PRERNA RAVI

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EDUCATION

MASSACHUSETTS INSTITUTE OF TECHNOLOGY | CAMBRIDGE, MA
S.M. & Ph.D., Electrical Engineering and Computer Science (EECS) | 2022 - Present
- MIT Computer Science and Artificial Intelligence Laboratory (CSAIL)
- Advisors: Hal Abelson and David Karger

GEORGIA INSTITUTE OF TECHNOLOGY | ATLANTA, GA
B.S., Computer Science | 2018 - 2022
- Advisors: Thad Starner and Neha Kumar
- GPA: 4.0/4.0 (Highest Honors)

RESEARCH STATEMENT

My research focuses on designing AI powered educational tools, curricula, and learning experiences that foster constructionism, equity and creativity. More specifically, I explore the interplay of social, cultural, economic, and digital infrastructures in historically marginalized contexts. Utilizing these insights, I develop assistive technologies and inclusive tools that empower people of all age groups and backgrounds to engage, learn, and create with AI and data science. I engage in ethnographic fieldwork, participatory design, system development, and evaluation.

PUBLICATIONS

- **Prerna Ravi**, Robert Parks, John Masla, Hal Abelson, and Cynthia Breazeal. "Mainstreaming K12 Data Science Education through a Student-Centered Interdisciplinary Curriculum". *Forthcoming at SIGCSE Virtual 2024.*
- Safinah Ali, **Prerna Ravi,** Katherine Moore, Hal Abelson, and Cynthia Breazeal. "A Picture is Worth a Thousand Words: Co-designing Text-to-image Generation Learning Materials for K-12 with Educators". *Proceedings of the AAAI Conference on Artificial Intelligence 2024.*
- Safinah Ali, **Prerna Ravi**, Daniella DiPaola, Randi Williams, and Cynthia Breazeal. "Constructing Dreams using Generative AI". *Proceedings of the AAAI Conference on Artificial Intelligence 2024.*
- David Kim, **Prerna Ravi**, Randi Williams, and Daeun Yoo. "App Planner: Utilizing Generative AI in K-12 Mobile App Development Education". *Proceedings of the ACM Interaction Design and Children (IDC) 2024.*
- Ariel Blobstein, Marc T. Facciotti, Michele Igo, David Karger, **Prerna Ravi**, Kamali Sripathi, and Kobi Gal. "#let's-discuss: Analyzing Students' use of Emoji when interacting with course readings". *International Journal of Artificial Intelligence in Education (AIED) 2024.*
- **Prerna Ravi**, Annalisa J. Broski, Glenda Stump, Hal Abelson, Eric Klopfer, and Cynthia Breazeal. "Understanding Teacher Perspectives and Experiences after Deployment of AI Literacy Curriculum in Middle-school Classrooms". *Proceedings of the 16th annual International Conference of Education, Research and Innovation (ICERI) 2023, IATED 2023.*
- **Prerna Ravi**, Annalisa J. Broski, Glenda Stump, Angela Daniel, Hal Abelson, Eric Klopfer, and Cynthia Breazeal. "An Art Teacher and AI: Creating Adaptable Curriculum for AI Literacy". *Play Make Learn Conference 2023.*
- Alex Duncan, Ana Rusch, **Prerna Ravi**, and David Joyner. "The L@St Eight Years: A Review of Papers and Authors at Learning @ Scale". *Proceedings of the Tenth ACM Conference on Learning @ Scale, 2023*.
- Safinah Ali, **Prerna Ravi**, Katherine Moore, Cynthia Breazeal, and Hal Abelson. "Demystifying Text-to-Image Generation for K12 Educators." *In Workshops and Tutorials: International Society of Learning Sciences (ISLS) 2023.*
- Glenda Stump, **Prerna Ravi**, Annalisa J. Broski, Angela Daniel, Hal Abelson, Eric Klopfer, and Cynthia Breazeal. "Ethical by Design: Teaching Middle-school Students to Think Ethically About AI". *AI Literacy Workshop at the 2023 CHI Conference on Human Factors in Computing Systems.*
- **Prerna Ravi,** Azra Ismail, and Neha Kumar. "The Pandemic Shift to Remote Learning under Resource Constraints". *Proceedings of the ACM on Human-Computer Interaction 5, CSCW2, Article 314 (October 2021), 28 pages.*
- Dhruva Bansal, **Prerna Ravi,** Matthew So, Pranay **A**grawal, Ishan Chadha, Ganesh Murugappan, and Colby Duke. 2021. "CopyCat: Using Sign Language Recognition to Help Deaf Children Acquire Language Skills." *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems. Association for Computing Machinery, New York, NY, USA, Article 481, 1–10.* [ACM CHI Student Research Competition Winner 2021]
- **Prerna Ravi** (Advisor: Thad Starner). "CopyCat: Leveraging American Sign Language Recognition in Educational Games for Deaf Children." *Georgia Tech Bachelor's Thesis (2022)*

FELLOWSHIPS

- Teaching Development Fellow, Teaching and Learning Lab (TLL) MIT, 2024-2025
- Artificial Intelligence in Education (AIED) DEIA Fellow, 2024-2025
- MIT Work of the Future Fellow, 2023-2024
- Ida M. Green Memorial Fellow, 2022-2023
- MIT Vice Chancellor's Inclusive Excellence Fellow, 2022-2023
- Adobe Research Women in Technology Scholar, 2021

AWARDS

- Winner - ACM CHI Student Research Competition, 2021
- Georgia Tech Outstanding Junior (EDS Rising Senior) Award, 2020-2021
- Georgia Tech Outstanding Sophomore Award, 2019-2020
- Google Computer Science Research Mentorship (CSRMP), 2021
- President's Undergraduate Research Award (PURA), 2020
- Apple Women in Science and Engineering Scholarship, 2021
- Georgia Tech Faces of Inclusive Excellence Honoree, 2021
- Microsoft Invent Finalist, 2021
- Winner - Nunn School of International Affairs Paper Competition for Global Development, 2021
- Rewriting the Code Fellowship, 2020-2021
- Apple's Grace Hopper Conference Scholarship, 2020
- Honorable Mention, Microsoft Global Hackathon, 2020
- GT College of Computing Grace Hopper Conference Scholarship, 2019
- Faculty Honors for 4.0 GPA, 2018-2022

TEACHING

Designed curricula and co-led instruction for the following courses:

Instructor	**6.S062 Generative Artificial Intelligence In K-12 Education** Massachusetts Institute of Technology, Fall 2023. Enrollment: MIT & Harvard graduate and undergraduate students
Instructor	**MAS.SX Text-to-Image Generation for K-12 Education** Massachusetts Institute of Technology, IAP 2023. Enrollment: MIT & Harvard graduate and undergraduate students, MIT staff
Instructor	**Impact and Application of Generative Artificial Intelligence within Education (Module on Text-to-image Generation)** IEEE Education Society hosted by Universidad Nacional de Educación a Distancia (UNED), Fall 2023 Massive Open Online Course (MOOC)
Head Teaching Assistant	**CS 1331 Introduction to Object Oriented Programming** Georgia Institute of Technology, Spring 2019 – Fall 2021. Enrollment: GT undergraduate students
Curriculum Developer	**Environmental Data Collection and Analysis using Micro:bits** Day of AI, 2024. Enrollment: Middle and high school teachers & students
Instructor + Curriculum Developer	**Data Science and AI with Micro:bits and MIT App Inventor** MIT Futuremakers Program 2024 Enrollment: Middle and high school students
Instructor	**Human Centered Design** Code.X, Summer 2021. Enrollment: Middle and high school students

RESEARCH PROJECTS

LLM Powered Assessment Tools for Project-Based Learning | *2024 – Present*
Advisors: Hal Abelson, Cynthia Breazeal
The purpose of this project is to explore the use of technology in enhancing project-based learning (PBL) by addressing the challenges teachers face in planning and assessing PBL curricula. Specifically, we focus on developing AI-powered tools, leveraging Large Language Models (LLMs), to improve the evaluation of student learning outcomes in areas such as teamwork, creativity, and problem-solving. The assessment of such multifaceted skills in PBL poses a significant challenge to teachers due to their qualitative and dynamic nature. Conducted interviews and co-design sessions with K12 educators (in diverse subject areas and school contexts) to create new a design framework outlining the affordances and challenges of integrating AI into PBL assessment environments.

MIT App Inventor: Block-based Mobile App Programming Environment | *2022- Present*
Advisor: Hal Abelson
MIT App Inventor is an intuitive, visual programming environment that allows everyone (including children) to build fully functional apps for phones and tablets. The project seeks to democratize software development by empowering all people, especially young people, to move from technology consumption to technology creation. Developed extensive curricula and teacher professional development resources on the use and integration of App Inventor within diverse contexts.

NB: Social Annotation Platform for Large-scale Classroom Collaboration | *2022 - Present*
Advisor: David Karger
NB is an in-place document annotation platform that enables and encourages students and faculty to collaboratively author and discuss questions, comments, and answers in the margins of course resources. Conducted multiple user studies and experiments, through the collection of qualitative and quantitative data, to guide the ideation, prototyping, and, and development of new features within NB as well as inform the revamping of large-scale (1000+ students) course resources and curriculum.

Responsible AI for Computational Action (RAICA): Project-based K12 AI Curriculum | *2022 - Present*
Advisors: Hal Abelson, Cynthia Breazeal, Eric Klopfer
RAICA focusses on growing middle-school students' skills as informed consumers and ethical producers of AI tools and technology through computational action. The curriculum is project-centered: students produce authentic learning artifacts by the end of each module and their learning is driven through explorations. Developed frameworks to assess fundamental computational thinking and AI literacy skills and conducted in-depth, iterative analysis to evaluate the efficacy of the curriculum.

K12 Data Science Literacy: Low-barrier Mobile Data Science Toolkit and Curriculum | *2022 - Present*
Advisors: Hal Abelson, Cynthia Breazeal
This curriculum and toolkit aim to educate students on the fundamentals of collecting, analyzing, and visualizing data collected from the environment. It will provide students with a framework needed to plan investigations for real-world challenges and prepare them to share the evidence obtained using IoT sensors and MIT App Inventor. Built tools and scaffolded resources, in combination with plugged and unplugged activities, to make this data science literacy accessible to both middle and high school students. Developed professional development materials for educators to seamlessly integrate and adapt these in their classrooms.

Generative AI Tutor: Personal Pedagogical Agent for Underrepresented College Students in Intro to Computing | *2023 - Present*
Advisors: Hal Abelson, Cynthia Breazeal
This generative AI powered tutor aims to promote culturally relevant, equitable education in introduction to programing courses by acting as a personal pedagogical agent to students from marginalized contexts. Designed tutor interactions that enhance student learning outcomes within diverse learning environments. Investigating the capabilities of Large Language Models (LLMs) in understanding and critiquing student-written solutions, providing detailed, scaffolded feedback, and the impact of different forms of model-generated feedback on student learning and problem-solving.

K12 Generative AI Literacy for K12 Students and Educators | *2022 - 2024*
Advisors: Hal Abelson, Cynthia Breazeal
This curriculum focusses on making generative AI knowledge as well as tools accessible to everyone, regardless of background and age group, using both interactive (plugged) and non-interactive (unplugged) resources. Co-developed, taught, and investigated the long-term effectiveness of generative AI educational programs tailored for adult learners, policy makers, as well as K-12 educators and students. Initiatives also include conducting professional development workshops for K-12 teachers on the integration of generative AI into classroom settings.

Modeling 'Aha!' Moments as a Proxy for Learning | *Spring 2024*
Collaborator: Eden Adler
This work proposes a novel approach to identifying a real-time learning signal, specifically focusing on the "Aha! Moment," representing sudden comprehension or insight. Although psychologists, educators, and cognitive scientists have explored these observable markers of insight, the potential of using machine learning to detect these moments in real-time remains untapped. Our research seeks to utilize our knowledge of these observable cues to computationally model them, creating a signal that makes the learning process visible. We explore the explainability of a relationship between facial and body language features and the occurrence of aha moments, thereby offering a clearer understanding of affective responses in learning. This could provide valuable feedback on the human learning process, particularly in insight learning.

Sparki: Interactive Learning Companion for AI Education | *Summer 2023*
Led by: Randi Williams
S.P.A.R.K.I. (Students' Personal Assistant for Reinforcing Knowledge and Innovation) is a GPT-powered chatbot that scaffolds children's work on AI projects. Sparki provides programming assistance, gives students feedback on their ideas, and socially mediates creative thinking. Measured the effectiveness and usability of Sparki through evaluative user studies.

Using Sign Language Recognition to Develop Educational Games for Deaf Children | *2019 – 2022*
Advisor: Thad Starner
CopyCat and Popsign are two educational games that help deaf children and their hearing parents communicate with one another by facilitating sign language acquisition. Designed and developed a real-time motion capture and calibration system (body, hands and face) in Unity by leveraging 4K depth cameras and pose estimators: Microsoft Kinect, Google MediaPipe and AlphaPose. Achieved user-independent word accuracy of 90.6% for a sign language recognition pipeline built using Hidden Markov Models (HMMs).

Technology and Design for Empowerment on the Margins | *2020 – 2021*
Advisor: Neha Kumar
Research in Human-centered computing and global development. Conducted empirical and ethnographic studies to examine the transition into online learning within the education system for underserved communities in India, during the COVID-19 pandemic. Employed qualitative methods such as interviews and surveys to study the workflows and social dynamics across different sectors and intersections of the Indian population such as class, gender and caste. Outlined areas for improvement in the design of online learning platforms, by partnering with students, teachers, non-profit organizations and school administrators within marginalized contexts.

Co-Designing Parent-Education Information and Communication Technologies (ICTs) with Hispanic Immigrants | *2019 – 2020*
Advisors: Betsy DiSalvo, Marisol Wong-Villacres

We explore the design of ICTs for diversifying strategies that low-income Hispanic immigrant parents use to effectively engage in their children's education, given information needs, cultural practices and socio-economic context. Organized participatory design workshops and conducted ethnographic studies informing the role of bilingual parent-education liaisons in assisting immigrant parents in the United States.

INDUSTRY RESEARCH INTERNSHIPS

Microsoft, Design Researcher Intern | *May 2023 – August 2023*

- Research in generative AI tools for neurodivergent and motor disability groups within Microsoft's Windows + AI UX research team.
- Deployed a foundational accessibility study to investigate the delighters and pain-points that people with disabilities encounter when using personal devices as well as AI tools. Also investigated their perceptions, expectations, and ethical concerns when using AI platforms.
- Designed and employed qualitative methods: surveys, unmoderated diary missions, and semi-structured interviews—to collect the above data and used deductive coding analysis to draw emerging trends between the two user groups.
- Conducted co-design workshops to inform future directions for the integration of generative AI platforms into the Microsoft Windows ecosystem.

Google, Research Intern | *January 2022 – April 2022*

- Research in American Sign Language (ASL) Recognition at Google Research's Perception Team, under the guidance of wearable computing pioneer Dr. Thad Starner.
- Collected and annotated over 1 million videos for an ASL fingerspelling dataset in collaboration with the National Technical Institute for the Deaf (NTID) and DPAN (Deaf Professional Arts Network) for PopSign.
- Built an automated data processing pipeline for extracting features and tracking movement using pose estimation tools: Google MediaPipe.
- Led the development, training, testing and fine tuning of multiple models-- Hidden Markov Models (HMMs), Long Short-Term Memory models (LSTMs), and Transformers-- used for fingerspelling sign recognition.
- Google Research Blog at I/O 2023: Technologies for inclusive and fair ML applications | YouTube Video

Avanti Fellows, Research Intern | *June 2021 – October 2021*

- Research Intern at Avanti Fellows, an educational technology-based startup guided by Dr. Neha Kumar.
- Organized a girls' leadership and mentorship program for high school girls of low-income backgrounds from central schools for students predominantly from rural areas in India, in partnership with LedBy Foundation to facilitate equitable access to high-quality college education and accelerate professional growth.
- Conducted ethnographic studies to examine and assess the outcomes of the mentorship program with respect to students' ability to articulate their career goals, confidence in communicating with peers and professionals, public speaking, their leadership strengths, and their ability to recognize and navigate anger and stress triggers.
- Designed and employed qualitative methods - interviews and surveys at the baseline, midline and endline stages of the program with its participants and code, summarize, and compare their results to analyze the program efficacy and outline future directions.

SOFTWARE ENGINEERING INTERNSHIPS

Microsoft, Software Engineer Intern | *May 2022 – July 2022*

- Designed and built an end-to-end Office 365 Extension for Microsoft's Artifact Management System, used for onboarding all legal matters (involving law firms for example), their stakeholders and documents into the Office 365 Infrastructure (used by 220,000 employees).
- Constructed a pipeline using React and C# .NET Core APIs to facilitate the smooth migration of artifacts sent via email on the Exchange server to the rest of the Office 365 ecosystem (SharePoint, OneDrive, Teams), thereby centralizing their storage.
- Developed an ML-based recommendation service for the add-in that displays SharePoint projects pertinent to the emails opened on Outlook, allowing users to iterate on existing matters and eliminating duplication.

Microsoft, Software Engineer Intern | *May 2021 – July 2021*

- Designed and built an end-to end intelligent solution for the Office 365 Enterprise Records Management System used for storing 6M+ regulatory, legal, and business-critical electronic records spanning 100 countries in three regions (US, EMEA and Asia) for 160K+ employees.
- Constructed a pipeline to create file plans and retention policies that automatically labels, stores, retains, retrieves and disposes records stored across the entire Office 365 ecosystem.
- Built a microservice for transactional systems using Azure Functions and data connectors that leverages C# (.NET Core) Rest APIs, Azure Portal and Visual Studio resources to facilitate automatic and iterative migration of records from every external Microsoft System (Azure Cosmos DB, SQL, File/Data Storage Blobs, etc.) into the Office 365 infrastructure.
- Implemented and trained machine learning models to automatically classify records across all Office 365 locations into different categories and extract critical and sensitive metadata information from them by leveraging Azure Machine Learning resources and SharePoint Syntex.

Microsoft, Software Engineer Intern | *May 2020 – July 2020*

- Designed a centralized telemetry service (to monitor a web platform used by internal consultants to track their projects and finances) using Angular and TypeScript that logs all UI events, page views, API requests and errors to Azure Application Insights to assist debugging and product improvement, thereby directly impacting 5000+ users.
- Standardized telemetry and documented new rules to make telemetry querying from Azure Application Insights fast, efficient and consistent.
- Built dashboards from real-time user data using Kusto Query Language (KQL), Azure Data Explorer and Microsoft Power BI to analyze user behavior, feature usage and pain points across multiple environments, to make recommendations for improving performance.

INVITED TALKS AND PRESENTATIONS

- **Mainstreaming K12 Data Science Education through a Student-Centered Interdisciplinary Curriculum**
  Speaker at UNESCO's Digital Learning Week 2024, held at UNESCO Headquarters, Paris
- **The Future of Generative AI in Higher Education**
  Guest speaker at 81st Annual Conference of Louisiana Colleges & Universities (CLCU) 2024
- **Generative AI for Responsible Community Engagement workshop**
  Guest speaker at Capitol Hill, Washington DC: #HouseOfCode, U.S. Congressional App Challenge
- **Social Annotation Systems for Large-Scale Classroom Collaboration and Learning**
  MIT CSAIL Alliances Annual Meeting, 2024
- **2024 Future Steminist Convention**
  Guest speaker and panelist, sySTEMic flow
- **Boston Public School AI and Data Science with App Inventor workshop**
  MIT Computer Science and Artificial intelligence Laboratory (CSAIL)
- **How Might We Redefine Learning in the Age of AI?**
  Guest speaker and panelist, Center for Constructive Communication (CCC), MIT Media Lab
- **AI is for Everyone: Transforming K-12 Learning and Education in the Era of AI**
  Center of Excellence in Teacher Education (CETE) at Tata Institute of Social Sciences (TISS), Mumbai, India
- **Day of AI India**
  Global Partnership on Artificial Intelligence (GPAI) 2023, New Delhi, India
- **Generative AI with MIT App Inventor**
  U.S. Congressional App Challenge 2023
- **Tracking Carbon Footprint using MIT App Inventor**
  Monterrey Institute of Technology and Higher Education, Mexico, and ELENA-Climate Academy
- **Supporting Entrepreneurship through Mobile App Development using MIT App Inventor**
  Guest Speaker at the Roxbury Latin High School, Massachusetts
- **PopSign: Mobile Games to teach Sign Language**
  Imagine RIT 2022, Rochester, NY
- **Intuitive Calibration and Data Collection Procedures for ASL Recognition using Azure Kinect**
  Undergraduate Research Symposium at Georgia Tech 2019
- **Pose Estimation for ASL Recognition using OpenPose and Microsoft Kinect**
  Georgia Tech GVU Center Research Showcase 2019

SERVICE AND NON-PROFIT WORK

- Diversity and Inclusion Chair, ACM Symposium on User Interface Software and Technology (UIST) 2024
- Associate Chair, ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW) 2024
- Tech Vetter, MIT Solve Global Learning Challenge, 2024
- Program Committee, MIT AI + Education Summit 2024
- Editor, MIT Work of the Future Substack Newsletter [link]
- Reviewer, ACM Computer-Human Interaction (CHI) 2024
- Reviewer, ACM Designing Interactive Systems (DIS) 2023
- Workshops and Outreach, App Inventor Foundation
- Founder and President, UNICEF @ Georgia Tech, 2018-2022
- Executive Project Lead, CS + Social Good @ Georgia Tech, 2019-2022
- Training Manager, Robogals @ Georgia Tech, 2019-2020

SELECTED MEDIA COVERAGE

- **MIT Open Learning News.** New Day of AI curricula brings climate change into the AI conversation with K-12 students. [link]
- **MIT News.** MIT launches Working Group on Generative AI and the Work of the Future. [link]
- **App Inventor Foundation News.** Boston Public School Students Consider AI and Data Science. [link]
- **MIT Center for Constructive Communication.** CCC and DemocracyNext hosted the First-Ever Tech-Enhanced Student Assembly. [link]
- **Georgia Tech College of Computing News.** CS Major Earns Adobe Research Women-In-Tech Scholarship. [link]
- **Adobe Research News.** Women-in-Technology Scholarship: Sparking Curiosity. [link]
- **App Inventor Foundation News.** High School Girls in Mexico Build App to Track Carbon Footprint. [link]
- **Rochester Institute of Technology (RIT) News.** Parents of deaf children can more easily learn sign language thanks to powerful tech collaboration. [link]
- **Google Research at I/O 2023.** Students x Sign Language Recognition | Google Lab Sessions. [link]
- **Avanti Fellows.** LedBy Girls' Leadership and Mentorship Program: The Why, What, and How. [link]