

Breanna Swan

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Education

PhD in Industrial and Systems Engineering, Minor in Statistics
North Carolina State University; 2016 – May 2021 (anticipated graduation date)
Dissertation: *Improving Patient Outcomes through Data Driven Medical Decision Making*

Master's Degree in Mathematics
University of Wisconsin – Milwaukee; 2014 – 2016
Thesis: *The Influence of Currents and Bathymetry on the Phytoplankton Growth Dynamics in a Deep Lake: An Application of the Lattice Boltzmann Method*

Bachelor of Science in Mathematical Physics, Viterbo University, La Crosse, WI

Experience

Data Science Intern, CNA, Arlington, VA, July – September 2019
Objective: Support Navy decision makers with interactive tools and data science.

- Constructed an interactive dashboard to visualize Navy supply chains, analyze the drivers of logistics response time, and inform evidence-based decisions
- Built an optimization tool to determine ideal combat group designs and assess tradeoffs between cost and operational capability
- Quantified scheduling risks and provided mitigation suggestions for platforms at-risk of deployment interruption due to COVID-19 effects on shipyards
- Extracted trends of maintenance patterns by developing time-dependent metrics from the integration of large datasets
- Briefed work to Navy stakeholders and C-Suite team

Data Analytics Intern, Retinal Care LLC., July - December 2019
Objective: Integrate data sources and machine learning techniques to improve the predictive ability of a novel eye care screening device.

- Improved predictive ability and prevented unnecessary care by developing a personalized prediction model using individual patient attributes and screening measurements.
- Transformed raw data from multiple clinical trials into process improvement recommendations aimed at operational efficiency of a small business.
- Continuously adjusted research to align with company priorities by collaborating with the company president, chief research officer, and physician.

Researcher, Southeastern Regional Medical Center, Aug 2018 – June 2019
Objective: Characterize processes in the emergency department (ED) and provide recommendations to improve the patient and staff experience.

- Identified drivers of variance in ED operations using data mining and statistical analysis on 15 years of health record data integrated across departments.
- Optimized staffing in a model informed by endogenous patient volume, capacity, and staff preferences.
- Demonstrated reduction in patient ED length of stay and a more balanced staff workload in a 3-D simulation model.
- Ensured implementable, relevant, and timely results by managing university research team and collaborating with hospital directors, providers, and analysts.

Skills

R
Python
Simio
Arena
Tableau
Gurobi
Excel VBA
Matlab
SAS Enterprise Miner

Related Coursework

Theory
Optimization*
Operations Research*
Linear Programming
Applied Stochastic Models
Adv. Production Planning
Industrial Mathematics*

Engineering
Simulation Methodology*
Automated Systems
Production Planning
Scheduling, Inventory Control
Logistics Engineering
Medical Decision Making
Healthcare Performance
Improvement

Statistics
Computational Statistics*
Data Mining with SAS
Stat. Principals Clinical Trials
Fundamentals of Inference
Experimental Stat. Engineers

*UW-Milwaukee

Research

Dissertation, North Carolina State University, Aug 2017 - Present

Objective: Implement machine learning techniques to identify patients at high risk of microvascular complications due to diabetes mellitus.

- Designed an algorithm to test combinations of machine learning techniques and to select the model which most accurately identifies high risk patients.
- Experimented with training data subsets and strategies for missing and imbalanced data using national clinical trial data.
- Developed an evidence-based nested cross validation technique to ensure an unbiased selection process and reliable performance estimates.
- Lead investigator on IRB protocol.

Specialty Referral Process; Duke University Health and NC State

- Projected 7 hours/week of electronic consultations will reduce appointment lead time by over 50 days.
- Illustrated the tradeoffs between outcome measures, compensation, and staffing needs by building a discrete event simulation informed by health records and pilot project data.

Duke Health Clinic of the Future; Duke University Health and NC State

- Extracted drivers of physician job dissatisfaction from surveys using natural language processing, data mining, and data visualization in Tableau.
- Prioritized evidence-based actionable process improvements to improve job satisfaction.

Effects of Clinic Location on Diabetic Retinopathy Screening Adherence: A Congested Facility Location Problem *Advanced Production Planning*

- Maximized potential screening adherence by identifying optimal clinical locations using a combined congested-facility-location model and screening adherence model for Wake County, NC.

Publications and Conferences

- B. Swan, S. Nambiar, et al. "Evaluating Diabetic Retinopathy Screening Interventions in a Microsimulation Model," 2020 Winter Simulation Conference (WSC), Orlando, FL, 2020. **Author, Oral Presentation.**
- B. Swan, M.E. Mayorga, and J. Ivy. "Personalized Risk Prediction of the Microvascular Complications of Diabetes using Machine Learning," INFORMS Annual Meeting 2020. **Oral Presentation.**
- B. Swan, M.E. Mayorga, and J. Ivy. "Risk Prediction Profile for Microvascular Complications in Patients with Diabetes," Society for Medical Decision Making Annual Meeting 2020. **Oral Presentation.**
- B. Swan, O. Ozaltin, S. Hillburn, E. Gignac, and G. McCammon, "Evaluating an Emergency Department Care Redesign: A Simulation Approach," 2019 Winter Simulation Conference (WSC), Ft Washington, MD, 2019. **Author, Oral Presentation.**
- B. Swan, S. Nambiar, et al. "Identification and Prioritization of Barriers to Care for Patients with Diabetes," INFORMS Annual Meeting 2019. **Oral Presentation.**
- B. Swan, C. Shevlin, A. Cho and D. Phinney, "Simulation Tool to Evaluate Electronic Consultations in Rheumatology," 2018 Winter Simulation Conference (WSC), Gothenburg, Sweden, 2018, pp. 2589-2599. **Author, Oral Presentation.**
- B. Swan. "Simulation Tool to Evaluate Electronic Consultations in Rheumatology." Healthcare Systems Process Improvement Conference 2019. **Oral Presentation.**
- Anthony L. Gerig and Breanna P. Swan. "Errors in ultrasonic scatterer size estimates due to mixed scatterer populations". The Journal of the Acoustical Society of America 134, 4122. 2013. **Author.**

Leadership Roles

Preparing the Professoriate
2019-2020 Cohort

ISE Teaching Assistant
NC State, 2019-2020

ISE Grad Student Association
President (2018 – 2019)
Treasurer (2017 – 2018)

Editorial Board Member
OR/MS Tomorrow, 2019

Math Instructor, UW-Milwaukee
2014 –2016

Awards

Excellence in Classroom
Teaching Award 2020

ISE TA of the Year Award 2020

NCSU Graduate Student
Association Travel Grant 2019

Shook Mentor Award 2019

Dean's Doctoral Fellowship
2016

Edward P. Fitts Fellowship
2017

Winter Simulation Travel Fund
2018

Health Systems Engineering
poster competition winner

Health Systems Engineering
Certificate

Grants

Co-Author

"Analytics-Based Platform for
Diabetic Retinopathy Care
Management"

Small Business Technology
Transfer Grant, National
Institutes of Health (NIH)