Approved by the Regents
May 20, 2021

PROMOTION RECOMMENDATION
THE UNIVERSITY OF MICHIGAN
SCHOOL OF INFORMATION

Grant Schoenebeck, assistant professor of information, School of Information, is recommended for promotion to associate professor of information, with tenure, School of Information.

Academic Degrees:

Ph.D.	2010	University of California- Berkeley, CA
S.M.	2004	Harvard University
A.B.	2004	Harvard University

Professional Record:

2019 – present	Assistant Professor of Information, School of Information, University of Michigan
2012 – 2019	Assistant Professor, Computer Science and Engineering, University of Michigan
2010 – 2012	Post-doctoral Researcher, Computer Science, Princeton University
2011 – 2012	Senior Post-doctoral Research, National Science Foundation
2011 – 2012	Visitor, Institute for Advanced Study, School of Mathematics

Summary of Evaluation:
Teaching: Professor Schoenebeck's goal in teaching is to stimulate students' curiosity about meaningful questions, including the ability to ask the right questions, guide them through the process of self-discovery, and learn about potential answers and methods offered by the scientific community. He believes in combining traditional methods such as problem sets, exams and term projects with active learning in the classroom. Some of the active learning techniques include students teaching a subset of the material, students having input on the course content for select topics, including recent research discussion on assignments, and "labs" in which students practice their machine learning skills.

Professor Schoenebeck has been teaching in the Masters of Applied Data Science (MADS) program focusing on methods courses. He is thoughtful about his evaluation and assessment practices in which he has assignments that reward effort and he never grades on a curve in order to give students accurate feedback about their learning.

Professor Schoenebeck takes student mentoring and supervision very seriously, including weekly individual meetings and weekly group meetings. A testament to his engagement with graduate students is that most of his journal and conference papers are co-authored with students. His three Ph.D. students from Electrical Engineering Computer Science (EECS) are currently in prestigious tenure-track positions in China or post-doctoral research fellows. He works with undergraduate students through Michigan's Undergraduate Research Opportunity Program, and has successfully worked with underrepresented minorities on research.

At the University of Michigan School of Information (UMSI), Professor Schoenebeck has been actively involved in curriculum development, both for the online MADS degree and for the on-campus master's degree. He sees his unique value added at UMSI in teaching various math methods courses across the curriculum, since UMSI programs focused on data science/information analysis

are becoming more technical. He substantially redesigned the content of a course focused on mathematical methods in the MADS degree track; the revised version prepares students better for the rest of the curriculum than the original version.

Research: Professor Schoenebeck's greatest contribution is that he has created a new theoretical lens on reliable information elicitation from independent agents who might strategically report their private signals, including colluding with each other. In so doing, he has solidified the goals for information elicitation mechanisms, and designed new mechanisms that achieve these goals.

Professor Schoenebeck's research applies mathematical paradigms and methods from computer science to the study of information, particularly in social science contexts. His work contributes to our understanding of (i) reliable mechanisms for accurate information elicitation and aggregation, with application areas that include crowdsourcing, survey data and on-line ratings, and peer grading; and (ii) large social and information networks, analyzing their structural properties (e.g. community structure) and the processes within them (complex contagion). In earlier work, Professor Schoenebeck's research focused on the theoretical potential power of certain types of optimization methods.

The external letter writers, whose collective expertise gives good coverage of all of his areas of research, provide a consistent characterization of Professor Schoenebeck's research portfolio, one that has exhibited both breadth and depth: breadth in the nature of problems and application domains he has explored, and depth in tackling specific problems such as effective information elicitation. The substance of the work is outstanding, bringing elegant mathematical foundations to applied problems, and yielding results that are surprising even to people familiar with his research questions.

The single stream of work with the biggest intellectual contribution is on information elicitation. His work provides an information theoretic framework for the challenge of how to incentivize the honest revelation of private signals when there is no objective ground truth to which reports can be compared. There have now been dozens of papers proposing mechanisms for slight variations of the basic setting. The paper provides a theoretical foundation for design: pay each rater the amount of "mutual information" between her set of reports and the reports of a reference rater, or rather, some unbiased estimator of the amount of mutual information, estimated from the set of reports by all the participants.

In other work, Professor Schoenebeck considers a setting in which agents always report truthfully, if they report. Here, the challenge is to decide who to ask and how much to offer to pay them. The main difficulty is that survey respondents' privacy costs may be correlated with the information that they provide, as in questions about personal health information. This work presents an elegant approach to deriving an upper-bound value and worst-case variance in the population mean.

Professor Schoenebeck has also advanced scholarship in the areas of modeling social networks and developing algorithms to analyze and interpret social network data. In this work, Professor Schoenebeck analytically proves that the time it takes to reach opinion consensus in a social network is very fast (linear in number of nodes) provided that underlying networks are either complete or sufficiently dense Erdos-Renyi networks. This mathematical proof shows Professor Schoenebeck's technical sophistication since he is able to demonstrate that the speed of convergence result holds for any majority-like function and not just under pure majority voting. His result is particularly attractive since it is not an approximation.

Professor Schoenebeck has also contributed new insights regarding complex contagion in social networks. Complex contagion refers to situations in which ideas or behaviors typically require multiple exposures for a network member to change; such changes are typically "costly." For example, emigration or social behaviors might be seen as likely to spread in social networks though "complex contagion" mechanisms.

Generally, in collaborations, doctoral students and post-doctoral fellows are expected to take the lead on papers, and in most subfields of computer science, publishing as first author. The vast majority of Professor Schoenebeck's collaborations are with students. There is one long-term collaboration with a computer science faculty member.

The NSF CAREER award is a prestigious early-career faculty award — in fact, at top institutions in computer science there is a strong expectation that most junior faculty receive one. Selection criteria include being able to clearly articulate a compelling research vision, and creative integration of research and teaching. Professor Schoenebeck's CAREER award is entitled "Social Networks - Processes, Structures, and Algorithms" and focuses on "better understanding of social networks and (their) ability to influence a wide range of phenomena, including: what technologies/practices people and firms adopt, how information is transmitted and aggregated, and how network structure relates to the agents' ability to search within the network." Unusual for a theoretical computer scientist, Professor Schoenebeck has received numerous other grants; he has been a principal investigator on an NSF Small grant, and a co-PI on a larger, multi-site collaborative NSF grant. His work has also been supported by industry funders, including Google and Facebook.

Recent and Significant Publications:

Yuqing Kong and Grant Schoenebeck. "An information theoretic framework for designing information elicitation mechanisms that reward truth-telling." *ACM Transactions on Economics and Computation* (TEAC), 7(1):2:1-2:33, February 2019.

Grant Schoenebeck and Fang-Yi Yu. "Consensus of interacting particle systems on Erdos-Renyi graphs." In *Proceedings of the Twenty-Nineth Annual ACM-SIAM Symposium on Discrete Algorithms* (SODA 2018), January 2018.

Yuqing Kong and Grant Schoenebeck. "Water from two rocks: Maximizing the mutual information." In *Proceedings of the 2018 ACM Conference on Economics and Computation* (EC 2018), June 2018.

Grant Schoenebeck and Salil Vadhan. 'The computational complexity of Nash equilibria in concisely represented games." *ACM Transactions on the Theory of Computation* (ToTC), 4, 2012. A previous version appeared in EC '06.

Service: Professor Schoenebeck's service is at the level expected for his career stage. Within UMSI, during his year on the faculty he served on the Online Programs Committee, which was responsible for the launch of the MADS program. He also took pro-active initiative to convene data science faculty to discuss how to better partition the data science curriculum in UMSI's on-campus course offerings.

Externally, Professor Schoenebeck has been a reviewer for top journals (*Econometrica*, *Proceedings of the National Academy of Sciences*, the *Association for Computing Machinery's (ACM) Transactions on Economics and Computation*), and has been on the program committees for most of the conferences in which he has participated. He was a senior program committee member for ACM's Economics and Computation, the top outlet for his kind of work, for two years. He has also served on seven National Science Foundation review panels.

External Reviewers:
Reviewer A: "He is an excellent researcher whose rigorous scholarship has advanced and in all probability will continue to advance the fields of computer science and economics."

Reviewer B: "…I think this should be a straightforward tenure + promotion case and I congratulate you for having [Professor] Schoenebeck on your faculty."

Reviewer C: "I am particularly impressed by his arguably breakthrough paper with his former Ph.D. student Yuqing Kong on *An information theoretic framework for designing information elicitation mechanisms that reward truth-telling*. This is the sort of paper that can really propel a field forward…"

Reviewer D: "Taking all of these results and others into account, it's clear that [Professor Schoenebeck] has been responsible for some of the most visible recent theoretical work in our understanding of large social and information networks — both in their structural analysis (through notions like community structure) and in the processes that take place on them (though phenomena like complex contagion)."

Reviewer E: "…I believe the quantity and quality of [Professor Schoenebeck's] work would be sufficient to meet the requirements for tenure."

Reviewer F: "I have followed his career closely…and have been extremely impressed with the quality, quantity, focus, and scholarly impact of his work. [Professor] Schoenebeck is a talented and technically sophisticated researcher with broad-ranging interests."

Summary of Recommendation:
Professor Schoenbecks's accomplishments in the areas of teaching, research, and service meet and exceed promotion requirements. Therefore, with the support of the promotion and tenure committee of the School of Information, I enthusiastically recommend Grant Schoenbeck for promotion to associate professor of information, with tenure, School of Information.

Thomas A. Finholt
Dean, School of Information

May 2021