# Thomas Magelinski

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## Summary of Interests

I am a PhD student at CMU developing high dimensional network and heterogeneous graph embedding techniques in order to find coordinated misinformation campaigns on Twitter. Societal Computing has been a perfect fit for me, satisfying my passion for complex dynamical systems and my desire to work on problems that really impact people's lives.

## Education

**Carnegie Mellon University** — Pittsburgh, PA
PhD Societal Computing *GPA: 3.9* — August 2017 - May 2022

**University of Oxford** — Oxford, UK
Visiting Student — January 2015 - April 2015

**Virginia Tech** — Blacksburg, VA
Honors Baccalaureate Engineering Science and Mechanics *GPA: 3.9* — August 2013 - May 2017
Minors in Math and Physics

## Experience

**CASOS Lab** — Pittsburgh, PA
*Graduate Research Assistant* — August 2017 - Present

- Currently developing scalable models to detect and characterize coordinated information operations on Twitter using heterogeneous graph embeddings and stochastic block models
- Developed techniques for detecting and characterizing changes in network communities. Tools were applied to Ukraine's parliament to understand political factions and their change over time
- Took a leadership role in a multi-university collaboration, leading to publications and talks with researchers across 5 universities

**Ross Dynamics Lab** — Blacksburg, VA
*Undergraduate Research Assistant* — November 2015 - May 2017

- Investigated sources of uncertainty in military airdrop results as measured by variance in simulated landing location using physical simulations derived analytically and coded in MATLAB

**Thermo Systems** — East Windsor, NJ
*Control Systems Intern* — May 2015 - August 2015

- Created user interfaces for operators of medium-scale power plants

**Mathematical Institute** — Oxford, UK
*Undergraduate Research Assistant* — January 2015 - April 2015

- Built and coded a mechanical material stretcher, complete with GUI and image-based software to measure material stress and strain

**Bio-Inspired Fluids Lab** — Blacksburg, VA
*Undergraduate Research Assistant* — September 2014 - December 2014

- Collected and organized data from experiments to understand drinking mechanisms of dogs

## Awards

**Knight Foundation Fellow** — August 2020 - December 2020
Tuition and stipend funding to support research on coordinated information campaigns on Social Media, particularly surrounding COVID-19 and the 2020 US Election

**ARCS Foundation Scholar** — August 2017 - August 2020
Supplemental funding to develop dynamic network analysis techniques to discover changes in community structure

**Outstanding Senior: Engineering Science and Mechanics** — May 2017

**Virginia Tech Rhode Scholar Nominee** — November 2016

**Virginia Tech Marshall Scholar Nominee** — November 2016

**Tau Beta Pi: Engineering Honors Society** — September 2015 - May 2017

## Activities

**Societal Computing Seminar Chair** — September 2020 - Present
The SC seminar is a platform for PhD students to hold talks and discussions about research and life as a PhD student. Duties include speaker recruitment, scheduling, ordering food, and advertising.

**Co-Organizer: Ethics for Technologists Lecture Series** November 2018 - Present
Our lecture series aims to equip technologists and engineers with tools and frameworks for handling the ethical aspects of their work. We have secured funding from the Dean's office to hold monthly talks from a wide range of speakers. The average attendance is 30 people. Duties include speaker recruitment and arrangements, scheduling, organization of food, and advertising.

**Faculty Hiring Committee Member** November 2020 - Present

**PhD Admissions Committee Member** 2018, 2019

**Biomedical Engineering and Mechanics Ambassador** August 2016 - May 2017

## Projects

**Distributed Network Analysis** *PySpark, PyTorch-BigGraph*
Currently working on distributed construction and embedding of networks from over 400GB of Twitter Data on COVID-19 and the 2020 Elections

**Weakly Supervised Twitter Bot Classification** *Python*
Implemented an Adaptive Graph Filter model to classify 87k Twitter users as human or bot with 79% accuracy given 10% of labels

**Convolutional Neural Network for Image Classification on CIFAR-10** *Python, NumPy*
Hand-coded a 2 convolutional + 1 fully connected layer neural network using only NumPy to classify images in CIFAR-10 with 54% validation accuracy

**Crowd Dynamics Robot** *Arduino, MATLAB*
Led a 6-member team to build, program, and deploy a robot that interacts with moving crowds based on a real-time data stream of individual's locations

## Teaching

I enjoy teaching and mentoring students. I have been a teaching assistant for the CASOS Summer Institute in 2018, 2019, and 2020, which is a week-long course in Network Science tools and applications, open to members of academia, industry, and government. I have also tutored students in AP Physics, AP Calculus, and Calculus 2.

## Review Activities

I believe serving as a peer reviewer is an important act of service as a researcher. I have reviewed multiple papers in Computer Networks, Computational and Mathematical Organization Theory, and SBP-BRiMS.

## Publications - Journals

**Magelinski, T.**, Bartulovic, M., & Carley, K. M. (2020). Measuring Node Contribution to Community Structure with Modularity Vitality. IEEE Transactions on Network Science and Engineering *Accepted.*

- We give a highly scalable algorithm for calculating Modularity-Vitality, which measures centrality of nodes with respect to communities. MV improves the ranking of 1 million PA road intersections by a factor of 8, as measured by ability to fragment the road network, when comparing to techniques like pagerank.

Uyheng, J., **Magelinski, T.**, Villa-Cox, R., Sowa, C., & Carley, K. M. (2019). Interoperable pipelines for social cyber-security: assessing Twitter information operations during NATO Trident Juncture 2018. Computational and Mathematical Organization Theory, 1-19.

- We advocate for interoperability when developing tools for analyzing information operations, and apply one such pipeline to the discussion of the Trident Juncture Exercise. We identify several anti-NATO narratives painting it as brutal, incompetent, or unwanted by the public, and looked at how those narratives complemented that of Russian state-sponsored media.

**Magelinski, T.**, & Carley, K. M. (2019). Community-based time segmentation from network snapshots. Applied Network Science, 4(1), 25.

- We give an algorithm for determining time segments of community stability. These segments can then be analyzed with static network analysis. Applied to the Ukrainian Parliament, we are able to see a massive change in political alliance following the revolution of 2014.

**Magelinski, T.**, & Carley, K. M. (2019). Analytic Models of Roll Call Voting Dynamics. IEEE Transactions on Computational Social Systems, 6(5), 932-942.

- Ukrainian parliament has an interesting structure, where bills require many votes to pass. We show that this system is well-modeled with an ordinary differential equation, showing that the first 2 votes are indicative of the bill's fate.

## Publications - Conferences

**Magelinski, T.**, Beskow, D. M., & Carley, K. M. (2020). Graph-Hist: Graph Classification from Latent Feature Histograms with Application to Bot Detection. In AAAI (pp. 5134-5141).

- We introduce a differentiable histogram layer to a deep graph-classification architecture written in PyTorch. Graph-Hist improves SotA graph-classification by 1-2% on Reddit Benchmarks. We show this leads to more generalizable, but less scalable bot-detection on Twitter.

**Magelinski, T.**, Bartulovic, M., & Carley, K. M. (2020). Canadian Federal Election and Hashtags That Do Not Belong. In International Conference on Social Computing, Behavioral-Cultural Modeling and Prediction and Behavior Representation in Modeling and Simulation. (pp. 161-170).

- We show that hashtags with the highest Modularity Vitality scores are more interpretable labels for hashtag clusters than existingmeasures like degree. We apply this method to the Canadian Election discussion with 3 networks of 10 million hashtags each, and find that the both of the major players had strong social media presence during the election, but discussion quickly changed to specific policy problems afterward.

**Magelinski, T.**, Stine, Z., Marcoux, T., Agarwal, N., & Carley, K.M (2020). Artifacts of Crisis: Textual Analysis of Euromaidan. In International Conference on Social Computing, Behavioral-Cultural Modeling and Prediction and Behavior Representation in Modeling and Simulation. (pp. 329-339).

**Magelinski, T.**, Hou, J., Mylovanov, T., & Carley, K. M. (2019). Detecting Disruption: Identifying Structural Changes in the Verkhovna Rada. In International Conference on Social Computing, Behavioral-Cultural Modeling and Prediction and Behavior Representation in Modeling and Simulation (pp. 194-203).

**Magelinski, T.**, & Carley, K. M. (2018). Legislative voting dynamics in Ukraine. In International Conference on Social Computing, Behavioral-Cultural Modeling and Prediction and Behavior Representation in Modeling and Simulation (pp. 82-88).

## Talks, Posters, and Working Papers

**Magelinski, T.** & Carley, K. M. (2020). Detecting Coordinated Behavior in the Twitter Campaign to Reopen America. Extended Abstract. IDeaS Conference on Social-Cybersecurity in Times of Crisis and Change.

Bartulovic, M. & **Magelinski, T.** (2020). Networked Time Series Analysis and Clustering. Tutorial. International Conference on Social Computing, Behavioral-Cultural Modeling, and Prediction and Behavior Representation in Modeling and Simulation.

Angelopoulos, S., Brik, T., **Magelinski, T.**, & Carley, K. M. (2020). What you gonna do when they come for you? Network effect of information exposure on coalition formation. Sunbelt.

Harder, N., Brashears, M., Brik, T., Carley, K.M., **& Magelinski, T.** (2020). Understanding and Predicting Legislative Behavior in the Verkhovna Rada through New Methods of Ecological Modeling. Sunbelt.

Bhutani, M., **Magelinski, T.**, & Kolter, Z. (2019). Sinkhorn-Flow: Predicting Probability Mass Flow in Dynamical Systems Using Optimal Transport. Optimal Transport & Machine learning Workshop at NeurIPS.

Uyheng, J., **Magelinski, T.**, Cox, R. V., Sowa, C., & Carley, K. M. (2019). Information Operations Analysis of NATO Trident Juncture Exercise 2018. International Conference on Social Computing, Behavioral-Cultural Modeling, and Prediction and Behavior Representation in Modeling and Simulation.

Hou, J., **Magelinski, T.**, & Mylovanov, T. (2019). Minsk II Agreement between Russia and Ukraine and Polarization of the Ukrainian Parliament. Advancing Research through Computing Student Poster Contest. **Winning Entry**.

**Magelinski, T.**, Cruickshank, I., & Carley, K. M. (2018). Comparison of faction detection methods in application to Ukrainian parliamentary data. International Conference on Social Computing, Behavioral-Cultural Modeling, and Prediction and Behavior Representation in Modeling and Simulation.

**Magelinski, T.**, & Carley, K. M. (2019). Effects of Network Aggregation in Simple Diffusion Simulations. International Conference on Social Computing, Behavioral-Cultural Modeling, and Prediction and Behavior Representation in Modeling and Simulation.

**Magelinski, T.**, & Ross, S. (2016). Sources of uncertainty and inaccuracy in airdrop operations. Fall Fluid Mechanics Symposium.