ADITI KRISHNA MALLAVARAPU

https://aditimallavarapu.github.io/aditi-portfolio/#/

Technology and Learning Sciences Postdoctoral Researcher
Center for Integrative Research in Computing and Learning Sciences (CIRCLS),
Digital Promise Global, Redwood City, CA
amallavarapu@digitalpromise.org

Artificial Intelligence in Education Visiting Scholar
School of Computing and Information
Learning Research & Development Center (LRDC)
University of Pittsburgh, Pittsburgh, PA
aditimal@pitt.edu

RESEARCH INTERESTS

Learning analytics, educational data mining, machine learning, computer vision, data visualization, artificial intelligence, open-ended learning systems, computer-supported collaboration, tangible and embodied learning environments, technology in informal social settings (e.g., museums), human-computer interaction, learning in interactive, immersive learning, learning in XR (virtual reality and mixed reality environments), participatory learning, complex systems learning environments, technology for real-world training.

PROFESSIONAL PREPARATION

2021 **PhD** **Computer Science,** Human-Computer Interaction, Learning Analytics, Educational Data Mining and Learning Sciences Concentration.
Advisor: Leilah Lyons
University of Illinois at Chicago (UIC), Chicago, IL, USA
PhD Thesis Title: Formative fugues: Conceptualizing data-driven formative feedback for open-ended learning environments

2014 **MS** **Computer Science,** Educational Data Mining Concentration
Advisor: Leilah Lyons
University of Illinois at Chicago (UIC), Chicago, IL, USA
MS Thesis Title: Developing Computational Methods to Measure and Track Learner's Spatial Reasoning

2011 **BE** **Computer Engineering**
University of Pune, India

RESEARCH EXPERIENCE

2021 - Present **Technology and Learning Sciences Postdoctoral Researcher**
Center for Integrative Research in Computing and Learning Sciences (CIRCLS)
Mentor: Jeremy Roschelle
Digital Promise Global, Redwood City, CA

2021 - Present **Artificial Intelligence in Education Visiting Scholar**
School of Computing and Information
Learning Research & Development Center
Mentors: Erin Walker & Rosta Farzan
University of Pittsburgh, Pittsburgh, PA

2017-2021 **Digital Learning Data Mining and Visualization Research Assistant**
Digital Learning
Mentors: Leilah Lyons & Stephen Uzzo
New York Hall of Science, Queens, NY

PROFESSIONAL DEVELOPMENT

2022-Present Cultural Competence in Computing (3C) Fellow, Duke University.

TEACHING EXPERIENCE

Graduate Teaching Assistant, Programming Design II, University of Illinois at Chicago, Chicago, IL, Spring 2018, Fall 2018, Spring 2019, Fall 2019, Spring 2020, Fall 2020, Spring 2021

Adjunct Professor, Discovering Computer Science, University of Illinois at Chicago, UIC Chance Program, Chicago, IL, Summer 2018

Instructor, Computer Science Elective: Discovering Computer Science, University of Illinois at Chicago, Saturday College UIC Chance, Chicago, IL, Spring 2017

Graduate Teaching Assistant, Discovering Computer Science University of Illinois at Chicago, Chicago, IL, Spring 2017, Fall 2017

Graduate Teaching Assistant, Discrete Mathematics, University of Illinois at Chicago, Chicago, IL, Fall 2016

PUBLICATIONS

Book Chapters

[B.1] Beheshti, E., Lyons, L., **Mallavarapu, A.,** Thompson, W., Wallingford, B., & Uzzo, S. (2021). Co-designing Learning Dashboards for Informal Educators in H. Ba, K. McMillan Culp, and M. Honey (Eds.), *Design Make Play for Equity, Inclusion, and Agency*, Routledge.

Journals

Published

[J.1] **Mallavarapu, A.,** Lyons, L., & Uzzo, S. (2022). Exploring the Utility of Social-Network Derived Collaborative Opportunity Temperature Readings for Informing Design and Research of Large-Group Immersive Learning Environments. *Journal of Learning Analytics*, *9*(1), 53–76. https://doi.org/10.18608/jla.2022.7419

[J.2] **Mallavarapu, A.,** Uzzo, S., & Lyons, L. (2021). Formative Fugues: Reconceptualizing Formative Feedback for Complex Systems Learning Environments. International Journal of Complexity in Education, 2(2), 4–46.

[J.3] Lyons, L., & **Mallavarapu, A.** (2021). Collective Usability: Using Simulation Tools to Explore Embodied Design Challenges in Immersive, Shared Mixed-Reality Experiences. Journal of Educational Technology & Society, 24(2).

[J.4] **Mallavarapu, A.**, Lyons, L., Slattery, B., Shelley, T., Minor, E., & Zellner, M. (2015) Developing Computational Methods to Measure and Track Learners' Spatial Reasoning in an Open-Ended Simulation. *Journal of Educational Data Mining 7*(2), 49-82.

In preparation

[J.5] **Mallavarapu, A.**, Lyons, L., & Uzzo, S., "Formative Fugues": A Novel Exploration Support Conceptualization for Collaborative Open-Ended Learning Environments. *To be submitted to the International Journal of Computer Supported Collaborative Learning.*

[J.6] **Mallavarapu, A.**, Lyons, L., Zheleva, E., & Uzzo, S., Causal Modeling of Open-Ended Learning Environments for Generating Formative Feedback. To be submitted in *the Journal of Artificial Intelligence for Education.*

[J.7] **Mallavarapu, A.**, Lyons, L., & Uzzo, S., Modified Implementation Design for validating data-driven outputs and designing data-driven tools. To be submitted *in the Journal of Learning Analytics.*

[J.8] **Mallavarapu, A.**, Risha, Z., Booth, J., Walker, E., & Farzan, R. Reimagining critical data literacy with Black youth for advocating for community issues. To be submitted in the *Transactions of Computer-Human Interaction (ToCHI)*.

[J.9] **Mallavarapu, A.**, Walker, E., Fusco, J., Gardner, S., & Roschelle, J. Mapping a decade of interdisciplinary collaborations in emerging educational technology research. To be submitted in the *Journal of Social Structure (JoSS)*.

Reviewed Conference Papers, Full

Published

[C.1] **Mallavarapu, A**., Lyons, L., Uzzo, S., Thompson, W., Levy-Cohen, R., & Slattery, B. (2019). Connect-to-Connected Worlds: Piloting a Mobile, Data-Driven Reflection Tool for an Open-Ended Simulation at a Museum. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (pp. 1-14). ACM Press.

[C.2] Wen, N., **Mallavarapu, A.,** Biehl, J., Walker, E., & Babichenko, D. (2022) Understanding barriers of missing data in Personal Informatics Systems. In the *Proceedings of the 16th EAI PervasiveHealth*.

Reviewed Conference Papers, Short

Published

[S.1] Risha, Z., **Mallavarapu, A.,** Rosta, F., Jaime, B., Dondal, B., & Walker, E. (2022). Proposing a Role-Based Framework for Data Literacy. In Chinn, C., Tan, E., Chan, C.,& Kali, Y.(Eds.). Proceedings of the 16th International Conference of the Learning Sciences ICLS 2022. Hiroshima, Japan: International Society of the Learning Sciences.

[S.2] Levy-Cohen, R., **Mallavarapu, A.,** Lyons, L., & Uzzo, S. (2021). Studying Shared Regulation in Immersive Learning Environments. In C. Hmelo-Silver, B. de Wever, & J. Oshima (Eds.). Proceedings of 15th International Conference on Computer-Supported Collaborative Learning – CSCL 2021 (pp. 100–115). International Society of the Learning Sciences.

[S.3] **Mallavarapu, A.,** & Lyons, L. (2020). Exploration Maps, Beyond Top Scores: Designing Formative Feedback for Open-Ended Problems. International Conference on Educational Data Mining (EDM 2020), 790–795.

[S.4] Beheshti, E., Lyons, L., **Mallavarapu, A.,** Wallingford, B., & Uzzo, S. (2020, April). Design Considerations for Data-Driven Dashboards: Supporting Facilitation Tasks for Open-Ended Learning. In Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems (pp. 1-9).

Reviewed Conference Abstracts

Published

[A.1] Levy-Cohen, R., **Mallavarapu, A.,** Lyons, L., Uzzo, M, S. (April, 2021). Studying collective problem-solving regulation in an immersive open-ended museum exhibit American Educational Research Association (AERA) Annual Meeting.

[A.2] Beheshti, E., Lyons, L., Thompson, W., **Mallavarapu, A.** & Uzzo, S. M. (2020, Apr 17 - 21) Human-in-the-Loop: Supporting Facilitators' Scaffolding of Visitor Engagement and Learning in Science Museums [Roundtable Session]. AERA Annual Meeting San Francisco, CA.

HONORS AND AWARDS

2022	Travel scholarship, $1,000, Consortium of Science of Socio-Technical Systems (CSST) Austin, TX
2022	Emerging Scholar in Research, CIRCLS
2020	Scholarship, $500, CRA-WP virtual mentorship workshop
2019	2018-2019 Best Teaching Assistant Award, $500, Computer Science, University of Illinois at Chicago, IL.
2019	ACM SIGCHI student travel grant, $1,800, Glasgow, UK.
2018	UIC Chance Program Scholarship, $2,000, University of Illinois at Chicago, IL
2016	Peter and Deborah Wexler Graduate Student Award Scholarship, $5,000, University of Illinois at Chicago, IL
2017	Peter and Deborah Wexler Graduate Student Award Scholarship, $5,000, University of Illinois at Chicago, IL
2015	Professor Ram Kumar Scholarship, $1,500, International Conference of Educational Data Mining, Madrid, Spain
2015	Travel Scholarship, $1,000, Computer Research Association for Women (CRA-W), San Francisco, CA
2014	Grace Hopper Celebration Scholarship, $1,000, Grace Hopper Celebration Conference (GHC), Phoenix, AZ

TECHNICAL SKILLS

Programming Languages	C, C++, Java , Python
Versioning Software	Git
Machine Learning / Data Mining Libraries	Python: scikit-learn, nltk, spacy; R
Causal Inference	Python: DoWhy; Web-based tool: Causal Fusion
Computer Vision	Python: OpenPose, OpenCV
Network Analysis	Python: NetworkX, PyVis; Gephi
Visualization Libraries	JavaScript: D3, Observable; Python: ggplot2, plotly
Scripting Languages	Shell scripting, PHP
Front-end Design	HTML, JavaScript, CSS, React
Databases	Oracle, MySQL, SQL, PL/SQL, MongoDB

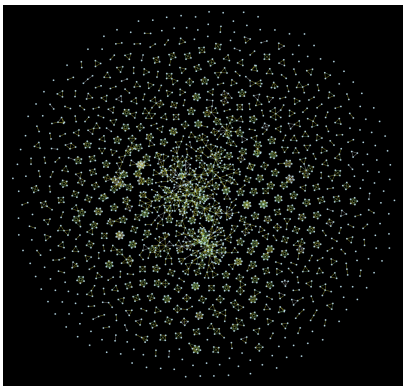
PROFESSIONAL EXPERIENCE

2015 - 2016	Technical Consultant Perficient Inc, Chicago, IL; Pleasanton CA.

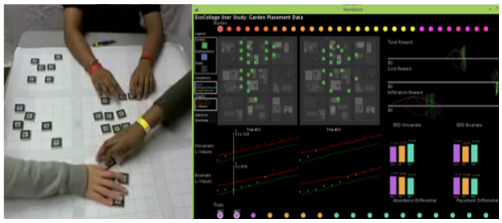
2013	Network Software Intern Tarana Wireless Inc., Santa Clara, CA
2011 - 2012	Programmer Analyst Trainee, Banking and Finance Sector Cognizant Technology Solutions, Pune, India

PROJECTS

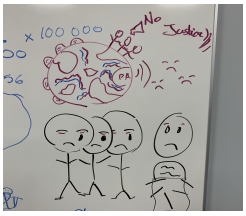
Mapping emergent edtech research. Leverages Natural Language Processing (NLP) techniques, Social Network Analysis (SNA), bibliometric methods and data visualization to characterize, map, mine and track the trends of research using funding information from National Research Foundation and researcher expertise information to empirically define interdisciplinarity in the field with an intention of understanding the nature and novelty of collaborative scientific research. These methods are being developed as a part of larger project of implementing a brokering tool that motivates researchers indulge in interdisciplinary collaborations for upcoming funding opportunities [J.9]



EcoCollage Designed metrics to evaluate and track learners' spatial reasoning skills when using an urban planning participatory simulation, EcoCollage. Used spatial metrics like Ripley's K and diversity metrics to derive a measure for spatial reasoning and applied regression to characterize the different spatial arrangements as good or bad strategies relative to simulation outcomes. The results were used to examine if the user interface design affected the way in which learners approached exploring the problem space: did they use different spatial strategies, or discover them more quickly or more slowly, when using different user interfaces? [J.4]

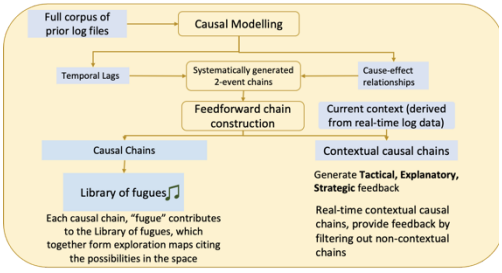


DATA: Data action to advocacy. We are co-designing a data advocacy toolkit with the youth from historically marginalized communities by engaging them with data and technical skills to create advocacy messages for personally relevant community issues. The sessions explore the affordances of data literacy and advocacy that the youth consider important for the toolkit design with a goal of cultivating job-ready skills and fostering a stronger sense of civic identity among the youth. We are in the process of using these lessons for developing a web-based data advocacy application that supports and affords critical data literacy. [J.8]

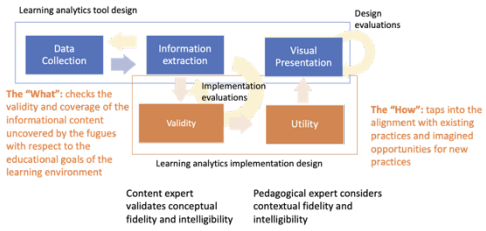


Causal Modeling. Constructing a causal graphical model of a complex system simulation that is an open-ended museum exhibit, Connected Worlds. The causal model learns system behavior from the causal relationships and temporal dependencies between the cause and consequences from prior learners' interaction data. This involved constructing outcome metrics to evaluate the state of the complex-system environment, selecting the granularity of the cause-and-effect nodes (visitor action and systemic action nodes) that constitute a complex system. The model uses causal inference to compute time lags that can accurately explain complex systems phenomena and thus can be used for generating formative feedback for guiding learner explorations. [J.6]

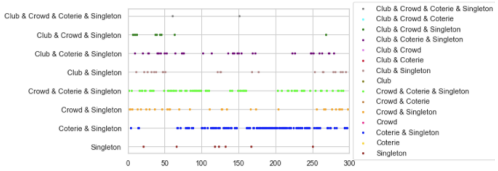
Formative Fugues. Conceived a novel data-driven approach to extract formative feedback, called "formative fugues," suitable for guiding learners exploring complex systems concepts in open-ended learning environments like museum exhibits. The approach learns common patterns of explorations by extracting scientifically meaningful sequences from a corpus of data of prior learners' explorations of a system. These common patterns, dubbed "fugues", can be reused, repurposed and reassembled into longer chains much like musical fugues. The computational approach leverages causal modeling followed by pattern matching to identify the formative fugues from among multiple simultaneous causal chains that occur during a given enactment. [J.2, J.5]



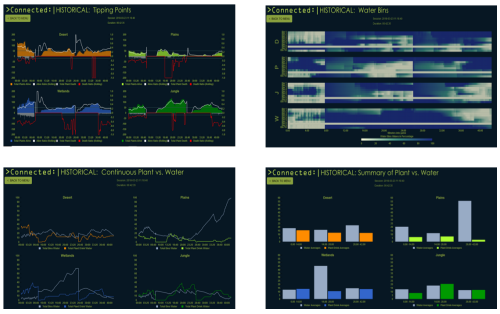
MultiStage Implementation design. Devised a Multistage Implementation Design (MID) to attend to how the design of data analytics and human practices have intertwined dependencies. The method engages practitioners to validate the interpretability (what) and utility (how) of the outputs, grounding the design in the principle that designing data-driven tools for learning and teaching does not end with generating computational outputs: it is critical to attend to the ways those outputs will be integrated into human practices. The information a computational system can provide shapes which educational practices are possible. This methodology applied to computationally generated formative fugues, (1) helped identify the alignment of the fugues with the educational goals of the learning environment, (2) highlighted the interpretability of the information by identifying practices afforded by fugues, and (3) suggested recommendations for delivery of the fugues [J.7].



“Collaborative Temperature”. Constructed a low-cost, low-effort, ethical method to detect ephemeral social configurations in a co-located museum environment, captured through video data. Using social network analysis and proxemics, combinations of different social configurations determined the “collaborative temperature” of visitors’ interactions in the exhibit, and were used to study the impact of an educational intervention. Additionally, this passive method of studying collaboration preserves the privacy of visitors as it can facilitate real-time determination of the collaborative temperature . [J.1].

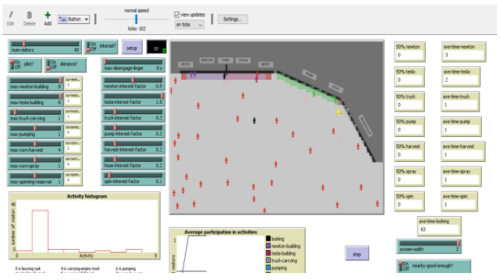


Connect-to-Connected Worlds. A web-based data-driven dashboard that supports facilitators, researchers and visitors to the New York Hall of Science’s Connected Worlds immersive simulation exhibit. This involves capturing live interaction data from the exhibit while it is in use, and digests it to visualize useful patterns of interactions in an on-demand fashion on a dashboard for use as a guiding tool within the exhibit. These live, dynamic data visualizations can help visitors understand how their manipulations affect the simulated ecosystem’s sustainability, facilitating reflection and planning in service of problem solving reasoning [C.1].



Human-centered AI. Data-driven dashboards are being integrated into various contexts as a way of informing ongoing processes, allowing educators to use the dashboard to reflect on and guide activities. Embedding novice educators in the design process is critical for producing designs of AI that augment their practices. We used participatory methodology to guide educators unfamiliar with data and AI methods to meaningfully incorporate analytics and visualizations into their brainstorming for co-designing a data-driven dashboard for an immersive simulated museum exhibit. [B.1, A.2].

Collective Usability. Used a complex system simulation tool (NetLogo) to model the layout and movement of visitors and the space for modeling collective usability for the design of a multi-user museum exhibit. Informed by real-world measurements of visitor movements and engagement, the study analyzed dozens of different permutations to understand which changes to the exhibit design could improve the collective usability. [J.3]



STUDENTS SUPERVISED

Zak Risha	University of Pittsburgh, PhD Information Science, Expected Graduation Fall 2025
Lydia Tse	University of Illinois at Chicago, MS Computer Science, Graduated Spring 2020 Visualization Engineer, NIKE
Noah Phillips	University of Pittsburgh, BS Computer Science, Graduated Spring 2022
Benjamin Truckenbrod	University of Pittsburgh, BS Computer Science, Graduated Spring 2022
Lydia Tse	University of Illinois at Chicago, BS Computer Science, Graduated Spring 2018 Visualization Engineer, NIKE
Eric Leon	University of Illinois at Chicago, BS Computer Science, Graduated Spring 2017 Software Engineer, PayPal

SCIENTIFIC COMMUNITY SERVICE

Executive and Organization Committees

Organizing Team, CIRCLS'21, Remake "Broadening" in Research on Emerging Technologies for Teaching and Learning. (Virtual Convening, 2021).

Virtual Conference Chair, ACM MobileCHI 2020, Expanding the horizons of mobile interactions, ACM in collaboration with University of Oldenberg, Germany.

Professional Memberships

Educational Data Mining (EDM)
Society for Learning Analytics Research (SOLAR)
International Society for Artificial Intelligence for Education (AIED)
Association for Computing Machinery (ACM)
Association for Computing Machinery – Special Interest Group for Computer and Human Interaction (ACM-SIGCHI)
International conference for Computer Supported Collaborative Learning (ICLS)
Computer Supported Collaborative Work (CSCW)

Professional Societies

Center for Integrated Research in Computing and Learning Sciences (CIRCLS)
Computing Research Association-Widening Participation (CRA-WP)
Consortium for the Science of Sociotechnical Systems (CSST)

Program Committee

International Conference of Artificial Intelligence in Education (AIED), 2023.
International Conference for Educational Data Mining (EDM), 2023.
International Conference of Artificial Intelligence in Education (AIED), 2022.
International Conference for Educational Data Mining (EDM), 2022.

Reviewer

International Journal of Learning Analytics, 2022.
International Journal of Computer Supported Collaborative Work, (ijCSCW), 2022

International Conference of Computer Supported Collaborative Learning (CSCL), 2022.

International Journal for Artificial Intelligence in Education (AIED), 2021.
International Conference on Human Factors in Computing Systems (ACM-CHI), 2020.

Invited Talks & Panels

2023 **Invited Speaker,** Designing a critical data literacy toolkit: Centering youth experiences. DINS Speaker series. School of Computing and Information, Department of Informatics and Networked Systems, University of Pittsburgh.

2021 **Panelist,** *Using Learning Sciences and Computational Approaches to develop Assessments and Intelligent Tutoring Systems***.** Expertise Exchange series, 2021 CIRCLS Convening.

Presentations

2021 Formative fugues: Conceptualizing data-driven formative feedback for open-ended learning environments, PhD Thesis Defense

2021 Formative fugues: Conceptualizing data-driven formative feedback for open-ended learning environments, Preliminary Defense

2020 Formative Fugues: Helping Learners Understand Complex Systems through Causal Inference and Lag Sequential Analysis. 5th Conference on Complex Systems, Satellite Symposium on Complex Systems and Education: Research and Practice, 2020.

2020 Exploration Maps, Beyond Scores, Educational Data Mining Doctoral Consortium, 2020.

2019 Connect-to-Connected Worlds: Piloting a Mobile, Data-Driven Reflection Tool for an Open-Ended Simulation at a Museum. In *2019 CHI Conference on Human Factors in Computing Systems*

2015 Developing Computational Methods to Measure and Track Learners' Spatial Reasoning in an Open-Ended Simulation. *Journal of Educational Data Mining*

Community Service

Facilitator, Engage AI Institute Forum roundtable session on Ethics of Designing and Using AI Applications in Education, 2022.

Facilitator, Research in Artificial Intelligence for Education Listening Sessions for National Educational Technology Plan (NETP) report, US Department of Education's Office of Education Technology (OET), 2022

Facilitator, Strategy Session on Learning Analytics Research Methods, 2021 CIRCLS Convening

Blogger, Society for Learning Analytics Research Nexus, 2021

Judge, 2018 CPS Exhibition of Student STEM Research

Volunteer Mentor for the Girls Who Code UIC division, 2017.

Volunteer for Hour of Code at the Skinner North Elementary School, IL, 2016