

David **Caleb** Robinson

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US Citizen

## INTEREST STATEMENT

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I am interested in using machine learning, optimization, and simulation techniques to create models that give better insights into the interactions of complex systems. An example of this is modeling the migration patterns of populations under different scenarios of sea level rise in order to understand and better plan for accelerated urban growth.

## EDUCATION

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- Georgia Institute of Technology, 2015-  
Ph.D. Computational Science and Engineering
- University of Mississippi, 2011-2015  
Major B.S. Computer and Information Science, Minor in Mathematics for Engineers  
GPA - 3.92

## SKILLS

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- Familiar with Python, Python machine learning/data science ecosystem and Python geospatial libraries
- Occasionally use Java, C#, HTML/CSS/Javascript, PHP
- Familiar working with geospatial datasets
- Familiar with formulating/solving mathematical programs using CLPEX or Gurobi
- Familiar with Linux, use Ubuntu Linux as main OS
- Graduate classes: Algorithms, Machine Learning, Computational Sustainability, Modeling and Simulation, Deep Learning, Network Science, Development Economics

## PUBLICATIONS

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### Journal Articles

C. Robinson, B. Dilkina, J. Hubbs, W. Zhang, S. Guhathakurta, M. A. Brown, and R. M. Pendyala, "Machine learning approaches for estimating commercial building energy consumption," *Applied Energy*, 2017

### Conference Proceedings

C. Robinson, F. Hohman, and B. Dilkina, "A deep learning approach for population estimation from satellite imagery," in *Proceedings of the 1st ACM SIGSPATIAL Workshop on Geospatial Humanities, GeoHumanities'17*, ACM, 2017

C. Robinson, A. Shirazi, M. Liu, and B. Dilkina, "Network optimization of food flows in the U.S.," in *Big Data (Big Data), 2016 IEEE International Conference on*, IEEE, 2016

A. Jain, C. Robinson, B. Dilkina, and R. Fujimoto, "An approach to integrate inter-dependent simulations using HLA with applications to sustainable urban development," in *2016 Winter Simulation Conference (WSC)*, IEEE, 2016

C. Robinson and J. Xue, "Sparse local binary pattern histograms for face recognition with limited training samples," in *Proceedings of the 2014 ACM Southeast Regional Conference*, ACM, 2014

### Other

C. Robinson and B. Dilkina, "A machine learning approach to modeling human migration," *arXiv preprint arXiv:1711.05462*, 2017

D. C. Robinson, "Modelling global climate variables with cellular automata networks." May 2015 (Honors Thesis)

## RESEARCH PROJECTS AND COURSEWORK

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### **Network Optimization of Food Flows in the U.S.**

advised by Dr. Bistra Dilkina

- The goal of this project was to treat the food-network in the U.S. as a graph, then to use optimization methods to re-organize the food flows between states in order minimize the number of food-miles traveled in the system.
- We formulated this goal as a multi-objective linear program and examined the tradeoffs between network efficiency and resiliency.

### **Optimization with Integrated Transportation and Land Use Models**

advised by Dr. Bistra Dilkina

- The goal of this project is to see if it is possible to influence where people live in an urban environment by changing the transportation networks with the purpose of achieving sustainability goals.
- We have coupled the recently released version of UrbanSim with MATSim to create a modeling framework in which to study this problem.
- I created several tools to visualize geographic and road network data to test the models.

### **Triangle Densest k-Subgraph problem with Integer Linear Programming**

advised by Dr. Bistra Dilkina

- Finding the Triangle Densest Subgraph of size  $k$  is a NP-hard problem that is useful for finding quasi-cliques in a graph.
- We are investigating finding and approximating hard instances of this problem with an Integer Linear Programming approach and comparing the performance against greedy heuristic based algorithms.

### **Vertex Cover solvers, Class Project**

CSE 6140 - Algorithms, Fall 2015

- I implemented Branch and Bound and Simulated Annealing algorithms in Python to solve the Vertex Cover problem.
- Tested the above algorithms with algorithms that team members implemented on common graphs from networking literature.

### **Cellular automata networks for predicting weather**

advised by Dr. Dawn Wilkins

- This was my undergraduate honors thesis project. I examined simulating climate variables with cellular automata models.
- I was interested if adding in long range connections to the cellular automata model could improve the accuracy of the model by learning the influences certain climate indicators (like El Nino) have on local weather.
- During the project I automated the training of over 10,000 neural networks on the Mississippi Center for Supercomputer Research's cluster.

### **Automating measurements of Space Plants**

advised by Josh Vandenbrink, Ph.D.

- This was my Senior year capstone project. I was tasked with creating a framework that automated the data collection process from images of seedlings grown on the International Space Station.
- A lab in the UM Department of Biology received groups of 80+ images, showing the growth of up to 10 seedlings per image over time, then had to measure each seedling in each image by hand with a graphics program.
- I created a Python program that facilitated faster manual measurements and automatically performed OCR, perspective transformations, and image registration on these image groups to standardize the measurements as much as possible.

### **Satire detection, Class Project**

CSCI 517 - NLP, Spring 2014

- The objective of this project was to make an algorithm that could detect whether a text was satirical or not.

- I scraped a corpus of articles from satirical news websites and regular news websites, then trained several common classifiers on parts of speech, n-grams, and bag of words features on the corpus.
- Found that the classifiers achieved high accuracy by overfitting to the high number of quotations used in satirical news articles.

**Face keypoints, Class Project**

ENGR 691 - Machine Learning, Spring 2014

- This problem was from the “Facial Keypoints Detection” Kaggle Competition, given an input image of a face, output where certain facial keypoints are.
- I attempted to use train a classifier to label the output from automatic keypoint detection methods from the OpenCV library.
- I also attempted a direct regression based approach using a neural network and local binary pattern images which performed better.

**Face recognition with limited training samples**

advised by Dr. Jianxia Xue

- This project was focused around the problems involved with automating classroom attendance using face recognition with a single training sample for each individual.
- I created a web application with a Python backend that performed online facial detection and recognition via a HTML5 webcam access.
- We examined improving the standard Local Binary Pattern Histogram approach for face recognition and using active learning to improve recognition accuracy.

## JOBS AND INTERNSHIPS

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**Research Intern, Oak Ridge National Laboratory.**

May 2016 - Aug 2016

- Created a web based visualizer that showed active hurricane tracks, and the probable power outages associated with the hurricane.
- Working on modeling human migration as a regression problem with deep learning techniques.

**Software Development Intern, FNC Inc.**

June 2015 - Aug 2015

- Created address validation software using machine learning techniques
- Created an automatic XML posting tool to assist testing API's

**Software Development Intern, CSpire Wireless**

June 2014 - Aug 2014

- Used Java with the Swing Framework and other enterprise level Java technologies
- Developed middleware REST services that facilitated communication between applications in different areas of the company
- Created a face recognition system that enabled a BrickPi Lego robot to shoot balls at unrecognized faces

**Software Development Intern, FNC Inc**

June 2013 - Aug 2013

- Worked on a development team using Agile Scrum methodology with 2 week sprints
- Used Team Foundation Server and Visual Studio with C# and ASP.NET
- Was able to integrate with the team quickly and wrote code that made it into production within the first week

**Software Development Intern, Wallace Community College, Selma, AL**

Dec 2012 - Jan 2013

- Worked on starting development of an air traffic controller simulator program
- Used Java to implement a multithreaded server as well as a full screen client application that could interact with multiple industry standard flight simulator programs

**Assistant Network Administrator, University of Mississippi Computer Science Department**

Jan 2012 Aug 2012

- Helped manage 79 laboratory computers spread over three different labs
- Created PHP based web application that ran on top of the Drupal CMS and interacted with departments active directory to manage student user accounts
- Recreated the department's Linux mailserver

Last updated: January 15, 2018

<http://calebrob.com/cv.pdf>