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## Dr. Ralph L. Wojtowicz

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[www.adjoint-functors.net/su/web](http://www.adjoint-functors.net/su/web)

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### Select Project Experience:

- Consultant: Senior Hadoop Analyst. PNC Bank. 2015–present
  - Developed and demonstrated MapReduce financial models
  - Translated statistical financial models in SAS to Python
  - Involved in strategic planning of corporate-level big data infrastructure
- Consultant: Financial analysis for Flexible Plan Investments, Ltd. 2014–2015
  - Developed machine learning and analysis software in R, Python and C
  - Researched and developed statistical algorithms for modeling financial markets
  - Designed SQLite and PostgreSQL databases for managing financial data
  - Wrote weekly technical reports for client
  - Tested and compared active trading strategies
- Principal Investigator: Applications of Big Data Technologies to Bio-Informatics. West Virginia NASA Space Grant Consortium (\$2000 grant). 2014
  - Conducted basic research in big data technologies
  - Prepared and delivered technical talk at annual NASA IV&V workshop
  - Implemented prototype software in Java using Apache Hadoop and Mahout
- Principal Investigator: Hadoop Cluster for Integrating Big Data Concepts and Methods into the Curriculum and Research at Shepherd University (\$19K grant). 2012–present
  - Developed hardware specifications for Hadoop cluster and purchased equipment
  - Installed all computer and networking hardware, all operating systems and software
  - Designed and implemented local area network
  - Developed and implemented demonstrations, course and research material involving Apache Hadoop, Mahout, Accumulo and Lucene/Solr
  - Served as system administrator for 20+ machine linux/unix Shepherd University Laboratory for Big Data Analytics
  - Wrote annual technical and financial report.
- Principal Investigator: Logic-Based Methods for Assurance of Complex System Performance. West Virginia NASA Space Grant Consortium (\$2500 grant). 2012
  - Conducted basic research in the independent verification and validation domain (IV&V)
  - Prepared and delivered technical talk at annual NASA IV&V workshop
  - Implemented software in Java

- Consultant (with faculty from Rensselaer Polytechnic Institute and the University of Illinois at Urbana-Champaign): Great Computational Intelligence. Air Force Office of Scientific Research (\$600K grant). 2011–2014
  - Conducted basic and applied research in artificial intelligence
  - Developed novel semantic technologies to support visualization and analysis of multi-sorted, linked data
  - Developed demonstrations in Java involving Jenna, Protégé, and Apache Accumulo
  - Gave research presentations at conferences including Turing Centenary Conference in Cambridge, UK
  - Wrote research articles and developed presentation material for a government client
- Assistant Professor: Shepherd University. 2011–present
  - Organized and taught 12 credit hours of undergraduate courses per semester
  - Implemented algorithms in Python for Hadoop streaming and developed relevant instructional material for numerical analysis and operations research
  - Implemented algorithms in Python and developed relevant course material for numerical analysis, operations research, mathematical modeling, capstone, and calculus
  - Implemented algorithms in R and developed relevant course material for introduction to statistics, probability and statistics, and linear algebra
- Principal Investigator: Quantum Kan Extensions and Applications. Intelligence Advanced Research Projects Activity (\$105K contract). 2011–2012
  - Managed all technical and financial aspects of project
  - Conducted basic and applied research involving algorithms for quantum computers
  - Developed software applications Java and Haskell
  - Wrote software documentation and user guide
  - Created presentation material and delivered presentations to a government client
  - Reviewed government contract and wrote subcontract for an academic co-investigator
- Analyst: Wide Aperture Array Passive Sonar Algorithm and System Development. Office of Naval Research. (\$1.6M contract). 2010
  - Developed analysis and simulation software in Matlab and Java
  - Analyzed sensor data from defense systems
- Technical Lead: Anomaly Detection Literature Survey for Adversary Detection Applications. Department of Homeland Security. 2010
  - Researched statistical anomaly detection techniques for applications to client systems
  - Wrote final technical report
- Technical Lead: Network Analysis and Activity Detection. Office of Naval Research (\$1.4M contract). 2009–2010
  - Responsible for data collection data and integration
  - Designed, developed and implemented network analysis application in Java
  - Utilized semantic web tools developed by the government and other contractors
  - Wrote monthly technical and financial reports to a government client
  - Demonstrated software system in a live Marine Corps exercise

- Analyst. Trade-Net Integration into Global Trader. Office of Naval Intelligence (\$1.9M contract). 2009–2010
  - Responsible for development of methods, algorithms and Java tools to support analysis and visualization of decades of cargo shipping transaction data from large Oracle database
  - Wrote user guides, research articles, technical reports and requirements documents
  - Conducted analysis and prepared presentation material for a government client
- Principal Investigator. Categorical Logic as a Foundation for Robust Decision Making. Air Force Office of Scientific Research (\$180K grant). 2008–2010
  - Responsible for all technical and financial aspects of the project
  - Conducted basic research in automated uncertainty management
  - Developed and implemented mathematical algorithms in Java
  - Prepared and delivered presentations to government program officers
- Principal Investigator. Categorical Logic as a Foundation for Reasoning Under Uncertainty. Missile Defense Agency (\$100K Phase I and \$500K Phase II SBIR contracts). 2006–2008
  - Developed and implemented algorithms in Java for integration into defense systems
  - Managed all technical and financial aspects of the project
  - Wrote monthly technical and financial reports and annual reports
  - Prepared and delivered presentations to government program managers
- Principal Investigator. Measures of Effectiveness Sensitivity Calculator. Office of Naval Research (\$100K contract). 2006–2007
  - Collected system performance metrics from multiple government and industry sources
  - Developed simulation software in Matlab and Java
  - Conducted numerical experiments over ranges of parameter values
  - Creating presentation material and technical reports for government clients
  - Made recommendations for government investment in future technologies
- Analyst: Algorithms for GPS-Denied Localization. Army Research Laboratory. 2004–2005
  - Researched and implemented computational geometry methods in Java and Matlab for applications to group localization in which some nodes lack GPS capabilities
  - Prepared presentation material for government clients

## **Employment:**

- Founder, Peakview Analytics, LLC. 2014
- President, Senior Scientist. Baker Mountain Research Corporation. Yellow Spring, West Virginia. 2011–present
- Associate Professor. Shepherd University. Department of Computer Sciences, Mathematics and Engineering. 2015–present
- Assistant Professor. Shepherd University. Department of Computer Sciences, Mathematics and Engineering. 2011–2015
- Analyst. Metron, Inc. Reston, Virginia. 2004–2011
- Assistant Professor. University of Dallas. Department of Mathematics and Computer Science. 2001–2004
- Visiting Assistant Professor. Rose-Hulman Institute of Technology. Department of Mathematics. 1999–2001

## **Education:**

- Doctor of Philosophy in Mathematics. University of Illinois at Urbana-Champaign. 2002
- Master of Science in Aeronautical Engineering. University of Illinois. 1992
- Bachelor of Science in Aeronautical Engineering. Rensselaer Polytechnic Institute. 1988
- Bachelor of Science in Mathematics. Rensselaer Polytechnic Institute. 1988

## **Select Awards:**

- Outstanding Faculty Award. Shepherd University. Nominated 2014
- Entrepreneur Award. CreateWV “Pitch Your Idea” contest. Charleston, WV. 2012
- Merit Award in recognition of exceptional professional development achievement. Shepherd University. 2012–2014
- Best Paper Award. International Conference on Computing Anticipatory Systems. Liège, Belgium. 2003
- University of Illinois College of Liberal Arts and Sciences Luckman Award for Excellence in Undergraduate Education. Nominated 1996
- University of Illinois Department of Mathematics Graduate Teaching Award. 1996
- National Science Foundation Graduate Fellowship. 1988–1992
- Outstanding Senior Award. Presented annually to the six outstanding students in the United States for exceptional academic achievement and participation in extracurricular activities by Sigma Gamma Tau, the national honor society for aerospace engineering. 1988
- Ricketts Prize. Presented by Rensselaer Polytechnic Institute in recognition of outstanding achievement. 1988

## **Software Development Experience:**

- Primary programming languages: Java, Python, R and Haskell
- Experience with: C/C++, Android, Hadoop/MapReduce, Processing, OpenGL, MatLab, Lisp, ML, Maple, PostScript, SQL (Oracle and PostgreSQL), Mathematica and Maxima
- Data analysis tools: Hadoop cluster implementation and management, MapReduce algorithm development and implementation, database management (Oracle, PostgreSQL) and design
- Knowledge of XML, RDF, OWL, Jenna, Protégé and semantic web technologies
- Operating environments: Linux, Unix , MacOSX, and Windows
- Other tools include: Version control (Subversion and CVS), emacs, vi and Eclipse

## **Select Presentations:**

- Innovation and Entrepreneurship Day at the State Capitol. February 2015
- West Virginia Higher Education Technology Conference. October 2014
- CreateWV Big Data panel session organizer and speaker. October 2014
- NASA IV&V Workshop. Fairmont, WV. September 2014
- Office of Naval Research Focus Area Forum: Data Science for Decision-Making. June 2014
- Rensselaer Polytechnic Institute Cognitive Sciences Colloquium. May 2014

- 8th International Conference on Semantic Technologies for Intelligence, Defense and Security. George Mason University. November 2013
- NASA IV&V Workshop. Morgantown, WV. September 2012
- IARPA Quantum Computer Science PI Meeting. Princeton, NJ. July 2012
- Turing Centenary Conference. Cambridge University. Cambridge, UK. June 2012
- IEEE 12th International Conference on Information Fusion. Seattle, WA. July 2009
- Air Force Institute of Technology Mathematics Colloquium. Dayton, OH December 2009
- Rose-Hulman Institute of Technology Mathematics Colloquium. October 2009
- Sixth International Conference on Computing Anticipatory Systems. Liège, Belgium. 2003
- Central Texas Algebra Conference. Baylor University. 2003
- AMS Special Session on Discrete Dynamics and Difference Equations. Joint Mathematics Meetings. Baltimore, MD. 2003

#### **Business Conferences and Workshops Attended:**

- Applications of R in Finance. University of Illinois at Chicago. May 2014
- Appalachian Regional Commission Workshop. Entrepreneurship Transforming Appalachia's Economy. Charleston, WV. November 2013
- Telework West Virginia Conference. Charleston, WV. May 2013
- Biometrics Identification Intelligence Strategic Planning Workshop. Bridgeport, WV. May 2013
- I-79 Technology Corridor Biometrics Workshop. Fairmont, WV. January 2013
- Create WV Conference. Charleston, WV. October 2012
- RESA 8 STEM Workshop. Martinsburg, WV. October 2012
- Appalachian Regional Commission Workshop. Charleston, WV. October 2011
- West Virginia Teaming to Win. 2011–2012, 2014
- Shepherd University Grant Workshop. January 2011
- NDIA Business Development Workshop. 2007
- Small Business Administration: Beyond Phase II Business Development Workshop. 2006

#### **Select Publications:**

- R. L. Wojtowicz. Fusion of State Estimates from Regime-Switching Models. Submitted to National Association of Active Investment Managers Wagner Award Competition. 2015.
- R. L. Wojtowicz. Sketch Theory as a Framework for Knowledge Management. To appear in *Innovations in Systems and Software Engineering*. 2015.
- R. L. Wojtowicz. Sketches, Views and Pattern-Based Reasoning. Proceedings of the 8th International Conference on Semantic Technologies for Intelligence, Defense and Security (STIDS 2013). George Mason University, November 2013.
- R. L. Wojtowicz and N. Yanofsky. *Quantum Kan Extensions and Their Applications*. IARPA contract D11PC20232 Final Report. 2013.
- R. L. Wojtowicz, S. Bringsjord and J. Hummel. Dynamic Semantics of  $\tau N$ -Theories. 2012.

- S. Bringsjord, J. Taylor, B. van Heuveln, K. Arkoudas, M. Clark and R. L. Wojtowicz. Piagetian roboethics via category theory: moving beyond mere formal operations to engineer robots whose decisions are guaranteed to be ethically correct. *Machine Ethics*. M. Anderson and S. L. Anderson Eds. Cambridge University Press. 2011.
- R. L. Wojtowicz. Non-Classical Markov Logic and Network Analysis. IEEE 12th International Conference on Information Fusion. Seattle, WA. July, 2009.
- R. L. Streit and R. L. Wojtowicz. A General Likelihood Function Decomposition that is Linear in Target State. in IEEE Aerospace Conference Proceedings. 2009.
- R. L. Wojtowicz. On Transformations Between Belief States. In Soft Methods for Handling Variability and Imprecision. D. Dubois, H. Prade, et al. editors. Volume 48 of Advances in Soft Computing. Springer-Verlag. pp. 313–320. 2008. <http://www.adjoint-functors.net/belief.pdf>
- R. L. Wojtowicz. *Categorical Logic as a Foundation for Reasoning Under Uncertainty and as a Guide to Machine Learning Algorithm Development*. SBIR Phase I Final Report. 2005.
- R. L. Wojtowicz. Symbolic Dynamics and Chaos Defined by Right Adjointness. CASYS'03-Sixth International Conference on Computing Anticipatory Systems (Liege, Belgium). D. Dubois, Editor. American Institute of Physics Conference Proceedings. (718):268-281. 2004. <http://www.adjoint-functors.net/aipcasy2.pdf>
- R. L. Wojtowicz. *On Categories of Cohesive, Active Sets and Other Dynamic Systems*. Ph.D. Thesis. Department of Mathematics, University of Illinois at Urbana-Champaign. 2002.
- R. L. Wojtowicz. *A Numerical Method for Computing Values of Maxwell's Collisions Integral on a Discretized Velocity Space*. M.S. Thesis. Department of Aeronautical and Astronautical Engineering, University of Illinois at Urbana-Champaign. 1992.

### Other Experience:

- Contract and grant management
- Non-profit 501(c)3 management
- Shepherd University micro-satellite student project manager. 2013–present
- Shepherd University Department of Computer Sciences, Mathematics and Engineering hiring committee. 2012–2014
- Shepherd University Department of Psychology hiring committee. 2012–2013
- Proposal Reviewer for Air Force Office of Scientific Research. 2012–present
- Reviewer: CogSci 2011, CogSci 2012 and CogSci 2013 conferences
- Extensive proposal writing and marketing experience with diverse clients
- Recruiting at American Mathematical Society Joint Mathematics Meetings 2006, 2008–2009
- Technical report writing in  $\LaTeX$

### Select Courses Taught:

- Operations Research. (Spring 2012, 2015). Course text: *Introduction to Algorithms* by Cormen, Leiserson, Rivest and Stein.
- Mathematical Modeling (Fall 2013, 2014). Course text: *Conceptual Mathematics* by Lawvere and Schanuel
- Probability and Statistics (Fall 2011). Course text: *Probability and Statistics* by DeGroot and supplemental material that I prepared covering the Kalman filter

- Numerical Analysis. (Spring 2014, 2015). Course text: *Introduction to Algorithms* by Cormen, Leiserson, Rivest and Stein. Supplementary text: *Mining Massive Datasets* by Leskovec, Rajaraman and Ullman.
- Introduction to Statistics. (Fall 2011, Spring 2012, Fall 2014, Spring 2015). Course text: *Statistics* by Freedman, Pisani and Purves
- Linear Algebra. (Fall 2014). Course text: *Linear Algebra Done Right* by Axler
- Mathematical Analysis I–II
- Introduction to Applied Mathematics I–II
- Introduction to Differential Equations
- Calculus I–III

**Online Coursework:**

- Mining Massive Datasets. Completion. Coursera. 2014
- R Programming. Completion with Distinction. Coursera. 2014
- Introduction to Data Science. Completion with Distinction. Coursera. 2013

**Citizenship:** USA