
CHARLES D. NICHOLSON, PH.D.

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SUMMARY

Dr. Charles Nicholson is an assistant professor at the University of Oklahoma in the School of Industrial and Systems Engineering and a principal faculty member of the Data Science and Analytics program in the Gallogly College of Engineering. He earned his Ph.D. in Operations Research from the Lyle School of Engineering at Southern Methodist University in Dallas, Texas in 2010.

Before joining the University of Oklahoma, he worked in the field of data science and analytics for 12 years. During this time he led multiple efforts and various teams in designing a broad array of proprietary data analytics solutions for multiple corporations across the nation and internationally. Projects include a wide variety of predictive and prescriptive analytics for diverse companies representing multi-billion dollar retail, finance, and restaurant industries. Successful data-intensive solutions developed include customer-level behavior prediction, fraudulent activity detection, GIS-based strategic and competitive targeting, and product allocation optimization.

After joining the University of Oklahoma in 2013, Dr. Nicholson developed two new graduate courses which became part of the core required curriculum of the Masters in Data Science and Analytics. His courses, offered on-campus and online, have attracted attention outside of the college and it is common to have students electing to enroll from other majors including Petroleum Engineering, Chemical Engineering, Industrial and Systems Engineering, Management, Economics, and others. His courses are often at full capacity, and it is not unusual to have 70+ graduate students enrolled with more still on the waiting list.

His research area is in complex resilient network systems, novel predictive and classification modeling approaches, and applied meta-heuristics. His current research activities are focused on modeling, optimization, and machine-learning algorithm methods to enhance communities (e.g., cities, towns) so that they can withstand and recover rapidly from major natural disasters. He works with experts from Civil Engineering, Economics, Social Science, and Computer Science to study and quantify how disruptions in the complex interdependent infrastructure systems that underpin modern society impact economic measures and social norms. This work is funded by both the National Institutes of Standards and Technology and the National Science Foundation.

EDUCATION

- Doctor of Philosophy, Operations Research, Southern Methodist University, December 2010
- Master of Science, Decision Technologies, College of Business, University of North Texas, May 2001
- Bachelor of Science, Physics, University of North Texas, May 1999
- Bachelor of Science, Mathematics, University of North Texas, May 1999

PROFESSIONAL EXPERIENCE

2013 – present **Assistant Professor, Industrial and Systems Engineering,
University of Oklahoma**

2008 – 2013 **Director and Founder, CN Analytics LLC, North Richland Hills, TX**

Provide statistical analysis, data mining, optimization modeling, predictive modeling, and database analytics consulting.

Project Excerpts

Client: Overseas online automobile insurance company

Project: Proprietary longitudinal customer data consolidated with demographic and survey data to develop a market segmentation paradigm for new product introduction.

Client: Emergency Department at large urban Hospital

Project: Analysis of ED data to evaluate the patient flow and the ED staffing. Currently developing a simulation of the ED department based on available data.

Client: National casual dining restaurant chain

Project: A technical analysis of company's data, systems, partners, and technological capabilities with respect to evolving their marketing strategies and channels.

Client: National fast-food restaurant chain

Project: Pre-post analysis of survey responses to determine and improve customer satisfaction in menu and products.

2002 – 2007 **Director of Consumer Analysis, Blockbuster, Dallas, TX**

- Lead marketing analytics and data mining for Blockbuster's strategic marketing department and various initiatives, including: Customer Relationship Management (CRM), competitive response, and new store concepts.

- Develop and lead teams of statistical analysts, programmers and campaign managers to provide: predictive modeling, exploratory data analysis, customer segmentation, directing marketing analysis, experimental design and GIS analysis for Marketing, Product, Finance, Field and Operations departments.
- Lead the data exploration and analysis of the multi-terabytes of data on customers, prospects, retail stores, finances, and competitors in a variety of data warehouses and proprietary systems.
- Provide management with valid, data-based decision support and communicating relevant findings effectively.
- Collaborate with cross functional teams of business subject matter experts, information technology teams, and external consultants to help guide the evolution of the in-house CRM system.

2000 – 2002 Statistical Analyst, UICI (Health Markets), North Richland Hills, TX

- Develop predictive models, customer profile analyses and experimental designs.
- Perform intense data and statistical analysis on large databases to evaluate and improve marketing strategies
- Design and implement multiple information system solutions leveraging Oracle and SAS on both NT and UNIX platforms.
- Direct vendor screening and selection process for large-scale information systems projects.

PUBLICATIONS

1. Zhang, W., P. Lin, N. Wang, C. Nicholson, X. Xue. 2017. Probabilistic prediction of post-disaster functionality loss of community building portfolios considering utility disruptions. **Accepted** in *Journal of Structural Engineering*.
2. Zhang, W., N. Wang, C. Nicholson. 2017. Resilience-based post-disaster recovery strategies for road-bridge networks. *Structure and Infrastructure Engineering*, **13**(11):1404-1413
3. Almoghathawi, Y., K. Barker, C.M. Rocco, and C. Nicholson. 2017. A multi-criteria decision analysis approach for importance ranking of network components. *Reliability Engineering and System Safety*, **158**: 142-151
4. Nicholson, C., L. Goodwin, and C. Clark. 2017. Variable neighborhood search for reverse engineering of gene regulatory networks. *Journal of Biomedical Informatics*, **65**:120-131
5. Barker, K., J. Lambert, C. Zobel, A. Tapia, J. Ramirez-Marquez, L. McLay, C. Caragea, C. Nicholson. 2017. Defining resilience analytics for interdependent cyber-physical-social networks. *Sustainable and Resilient Infrastructure*, **2**(2):59-67

6. Nicholson, C., K. Barker, and J.E. Ramirez-Marquez. 2016. Flow-based vulnerability measures for network component importance: Experimentation with preparedness planning. *Reliability Engineering and System Safety*, **145**: 62-73
7. Zhang, W. and C. Nicholson. 2016. Prediction-based relaxation solution approach for the fixed-charge network flow problem. *Computers & Industrial Engineering*, **99**:106-11
8. Nicholson, C. and W. Zhang. 2016. Optimal network flow: A predictive analytics perspective on the fixed-charge network flow problem. *Computers & Industrial Engineering*, **99**:260-268
9. Zhang, W. and C. Nicholson. 2016. A multi-objective optimization model for retrofit strategies to mitigate direct economic loss and population dislocation. *Sustainable and Resilient Infrastructure*, **1** (3-4):123-136
10. Kennington, J. and C. Nicholson. 2010. The uncapacitated time-space fixed-charge network flow problem: An empirical investigation of procedures for arc capacity assignment. *INFORMS Journal on Computing*, **22**: 326-337.
11. Zhang, W. and C. Nicholson. 2017. Objective scaling ensemble approach for mixed integer programming. In review in *Journal of Heuristics*.
12. Morshedlou, N., K. Barker, G. Sansavini, C. Nicholson. 2017. Adaptive capacity planning formulation for infrastructure networks. In review in *Journal of Infrastructure Systems*.
13. Zhang, W., N. Wang, C. Nicholson, M. Tehrani M. 2017. A Stage-wise decision framework for transportation network resilience planning and recovery." In review in *Reliability Engineering and System Safety*.
14. Darayi, M., K. Barker, C. Nicholson. 2016. A multi-industry economic impact perspective on adaptive capacity planning in a freight transportation network. In review in *International Journal of Production Economics*.

CONFERENCE PROCEEDINGS

1. Zhang, W., Wang, N., Nicholson, C. & Tehrani, M.H. 2017. Stage-wised Resilience Planning for Transportation Networks. Proceedings of the 12th International Conference on Structural Safety & Reliability (ICOSSAR 2017), Vienna, Austria, August 2017.
2. Cutler, H., Nicholson, C., Wang, N. & Zahran, S. 2016. Merging Economic and Civil Engineering Models to Estimate the Impact of Earthquakes. Proceedings of the 55th Annual Meeting of the Southern Regional Science Association, Washington, D.C. 2016.
3. Barker, K., C. Nicholson, J. Ramirez-Marquez. 2015. Vulnerability importance measures toward resilience-based network design. International Conference on Applications of Statistics and Probability in Civil Engineering (ICASP12), Canada, July 12-15, 2015.

INVITED TALKS AND CONFERENCE PRESENTATIONS

1. Zhang W., N. Wang, C. Nicholson, M. Tehrani M. 2017. Stage-wised Resilience Planning for Transportation Networks. Presented at the 12th International Conference on Structural Safety and Reliability, Technische Universitat Wien, Vienna, Austria.
2. Nicholson C., Intelligent Data Analytics. Invited speaker at the October 2017 OKC Innovates Big Data Symposium, Oklahoma City, OK, USA.
3. Nicholson, C., 2016. System and Modeling Interfacing. Presented at Semi-Annual Meeting of the NIST-funded Center for Risk-based Community Resilience Planning, Gaithersburg, Maryland, USA. November, 2016
4. Zhang, W., N. Wang, C. Nicholson. 2016. Resilience-Based Risk Mitigation and Recovery for Highway Transportation Network. Presented at the Probabilistic Mechanics & Reliability Conference 2016, Nashville, TN.
5. Zhang, W., N. Wang, C. Nicholson. 2016. Resilience-Based Post-disaster Recovery Strategies for Community Road-bridge Networks. Presented at INFORMS Annual Meeting, Nashville, TN.
6. Zhang, W., C. Nicholson. 2016. A Multi-objective Optimization Model for Mitigating Community Economic Loss and Population Dislocation. Presented at INFORMS Annual Meeting, Nashville, TN.
7. Zhang, W., C. Nicholson. 2016. Objective Scaling Ensemble Approach for Integer Linear Programming. Presented at INFORMS Annual Meeting, Nashville, TN.
8. Nicholson, C. and W. Zhang. 2015. Optimal Flow Analysis. Presented at INFORMS Annual Meeting, Philadelphia, PA.
9. Zhang, W. and C. Nicholson. 2015. Regression Based Relaxation. Presented at INFORMS Annual Meeting, Philadelphia, PA.
10. Barker, K., C. Nicholson, and J.E. Ramirez-Marquez. 2014. Resilience-based importance measures for network design optimization. Presented at Industrial and Systems Engineering Research Conference, Montreal, QC.
11. Clark, C. and C. Nicholson. 2013. Distributed parallel process particle swarm optimization on fixed charge network flow problems. Presented at INFORMS Annual Meeting, Minneapolis, MN.
12. Nicholson, C. 2010. Generalized time-space fixed-charge network flows. Presented at INFORMS Annual Meeting. Austin, TX.

FUNDED PROJECTS

Center for Risk-Based Community Resilience Planning

National Institute of Standards and Technology

Co-Principal Investigator: 02.01.2015 to 01.31.2020

Total: \$20,000,000; OU portion: \$1,374,998; Nicholson: \$458,332

Collaborative Research: Resilience Analytics: A Data-Driven Approach for Enhanced Interdependent Network Resilience

National Science Foundation

Co-Principal Investigator: 10.15.2015 to 10.14.2018

Total: \$2,209,129; OU portion: \$534,040; Nicholson: \$267,020

Data mining applications for gaming data

Nerd Kingdom

Principal Investigator: 01.15.2016 to 5.15.2017

Total: \$40,000; Nicholson: \$40,000

TEACHING ACTIVITIES

GRADUATE ADVISING: Ph.D. Candidates/Students

Weili Zhang; Industrial System Engineering (2013-2017)

Dissertation Topic: *Resilience-based performance modeling and decision optimization for transportation network*

Vera Bosco; Industrial System Engineering (2016-Present)

Dissertation Topic: *Optimization Modeling for Port Resilience*

Sai Theja Bhavraju; Industrial System Engineering (2017-Present)

Dissertation Topic: *TBD*

GRADUATE ADVISING: MS Students

Industrial and Systems Engineering

Yanbin Chang, Completion expected: May 2018

Thesis: *Optimal scheduling for transportation network recovery*

Samineh Nayeri, Completion: December 2017

Thesis: *Decomposition algorithm for time-space fixed-charge network flow problems*

Pauline Ribeyre, Completion: December 2017

Thesis: *Machine learning to identify characteristics of promising compounds for anticancer drug discovery*

Megan Snelling, Completion: May 2017

Thesis: *Model for mitigating economic and social disaster damage through structural reinforcement*

Olivia Perret, Completion: 2016

Thesis: *A novel post-hoc matching procedure using statistical learning methods*

Param Tripathi, Completion: 2016

Thesis: *Analysis of resilience in US stock markets during natural disasters*

Leslie Goodwin, Completion: 2015

Thesis: *Divided neighborhood exploration search for inferring gene regulatory networks*

Diana Wang, Completion: 2015

Thesis: *Modeling approach to network performance evaluation*

Cyril Beyney, Completion: 2015

Thesis: *Quantitative analysis of social media sensitivity to natural disasters*

Data Science and Analytics

Paul Calle, Completion expected: December 2018

Thesis: TBD

Alexander Rodríguez Castillo, Completion expected: May 2018

Thesis: *Novel approach to component-importance for resilience decision-making*

Alex Beene, Completion expected: May 2018

Thesis: *Predictive modeling for professional basketball performance*

Yunjie Wen, Completion: December 2017

Thesis: *Game theoretic approach to resilience strategies in transportation systems*

Gowtham Talluru, Completion: December 2017

Thesis: *Dynamic incremental response modeling*

Alexandra Amidon, Completion: December 2017

Thesis: *Dynamic online learning strategies for neural networks*

Emily Grimes, Completion: December 2017

Thesis: *Quantitative framework for user engagement analysis*

COURSES**ISE/DSA 5103 – Intelligent Data Analysis**

(Spring '14, Fall '14, Fall '15, Fall '16, Fall '17)

Intelligent Data Analytics is an approach to addressing real-world data intensive problems that integrates human intuition with data analysis tools to best draw out meaningful insights. Topics include problem approach and framing, data cleansing, exploratory analysis and visualization, dimension reduction, linear and logistic regression, decision trees, and clustering. Students will be introduced to a powerful open source statistical programming language (R) and work on hands-on, applied data analysis projects.

ISE 5113 Advanced Analytics and Metaheuristics

(Spring '15, Spring '16, Spring '17)

Advanced Analytics and Metaheuristics builds on the foundation established in Intelligent Data Analytics to explore and apply advanced techniques for addressing complex and potentially data intensive problems. Focus is on developing and employing problem solving strategies using advanced methods in the context of Data Science and Analytics. Topics include both continuous and combinatorial optimization with an emphasis on traditional techniques such as mathematical programming as well as modern heuristics such as simulated annealing, evolutionary algorithms, and swarm optimization. Students will use programming skills to implement algorithms and solve problems.

ISE 3293/5013 Applied Engineering Statistics

(Summer '14, Fall '14, Summer '15, Fall '15)

Introduction to probability, one and higher dimensional random variates, function of random variables, expectation, discrete and continuous distributions, sampling and descriptive statistics, parameter estimation, use of statistical packages.

ISE 4113 Spreadsheet-based Decision Support Systems

(Fall '16, Fall '17)

Covers all aspects of spreadsheet-based software functionality that are relevant to supporting decision-making. Microsoft Excel is used as the subject tool. Students will learn advanced functions of Excel that are available through the spreadsheet interface, the Visual Basic language and its integration with the spreadsheet environment, principles of decision-support systems studied in a variety of applications, including facility layout, warehousing, portfolio optimization, and various statistical inference problems.

EDITORIAL BOARDS

2015-Present: *Journal of Sustainable and Resilience Infrastructure*

HONORS AND RECOGNITONS

- 2017 Gallogly College of Engineering Teaching Scholar Award

During graduate and undergraduate studies

- Decision Technology Masters Academic Excellence Award
- Business Computer Information Systems Honors Award
- University of North Texas Master Fellowship
- University of North Texas Transfer Scholarship
- National Association for the Self Employed (NASE) Academic Scholarship
- University of North Texas Dean's List
- Physics Scholarship

TOOLS AND SKILLS

- Statistical and Analytical Software: SAS, Enterprise Miner, SPSS, R
- Optimization: AMPL, CPLEX
- Database: Oracle PL/SQL, SQL, SQL*Plus, TOAD
- Simulation: ProModel, Anylogic
- Programming: Python, C++, Java, Visual Basic, VBA, UNIX Scripting

PROFESSIONAL AFFILIATIONS

- INFORMS (2009 - Present)
- University of North Texas Information Technology and Decision Science Advisory Board Member (2006-2007)
- Luggage With Love (2016) (non-profit group dedicated to helping foster families), Board of Directors

PROFESSIONAL EDUCATION

- Certified Professional SAS Programmer
- SAS: Data Mining, Predictive Modeling, Neural Networks, Decision Trees, Advanced Programming
- ORACLE: Oracle SQL Optimization, PL-SQL

SPOKEN LANGUAGES

Completely fluent in English and Spanish