Bridging Disciplines in Data Management Research to Solve Complex Data Problems

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ABSTRACT

Scientific discovery has undergone profound transformations across multiple paradigms, each bringing new data challenges whose solutions demand bridging multiple areas of computer science. This talk presents a research journey spanning three scientific paradigms and projects that illustrate how domain-driven problems reveal fundamental data management challenges and drive interdisciplinary innovation. From the need to manage complex pipelines and their provenance in computational science (3rd paradigm), to new requirements that arise in data-driven discovery (4th paradigm) to support visual exploration of large-scale spatio-temporal data, and today's AI-powered discovery paradigm (5th paradigm), where AI enables effective and general approaches to the long-standing data integration problem. The projects share a common pattern: complex scientific challenges demand more than single-discipline solutions, and by embracing collaboration across computer science areas and working closely with domain experts, we can identify fundamental research opportunities that lead to both methodological advances and systems with real-world impact.

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BIOGRAPHY

Juliana Freire is an Institute Professor at the Tandon School of Engineering and Professor of Computer Science and Data Science at New York University, where she co-directs the Visualization Imaging and Data Analysis (VIDA) Center. Her research develops methods and systems that enable a wide range of users to obtain trustworthy insights from data. It spans topics in large-scale data analysis and integration, visualization, machine learning, provenance management, and web information discovery, addressing application areas including urban analytics, predictive modeling, computational reproducibility, and biomedical data harmonization. She has co-authored over 250 papers, including 12 award winners and a test-of-time award. She served as elected chair of ACM SIGMOD and as a council member of the Computing Community Consortium (CCC), and was the NYU lead investigator for the Moore-Sloan Data Science Environment. She is a Fellow of the ACM and AAAS, and a winner of the ACM SIGMOD Contributions Award. Her work has been supported by funding agencies and industry partners including the National Science Foundation, DARPA, ARPA-H, Department of Energy, National Institutes of Health, and technology companies including Google, Amazon, Microsoft Research, and IBM. Freire received her Ph.D. and M.Sc. degrees in computer science from the State University of New York at Stony Brook and her B.S. degree in computer science from the Federal University of Ceara in Brazil.

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