Prerna Chikersal

Machine Learning · Data Science · Human-Computer Interaction · Ubiquitous Computing · NLP · UX Research

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Professional Interests

My research focuses on developing machine learning methods and data-driven UIs for understanding and augmenting human behavior, with the goal of advancing high-impact application areas like health, well-being, computer-mediated communication, and collaboration.

Leveraging my diverse skills in behavioral statistics, machine learning, human-computer interaction, natural language processing, speech processing, and computer vision, I analyze and model complex datasets from various modalities, such as smartphone and wearable data, web interaction logs, text and speech data, face and body video, and electronic health records. My research methodology also involves user studies, iterative prototyping, and qualitative methods like user interviews and thematic analysis, enabling me to create methods and user interfaces that are tailored to the needs of specific populations, including clinical populations consisting of people with depression or Multiple Sclerosis.

Education

Carnegie Mellon University *Pittsburgh, PA, USA*

Ph.D. in Human-Computer Interaction, School of Computer Science *Aug 2017 - Present*

- Committee: Anind Dey (Co-Chair), Mayank Goel (Co-Chair), Andrew Campbell, Mary Czerwinski, and Geoff Kauffman.
- Research focus: Multimodal Machine Learning, Data Science, Human-Computer Interaction, Ubiquitous Computing
- Thesis: "Multimodal Behavioral Sensing for Precision Mental Health Care"
- TA-ed: User Centered Research and Evaluation, Programming Usable Interfaces

Carnegie Mellon University *Pittsburgh, PA, USA*

M.S. in Human-Computer Interaction, School of Computer Science *Aug 2017 - May 2022*

- Completed during the Ph.D. in Human-Computer Interaction degree.
- Relevant Courses: HCI Process and Theory, Pervasive and Ubiquitous Computing, Social, Cognitive, Design, and Computer Science Perspectives in HCI, Human-AI Interaction, Computational Medicine, Data Visualization, and Applied Data Analysis.

Carnegie Mellon University *Pittsburgh, PA, USA*

M.S. in Robotics, School of Computer Science *Aug 2015 - Aug 2017*

- Committee: Laura Dabbish (advisor), Louis-Philippe Morency, Marynel Vázquez
- Collaborators: Anita Woolley, Maria Tomprou, Young Ji Kim
- Thesis: "Deep Structures of Collaboration"
- Relevant Courses: Introduction to Machine Learning (PhD-level), Computer Vision, Human-Robot Interaction, Human Communication and Multimodal Computation, and Experimental Design for Social and Behavioral Sciences.

Nanyang Technological University *Singapore*

B.Eng. in Computer Science, School of Computer Science and Engineering *Aug 2011 - May 2015*

- First Class Honors and Specialization in Intelligent Systems
- Thesis Advisor: Erik Cambria
- Final Year Thesis: "Modeling Public Sentiment in Twitter" (A+ Grade)
- Relevant Courses: Natural Language Processing, Neural Networks, Intelligent Agents, Artificial Intelligence, and Intro to Psychology.

Columbia University *New York, NY, USA*

Summer School *Jul 2014 - Aug 2014*

Publications

Peer-reviewed Conference and Journal Papers

- **Chikersal, P.**, Bayer, K., , Nayar, S. K., Smith, B. A. When Emoji Speak Louder than Words: Personalized Emoji-first Messaging for Enhanced Communication between Partners and Close Friends. In Preparation (Manucript available).
- **Chikersal, P.**, Venkatesh, S., Masown, K., Walker, E., Quraishi, D., Dey, A., Goel, M., & Xia, Z. Predicting Multiple Sclerosis Outcomes during the COVID-19 Stay-at-Home Period: Observational Study Using Passively Sensed Behaviors and Digital Phenotyping. In *JMIR mental health (2022)*.
- Xu, X., **Chikersal, P.**, Dutcher, J. M., Sefidgar, Y. S., Seo, W., Tumminia, M. J., Villalba, D. K., Cohen, S., Creswell, K. G., Creswell, J. D., Doryab, A., Nurius, P. S., Riskin, E., Dey, A. K., & Mankoff, J. Leveraging Collaborative-Filtering for Personalized Behavior Modeling: A Case Study of Depression Detection among College Students. In *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (Ubicomp 2021)*.
- Tomprou, M., Kim, Y. J., **Chikersal, P.**, Woolley, A. W., & Dabbish, L. (2021). Speaking out of turn: How video conferencing reduces vocal synchrony and collective intelligence. *PLOS ONE*.
- **Chikersal, P.**, Doryab, A., Tumminia, M., Villalba, D., Dutcher, J., Liu, X., Cohen, S., Creswell, K., Mankoff, J., Creswell, D., Goel,

M., & Dey, A. (2020). Detecting Depression and Predicting its Onset Using Longitudinal Symptoms Captured by Passive Sensing: A Machine Learning Approach With Robust Feature Selection. *ACM Transactions on Computer-Human Interaction (TOCHI 2020)*. (Presented at CHI 2021).

- **Chikersal, P.**, Belgrave, D., Doherty, G, Enrique, A., Palacios, J., Richards, D., & Thieme, A. (2020). Understanding Client Support Strategies to Improve Clinical Outcomes in an Online Mental Health Intervention. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI 2020)*. (Talk, Microsoft's Blog Post)
- Xu, X., **Chikersal, P.**, Doryab, A., Villalba, D., Dutcher, J. M., Tumminia, M. J., Althoff, T., Cohen, S., Creswell, K., Creswell, D., Mankoff, J., & Dey, A. K. (2019). Leveraging Routine Behavior and Contextually-Filtered Features for Depression Detection among College Students. In *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (Ubicomp 2019)*.
- Doryab, A., Villalba, D. K., **Chikersal, P.**, Dutcher, J. M., Tumminia, M., Liu, X., Cohen, S., Creswell, K., Mankoff, J., Creswell, D., & Dey, A. K. (2019). Identifying Behavioral Phenotypes of Loneliness and Social Isolation with Passive Sensing: A Three-fold Analysis. In *Journal of medical Internet research (JMIR 2019)*.
- **Chikersal, P.**, Tomprou, M., Kim, Y. J., Woolley, A. W., & Dabbish, L. (2017). Deep Structures of Collaboration: Physiological Correlates of Collective Intelligence and Group Satisfaction. In *Proceedings of the 20th ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW 2017)*.
- **Chikersal, P.**, Poria, S., Cambria, E., Gelbukh, A., & Siong, C. E. (2015). Modelling Public Sentiment in Twitter: Using Linguistic Patterns to Enhance Supervised Learning. In *International Conference on Intelligent Text Processing and Computational Linguistics (CICLing 2015)* (pp. 49-65).

Peer-reviewed Workshop Papers

- **Chikersal, P.**, Doherty, G, & Thieme, A. (2020). Towards Using AI to Augment Human Support in Digital Mental Healthcare. In *Proceedings of the 2020 CHI Workshop on Technology Ecosystems: Rethinking Resources for Mental Health*.
- **Chikersal, P.**, Poria, S., & Cambria, E. (2015). SeNTU: Sentiment Analysis of Tweets by Combining a Rule-based Classifier with Supervised Learning. In *Proceedings of the 4th International Workshop on Semantic Evaluations* (pp. 647-651). Association for Computational Linguistics.

Thesis

- **Chikersal, P.** (Est. 2023). Multimodal Behavioral Sensing for Precision Mental Health Care. *Upcoming Doctoral Thesis, Carnegie Mellon University, Pittsburgh, PA, USA.*
- **Chikersal, P.** (2017, May). Deep Structures of Collaboration. *Masters Thesis, Carnegie Mellon University, Pittsburgh, PA, USA.*
- **Chikersal, P.** (2015, May). Modelling Public Sentiment in Twitter. *Bachelor Thesis, Nanyang Technological University, Singapore.*

Patents

- Bayer, K., **Chikersal, P.**, Nayar, S. K., Smith, B. A. Client device processing received emoji-first messages. U.S. Patent 11,593,548, filed Apr 20, 2021, and issued on Feb 28, 2023.
- Bayer, K., **Chikersal, P.**, Nayar, S. K., Smith, B. A. Personalized emoji dictionary. U.S. Patent 11,531,406, filed Apr 20, 2021, and issued on Dec 20, 2022.
- Bayer, K., **Chikersal, P.**, Nayar, S. K., Smith, B. A. Emoji-First Messaging. U.S. Patent Appl. No. 17/234,884, filed Apr 20, 2021, and currently pending.

Work Experience

Human-Computer Interaction Institute, Carnegie Mellon University — *Pittsburgh, PA, USA*
Graduate Research Assistant (PhD Student) — *Jul 2017 - PRESENT*

- Leveraged passively sensed contextual data from multiple sensors on the user's smartphones and wearables to develop tools that aid in diagnosis, monitoring, and treatment of diseases, and make medicine more precise.
- E.g. Predicting symptoms of depression and loneliness in college students, neurological and mental health symptoms in patients with multiple sclerosis, understanding the user's context to intervene and reduce problematic smartphone use, and analyzing patterns in textual Electronic Health Records to suggest data-driven insights to reduce ER visits by young adults.
- Designed and implemented several in-person and remote human subject research studies, while collaborating with clinicians and researchers from various fields such as neurology, psychology, psychiatry, and emergency medicine.
- Developed Android and iOS apps for sensor-based human subject research.
- Led the development of novel machine learning and data mining methods for predicting health outcomes in mHealth.

Snap Research (Snapchat) *New York City, NY*
Research Intern (UX + Data Science + HCI Focused) *May 2020 - Aug 2020*

- Supervisors: Brian Smith, Shree Nayar
- Teams: Human-Computer Interaction, Computational Imaging
- Developed a new method of social visual communication. I implemented a novel emoji-first communication app for partners and close friends, that enhanced humor, affection, and creativity by leveraging the shared language formed between partners.
- I built the iOS app in Swift that allowed users to communicate via a novel "emoji first" paradigm. For this purpose, I computed default emoji-to-text mapping using an Emoji-to-Word Embedding model trained on emoji descriptions and Twitter data. I also implemented novel interaction design features that allowed users to develop their own shared emoji language.
- To test this app, I ran a user study during which I conducted semi-structured interviews and thematic analysis, to understand how users use the app, identify pain points, identify usability themes, understand design implications, and make design recommendations for future products. My project developed and explored a new messaging paradigm that has not previously explored.
- This project was the first to investigate the properties and affordances of an emoji-first messaging app for close relationships. I identified ten themes from participant interviews, revealing the values that EmoChat adds to messaging (compared to the status quo of text-based messaging). My results suggest that emoji-first messaging between partners in close relationships adds humor; builds secrecy for the exchange of private messages; promotes creativity, fun, a sense of play; and promotes companionship through affection and the sharing of perspectives.

Microsoft Research *Cambridge, UK*
Research Intern (Data Science + HCI Focused) *May 2019 - Sep 2019*

- Supervisors: Anja Thieme, Danielle Belgrave
- Teams: Health Intelligence, Human Experience Design and Engineering
- Analyzed and modeled user interactions with a widely used Digital Mental Health Intervention, in order to recommend changes that would make the intervention more effective.
- Analyzed over 200K supporter messages to discover how different support strategies correlate with clinical outcomes.
- Developed novel machine learning methods for: (i) clustering supporters based on client outcomes; (ii) using natural language processing techniques to extract and analyze linguistic features from supporter messages; and (iii) identifying context-specific patterns of support.
- The findings indicate that concrete, positive and supportive feedback from supporters that reference social behaviors are strongly associated with better outcomes; and show how their importance varies dependent on different client situations.
- I collaborated with and presented my findings to researchers at Microsoft Research, as well as the CTO and other technical and scientific leadership of a tech company called SilverCloud.

Human-Computer Interaction Institute, Carnegie Mellon University *Pittsburgh, PA, USA*
Graduate Research Assistant (MS Student) *Aug 2015 - Jul 2017*

- Studied the physiological and behavioral underpinnings of Team Performance (Collective Intelligence) and Cohesion (Group Satisfaction) using speech, video, and physiological sensor data collected during a video call between 2 people. My work revealed new relationships between Synchrony in Facial Expressions and Collective Intelligence, and Synchrony in Electrodermal Activity and Group Satisfaction.
- Repeated the study by connecting participants over an audio-only call, and found that contrary to popular belief, the presence of visual cues surprisingly has no effect on Collective Intelligence (CI). In fact, teams without visual cues are more successful in synchronizing their vocal cues and speaking turns, and when they do so, they have higher CI. These findings show that nonverbal synchrony is important in distributed collaboration and call into question the necessity of video support. This work was widely covered by major media publications such as the Wall Street Journal, Forbes, and Harvard Business Review.
- Predicted the outcomes of negotiations between 2 people by applying Multimodal Machine Learning techniques to audio and video recordings of their interaction. Support Vector Machine (SVM) with Multiple Kernel Learning that learnt different kernels for audio and video features gave a 10% higher accuracy than the LSVM baseline.
- A combination of qualitative (surveys, user-centered tasks) and quantitative methods (statistics, machine learning) were used.

Nanyang Technological University *Singapore*
President Research Scholar (Senior) *Sep 2014 - Jun 2015*

- Proposed a system to enhance supervised learning for polarity classification by leveraging on linguistic rules based on conjunctions and conditionals. Additionally, built a hybrid classifier by adding an unsupervised classification layer to the supervised classifier. The unsupervised classifier applied rules based on commonsense concepts extracted from text. By estimating the polarities of multiple expressions of one or a few words, then analyzing these polarities when taken together, my approach provides more accuracy than simply assigning word-level polarities, since it provides more contextual information about the concepts expressed in a given passage.

Computer Vision Lab, École Polytechnique Fédérale de Lausanne, Switzerland — *Lausanne, Switzerland*
Research Intern — *Aug 2013 - Jan 2014*

- Worked on re-identification and tracking of people in sports and pedestrian datasets using appearance cues like color and texture. Implemented and evaluated methods using – (i) dominant colors, (ii) color histograms, and (iii) color invariants.

Computer Graphics Lab, École Polytechnique Fédérale de Lausanne, Switzerland — *Lausanne, Switzerland*
Summer Research Intern — *May 2013 - Aug 2013*

- Used RGB-D input to track a person's hand in real-time and capture its performance. More specifically – Used RGB-D data to create a 3D mesh of a person's hand in real-time. Multithreading and Optimization was used to improve performance. Hand and fingertips were detected.

Nanyang Technological University — *Singapore*
President Research Scholar (Sophomore) — *Sep 2012 - May 2013*

- Conducted a literature review and helped develop an animated "Talking Head" of a living person, based on how phonemes and visemes of speech appear in 3D computer graphics.

Awards & Fellowships

1. **Awarded the Snap Research Fellowship (from Snapchat)** – which "honors the brightest, most driven students who positively impacted research and product development during their internships at Snap". — *Dec 2020*
2. **Awarded the Grace Hopper Celebration (GHC) Scholarship** – sponsors women who actively contribute to their community, to attend the Grace Hopper Celebration of Women in Computing. — *Jun 2020*
3. **Awarded a Fellowship in Digital Health** by the Center for Machine Learning and Health (CMLH) at CMU. Covers tuition, stipend, and $3000 research expenses for 1 year. — *Aug 2017 – Aug 2018*
4. **Awarded a Research Scholarship by EPFL** for NTU-EPFL's research exchange program. — *Aug 2013*
5. **Accepted into the Summer@EPFL Research Internship Program** (0.03% acceptance rate; 1500 applications; fully funded). — *Apr 2013*
6. **2nd Prize in URECA@NTU Poster Competition** – a research competition held for students participating in NTU's prestigious Undergraduate Research Experience on CAmpus program. — *Mar 2013*
7. **1st Prize in the NTU's TechFest 30 hours Hackathon 2013** for an e-commerce app that uses computer vision to recommend "matching" fashion accessories. — *Feb 2013*

Media Coverage

- **HuffPost.** Here's Why Your Next Work Meeting Should Not Be A Zoom Call. June 2021.
- **Wall Street Journal.** How Videoconferences Make It Harder for Employees to Collaborate. June 2021.
- **Forbes.** Are Zoom Meetings Reducing Our Collective Intelligence?. April 2021.
- **Fast Company.** Zoom is actually less effective than a phone call for these types of meetings. March 2021.
- **IndiaTV.** Disabling video during online meets boosts communication. March 2021.
- **The Economic Times (CIO).** Disabling video during online meets boosts communication. March 2021.
- **Harvard Business Review.** Successful Remote Teams Communicate in Bursts. October 2020.

Academic and Professional Service

Reviewing

- ACM Conference on Human Factors in Computing Systems (CHI): 2022 (2), 2021 (4), 2020 (2), 2019 (3)
  ⋆Special Recognition for Exceptional Reviewing! 2021 (1), 2019 (1) ⋆
- ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT): 2021 (1), 2020 (2), 2019 (1)
  ⋆Special Recognition for Exceptional Reviewing! 2020 (1) ⋆
- Journal of Medical Internet Research (JMIR): 2020 (1)
- ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW): 2018 (2)
- The International AAAI Conference on Web and Social Media (ICWSM): 2021 (1), 2020 (1)
- International Conference on Affective Computing & Intelligent Interaction (ACII): 2019 (1)
- International Conference on Multimodal Interaction (ICMI): 2018 (2)

Program Committee(s)

1. Workshop on **"Machine Learning for the Diagnosis and Treatment of Affective Disorders"** at the *8th International Conference on Affective Computing & Intelligent Interaction* (ACII) — *2019*

Teaching and Community Involvement

1. **Graduate Teaching Assistant** — *Aug 2021 – Dec 2021*
   05-410/05-610 User-Centered Research and Evaluation at Carnegie Mellon University, Pittsburgh, PA, USA. I reviewed various qualitative methods used in UX Research, and supervised UX research student projects.
2. **International Student Advocate for CMU's Graduate Student Assembly (GSA)** — *Sep 2020 – May 2021*
   Led advocacy efforts on the behalf of CMU's International Students. E.g. I advocated for specific changes at the Office of International Education (OIE) to help them better support International Students.
3. **Served on the PhD Admission Committee of Carnegie Mellon University's Human-Computer Interaction Institute** — *Dec 2020 – Feb 2021*
   Reviewed applications to the PhD in HCI program and recommended applicants for admission.
4. **Facilitator, BiasBusters @ SCS** — *Spring 2020*
   Facilitated implicit bias training workshops for faculty, students, and staff.
5. **Graduate Teaching Assistant** — *Aug 2019 – Dec 2019*
   05-430/05-630 Programming Usable Interfaces at Carnegie Mellon University, Pittsburgh, PA, USA. I taught students to prototype UIs, test the UIs with users, and then modify the UIs based on their findings. I also taught programming using web development tools like HTML, CSS, Javascript, jQuery, D3.js, etc, and covered the basics of data visualization and Git.
6. **Vice Chairperson - Internal, IEEE-NTU, Science Symposium Committee** — *Aug 2012 – May 2014*
   Organised symposiums in which, high students presented papers on research projects and received feedback from NTU faculty. The goal was to encourage students to pursue STEM careers.
7. **Instructor, "Web Development" Workshop, Computer Engineering Club, NTU** — *Mar 2013*
   Created the curriculum and taught 40 school students the basics of HTML and helped them create their first website which was hosted online, during a Community Involvement Program.
8. **Instructor, "Google Search Techniques", Computer Engineering Club, NTU** — *Dec 2012*
   Created the curriculum and taught 40 school students how to perform web searches and filter the results.

Selected Research Project Supervision

Christine Wu	B.S. in Cognitive Science at CMU.	*May 2019 – Aug 2020*
Kusha Maharishi	B.S. in Computer Science at CMU.	*Jan 2019 – Dec 2019*
Ishaan Gupta	B.S. in Electrical & Computer Engineering at CMU.	*Jun 2018 – Dec 2018*
Swagata Ashwani	M.S. in Integrated Innovation for Products & Services at CMU. *Next Stop: Data Scientist at Highmark Health.*	*Dec 2017 – May 2018*
Brian Hall	Visiting Student under the Research Experiences for Undergraduates program at CMU. *Next Stop: PhD student at UMich, Ann Arbor (School of Information).*	*Jun 2016 – Aug 2016*

Skills (Selected)

Programming	Python, Jupyter/ Collab, R, Matlab, Android, Swift (iOS), C/C++, Qt (with C++), Java, OpenCV, OpenGL, OCaml
Data Science	Scikit-learn, Tensor Flow, Keras, PyTorch, Pandas, Numpy, Scipy, Pingouin, Statsmodels, NLTK, GenSim, SpaCy, CoreNLP, SQL, SPSS
Visualization	Matplotlib, Seaborn, Plotly, Tableau, D3.js
UX Research	Qualtrics, User Interviews, Contextual Inquiry, Thematic Analysis, Eye Tracking, Usability Testing
Hardware	Arduino, Particle's Photon, Verilog (Hardware Description Language)
Web Dev	PHP, JSP, HTML, CSS, JavaScript, jQuery, React, Bootstrap, Django
Human	English (native), Hindi (native), French (beginner)

References

PhD Advisors

- **Anind Dey**: Dean, Information School, University of Washington, Seattle, WA.
- **Mayank Goel**: Assistant Professor, School of Computer Science, Carnegie Mellon University, Pittsburgh, PA.

At Microsoft Research:

- **Anja Thieme**: Senior Researcher, Microsoft Research, Cambridge, UK.
- **Danielle Belgrave**: Principal Researcher, Microsoft Research, Cambridge, UK.

At Snap Research (Snapchat):

- **Brian Smith**: Research Scientist at Snap Inc. and Assistant Professor of Computer Science at Columbia University.
- **Shree Nayar**: Director of NYC Research at Snap Inc. and Professor of Computer Science at Columbia University.

Masters Advisor and Collaborator

- **Laura Dabbish**: Associate Professor, School of Computer Science, Carnegie Mellon University, Pittsburgh, PA.
- **Anita Woolley**: Assistant Professor, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA.