ using PETSc and SLEPc that are used to score claims for use in the company's fraud detection technology.

**Data Scientist, Macy's Systems and Technology**, Johns Creek, GA, February 2016 – February 2017
- Formulated ways to quantify "poor user experience" for Macys.com and Bloomingdales.com user population so predictive models could be used to perform root cause analysis using graphs of connections between application JVM pools, number of transactions, and response times, blocked connections, bytes in and out, etc.
- Fit Random Forest, ADABoost, and other models to predict web server error code counts and web server transaction response times. Used a variety of methods to select features. Worked with team members and other stakeholders to formulate features that incorporate unique characteristics of the Macys.com environment. Created a super–learner to make final predictions from a number of models. Evaluated models with respect to known bad days for the Macys.com environment.
- Code and model reviews of junior team member's work along with mentorship and guidance in work-related matters.
- Created a Lunch and Learn series to further educate junior team members in Python, Pandas, and scikit–learn.

- Formulated plans to integrate disparate datasets from server logs and other sources which were collected at different time intervals. Formulated plans to move to one minute data collection.
- Formulated plans and procedures for the new Data Engineer. Coordinated tasks against user stories and prioritized work. Formulated data recovery procedures and plans so that the team's database does not have significant gaps in the time series. Formulated plans to create a crawler to find gaps and fill them in automatically. Wrote SQL stored procedure to find gaps in time series data.

**Data Scientist, Nexidia**, Atlanta, GA, January 2015 – January 2016

- Used ensemble classification algorithms such as Random Forests to improve and rework an existing churn prediction model for a major cable operator. Feature selection and algorithm parameters were selected using recursive feature elimination and searching a grid of parameters (coarse, then fine) using cross–validation. Loaded and extracted evaluation data provided by the customer. Prepared reports evaluating model against out-of-sample churn experience.
- Troubleshoot and improve existing production churn model in R. Wrote R code to train new version of the random forest model and evaluate current model. Evaluated multiprocessing infrastructure in R versus python. Rewrote production prediction process in Python using scikit–learn and pandas. Integrated new model into the existing production system.
- Wrote Cython wrapper around Nexidia C++ libraries used to read tens of thousands of transcript files along with metadata.
- Wrote feature extraction code to reproduce a SVM model from a published paper in order to classify zones (disclaimer, etc) in emails.

**Senior Quantitative Analyst, Fiserv.**, Norcross, GA, March 2011 - Present

- Wrote R package used for prototyping and unit testing regression diagnostics written in RcppArmadillo; compared to known results in R and then reimplemented in Visual Studio using Armadillo.
- Implemented linear regression model classes and model diagnostics in C++ using Armadillo for use in automated model building in various software products as well as in DFAST stress testing.
- Wrote R and C++ code to implement linear regression models and diagnostics to forecast balances and charge-offs for a bank's balance sheet as inputs into the DFAST stress testing process.
- Wrote a proposal to add seasonality and trend decomposition to the existing time series analysis tool.
- Wrote a proposal to add credit adjusted cash flows using probability of default models.
- Wrote a proposal to address prepayment model changes including fitting seasoning, burnout, and seasonality effects as well as a new two factor (home prices and interest rates) option-theoretic valuation methods using partial differential equations to incorporate default and prepayment in the boundary conditions.
- Wrote a paper outlining the uses of prepayment models in asset/liability management for small and medium size banks. Researched vehicle loan prepayment models and made recommendations to include such models in the Fiserv prepayment model tool.
- Evaluated the economic capital model. Wrote technical paper outlining the model and incorporated changes into the C++ source code. Wrote unit tests to assure that changes to the source only incorporate known changes. Re-implemented in R to check the model source code. Bivariate normal probability calculations being a key part of the model, known algorithms were investigated in order to achieve the greatest speed while preserving double precision. Current

work involves extending and developing new algorithms to speed up bivariate normal and t probability calculations.

- Worked with business analyst to identify gaps in valuation of commonly-held securities and other instruments (deposits, CD's, etc) held as assets and liabilities by banks. Wrote up the Hull-White model in C++ and used QuantLib classes to bootstrap yield curves for use with fixed-income instruments with embedded interest rate options. Evaluated common loss given default statistical models. Researched loss given default and default probability models, including lasso and ridge regression models, intended for use by small banks on their own portfolios.

**Analyst (Contractor), Credit Suisse**, New York, NY, November 2009 - March 2011

- Provided support and analysis for a trading desk and middle office risk management system, including user and technical documentation of analytics and user interfaces.
- Developed decomposition algorithms for ETF's which hold other ETF's, bond ETF's, and leveraged ETF's and wrote functional specs.

- **Quantitative Developer, Vicis Capital LLC**, New York, NY, June 2007 - October 2009
  - Wrote SQL stored procedures and C++ programs to create multithreaded programs for scenario analysis of convertible bonds. Wrote C# programs to automate downloading data from Bloomberg and populating into the database. Wrote C# front end to facilitate setting up new convertible bonds. Produced various charts and analyses in R (free version of S-Plus). Interfaced Excel with Bloomberg API. Supervised end of day pricing for over $4 billion in securities.
  - Supervised work implementing and evaluating the finite element method for the Black-Scholes partial differential equation in ANSI C++ which was used to value and calculate Greeks for warrants book. Reviewed C++ code and models for pricing equity options with an eye to performance enhancements and reliability. Also supervised the work to develop a Gaussian copula model in R which is used to value and calculate Greeks for OTC basket equity derivative options with various payoffs, including dispersion payoffs.
  - Wrote report tool in Excel/VBA to streamline and automate risk report generation for risk committee and investors. Streamlined scenario analysis generation for US and non-US convertible bonds.
  - Worked with convertible bond desks in Hong Kong, London, and New York on traders blotter in Excel/VBA which was interfaced via Web Services with associated C++ .NET classes in the .NET calculation server and Bloomberg. Automated the end of day convertible bond analytics generation.

**Senior Software Engineer, Aladdin Capital Management**, Stamford, CT, August 2005 - June 2007

- Supported the team that obtained provisional AAA ratings for a Credit Derivative Products Company (CDPC). Integrated Excel-based capital models with Murex using VBA and stored procedures for proof of concepts to prepare for rating agency visits. Reviewed relevant documents and conceptualized systems to fulfill CDPC requirements. Provided technical support during rating agency visits. Wrote specifications for external reporting to rating agencies and counterparties. Provided time series of average CDS spreads by rating and fielded other data mining requests.
- Provided reports and programming support in Python and SQL for the ABS and Corporate bond trading desks.
- Wrote prototype of an ABS credit monitoring application in Java.
- Wrote design documents for trade order management and credit monitoring applications.

**Director, Quantitative Risk Group, Risk Management Department, Depository Trust & Clearing Corporation**, New York, NY August 2004  August 2005

- Assisted development team with financial indicator interpretation, mathematical optimization algorithms and source code for a credit risk ratings project used by the Credit and Market Risk group to evaluate DTCC participant financial strength.  Wrote test system in SQL stored procedures used to evaluate the ratings produced relative to various changes in underlying financial indicators. Evaluated quadratic programming optimization algorithms and their implementations as open-source projects in C++.
- Evaluated and rewrote models for FICC Fixed Income VaR project, including corporate and convertible bonds. Created test bonds and data for Quality Assurance department prior to moving to production systems.
- Wrote back and stress test reports (in Word, Excel/VBA, and PowerPoint) of simulations of participant failures in order to evaluate margin requirements for NSCC and FICC. These reports were sent to the Board of Directors risk committee.
- Wrote back test report evaluating risk controls in DTCs money market instrument business.
- Investigated depth and breadth of commercial paper markets. Used Bloomberg historical download tools in Excel to develop a haircut schedule for commercial paper for potential use as repo collateral for FICCs General Collateral Finance program. Wrote report sent to the Board of Directors risk committee. Investigated default probabilities and various ratings transitions for various worst-case scenarios for selected companies.
- Managed upgrades and software installations, worked with the IT department to implement automated data feeds, and wrote prototype C++ database access bridge class on the groups high performance computing platform.

**Programmer/Analyst, Financial Engineering Group, Greenwich Capital Markets**, Greenwich, CT, April 2000  August 2004

- Supported the risk group and agency mortgage-backed securities desk. Added new capabilities to an application used to value bonds, and additional functionality to other applications used to visualize data and value CMBS securities. Designed and implemented overnight batch jobs to perform risk and valuation calculations.
- Managed overnight batch processing system, wrote new Perl and Unix shell scripts when required, and provided troubleshooting of existing scripts and C++ programs. Interfaced with Sybase servers using SQL stored procedures.
- Added capabilities to record additional CMO information using an Intex-based Unix C++ program used to obtain whole loan and agency deal and tranche information.
- Increased the reliability of a critical data upload process using stored procedures and staging tables, increasing efficiency in producing reports for the trading desk.  Reduced total elapsed time of overnight valuation of trading desk bond positions from 14 to 11 hours by analyzing database jobs and correcting inefficiencies.
- Created database tables that provided a cross-reference between agency CMO deals and MBS pools, and wrote an Intex-based C++ program called from an overnight batch job to produce data files used to update the table.

**Programmer/Analyst, Radio Dynamics Corporation**, Atlanta GA and Bethesda MD, November 1996  April 2000

- Delivered web-based solutions running on Linux servers to support research projects in wireless engineering:
  - Perl and Unix shell scripts: Wrote a Web-based timesheet submission system, a work log management system, and a product tracking system using HTML, JavaScript, and CGI, and wrote scripts to interface with an Oracle database

       using ODBC and SQL. Provided data analysis, reporting, and other tasks for special projects in a time-critical environment.

- C and Java: Maintained existing code and wrote several programs to support Mobile Satellite System projects.

- Member of teams working at client sites to provide interference studies for coordinating PCS and terrestrial microwave deployments, and engineering design and optimization projects for PCS networks.