

I am interested in combining axiomatic and data-driven approaches to identify structures of social networks and online communities. With those insights, I want to design theoretically robust mechanisms to measure and reinforce fair online engagement, including reducing misinformation, bias, and supporting online movements. I hope to work with faculty who work broadly in **algorithms and theory** and **social computing** at UMSI. I find the work of Professors Ceren Budak, Grant Schoenebeck, Yan Chen, and Abigail Jacobs particularly compelling and relevant to my interests in sociotechnical systems and information economics. My research has been in **Human-Computer Interaction** (HCI) – online movements and mobile computing. My senior thesis is in Bayesian inference.

With Dr. Shuo Niu, I studied social media campaigns on YouTube funded by LEEP Fellowship. I investigated #TeamTrees which fundraised for 20 millions trees. I built sanitization pipeline and performed Chi-squared test to establish the correlation between factors such as video themes, rationale for joining, and recruitment method. Our paper shows the importance of having initial momentum from celebrity organizers, as well as the crucial and unique role of “slacktivists” in spreading and delivering the campaign, which can inform platforms how to support amateur creators.

In the first submission, our categorization of campaign roles was unconvincing so we reframed the paper to focus more on grassroot movement building. As our coding scheme was not a textbook case, I then proposed a pipeline using modified Kappa to measure coder’s agreement to enable multivariate analysis. Our paper finally got accepted at CSCW ’21 [1].

I leveraged this project setup to analyze videos during the pandemic. I released a YouTube crawler package that was used across multiple projects. Previously, my classmate and I used Naive Bayes classification on 5000 YouTube videos created during COVID-19 to see if they engaged directly with the pandemic. As this fit in with Dr. Niu’s lab theme, we fleshed out the correlation analysis and applied Weiss’ loneliness theory to derive classification of support roles e.g. emotional, guidance, spiritual support. Our work highlights different methods of online social integration and video-sharing as a pathway to social support. This work resulted in a paper at CHI ’21 [2]. We extended our focus on loneliness support by analyzing content surrounding drug addiction discourse on YouTube [3].

In a different flavor of HCI, in summer 2021 I worked with Dr. Jeff Huang at Brown HCI on using back-of-device pressure readings and 6DOF motion replay to predict users’ emotion and attention levels. I added cross-validation, tweaked and retrained CNN and Random Forest models, and analyzed performance increase by using pressure readings vs. phone motion. I formulated main research questions and rewrote the paper significantly. Our paper contributes insights on how humans used non-contextual data to predict affect and the significance of using back-of-device pressure to infer immediate affect. As the first author was busy for the summer, I was the corresponding author for the submission to IMWUT¹. I presented the research at Clark’s 2021 symposium. I also work briefly on using private texts to encourage healthier social media usage. I presented this work at Brown HCI research group.

While my research has offered insights on how YouTubers created content during social media campaigns, [sentences on how I think the insights are not not generalizable-ish].

Towards that end, I want to develop new theories and extend existing paradigms to reveal insights about collective behavior. Users’ decisions change in response to changes in algorithms and mechanisms, which also use users’ decision to update. Therefore, in order to measure dynamic systems such as social networks, methods have to both incorporate existing knowledge about the data distribution, as well as

¹IMWUT/UbiComp

incentives and norms of the agents in the system by treating users as strategic agents. My research has centered around participation roles and campaign propagation mechanism in online social movements. Therefore, I am motivated to take a theoretical approach to quantify online social movements. The axiomatic approach can help us understand how to incentivize civic participation or to design platforms that maximize the success of grassroots movements with theoretical optimal guarantees.

My experience at various HCI labs has culminated my interest in human-centered computing. As I want to develop robust frameworks with mathematical validity, I decide to deepen my understanding of statistical methods. For my senior thesis, I am working with Prof. Michael Satz on Bayesian inference through Markov Chain Monte Carlo (MCMC).

I examine different MCMC sampling algorithms, e.g. Gibbs and Metropolis-Hasting, to assess their convergence to the target distribution. To maximize computational efficiency, I investigate reparameterization and different jumping rules. But for a complex e.g. high-dimensional target distribution, traditional MCMCs are still inefficient because of their random walk behavior. So we decide to explore Hamiltonian Monte Carlo, where the jumping rule embeds the gradient of the log-posterior density at every step. It combines the usual MCMC mechanism with deterministic calculations, resulting in much faster convergence in complex models. In class, I had learned and proved MCMC's properties, but to be able to formulate a problem myself for MCMC to work has been fascinating.

As a foray into numerical analysis, I worked with my group to develop an algorithm for computing the tension spline, a general case of cubic spline, often used to smooth curves. I derived a system of unknowns as a tridiagonal matrix and computationally solved for the coefficients. This project gave me a deeper understanding of various interpolation techniques and scientific computing.

My senior thesis confirms that I enjoy working in algorithms and my HCI experience has cultivated my inclination towards social computing. I was immediately fascinated by Dr. Budak's works on measuring social movements' changes and extensive analysis on diffusion of information in social networks. I also want to work with Dr. Schoenebeck and Dr. Chen to combine ideas from economics, specifically algorithmic game theory and mechanism design. Dr. Jacobs has developed frameworks for identifying communities' structures and ways to reduce inequalities in sociotechnical systems. Therefore, I want to pursue a PhD in Information at UMSI because of the highly interdisciplinary, collaborative research environment and many faculty working on social networks and online communities.

A PhD education will push me and strengthen my technical ability and mathematical maturity to employ those theoretical foundations to human-centered research. I have also enjoyed being a teaching assistant for almost every semester, and I want to remain in academia as a professor to both pursue my research interests as well as mentoring students.

References

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- [2] S Niu, A Bartolome*, **C Mai*** and NB Ha*. #StayHome #WithMe: How Do YouTubers Help with COVID-19 Loneliness?. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems. [\[pdf\]](#)
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