Prerna Chikersal

Machine Learning · Data Science · Ubiquitous Computing · Natural Language Processing · Human-Computer Interaction

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Professional Interests

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

I analyze and model **complex datasets from multiple modalities**, such as smartphone and wearable data, web interaction logs, text and speech data, face and body video, and electronic health records by leveraging my diverse skills in machine learning, human-computer interaction, natural language processing, speech processing, and computer vision. To develop data-driven interfaces, I also leverage iterative prototyping and qualitative methods like user interviews and thematic analysis, thereby creating interfaces tailored to the needs of the user.

I'm a strong software developer experienced in various programming languages and platforms, and have advanced knowledge of **data structures and algorithms**, **structured query language (SQL)**, and **core machine learning frameworks**.

I am committed to promoting diversity, equity and inclusion in computing, and do so through (1) mentoring, (2) advocacy and service within my department and student organizations, and (3) increasing awareness about bias and the barriers it creates.

Education

Carnegie Mellon University   *Pittsburgh, PA, USA*

Ph.D. Candidate, 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, Ubiquitous Computing, Human-Computer Interaction
- Upcoming Thesis: "Multimodal Behavioral Sensing for Precision Mental Health Care"

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. degree.
- Relevant Courses: Human-AI Interaction, Pervasive and Ubiquitous Computing (ML for ubiquitous and IoT devices), Computational Medicine (ML for genomics), Applied Data Analysis (Advanced Statistics), Data Visualization, and HCI Process and Theory.

Carnegie Mellon University   *Pittsburgh, PA, USA*

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

- Committee: Laura Dabbish (Chair), Louis-Philippe Morency, Marynel Vázquez
- Collaborators: Anita Woolley, Maria Tomprou, Young Ji Kim
- Thesis: "Deep Structures of Collaboration"
- Relevant Courses: 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*

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

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 (Manuscript 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

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 machine learning methods 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.

- Developed Android and iOS apps to collect multimodal sensor data for sensor-based human subject research in the wild. Created a data monitoring dashboard to monitor user compliance and data quality in real-time. Used REST APIs to fetch Fitbit data.

- Ran several user studies in collaboration with clinicians from various fields such as neurology and psychology.

- Developed **novel machine learning and data mining methods for predicting health outcomes** from real-world multimodal sensor data. These methods were based on Logistic and Regularized Regression, Gradient Boosting Machines, and AdaBoost.

Snap Research (Snapchat) *New York City, NY*
Research Intern *May 2020 - Aug 2020*

- Supervisors: Brian Smith, Shree Nayar
- Teams: Computational Imaging, Human-Computer Interaction
- Developed a new messaging paradigm by implementing a emoji-first communication app for partners and close friends, that enhanced humor, affection, and creativity by **personalizing their chat to their shared language and context**.
- 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 a **Word2Vec** 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 *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 **privacy-preserving 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.

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

- Studied the physiological and behavioral underpinnings of Team Performance and 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 team performance. 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.
- In this project, I (1) processed signals related to human behavior using **signal processing, speech processing, and computer vision**, (2) developed a computational method to measure synchrony in human behavior and physiology, and (3) used **statistics and causal inference** to study relationships between computed features and collaborative outcomes.

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. Deployed the system using a **cloud platform** called Heroku.

Computer Vision Lab, École Polytechnique Fédérale de Lausanne, Switzerland
RESEARCH INTERN

Lausanne, Switzerland
Aug 2013 - Jan 2014

- Improved continuous tracking of people in sports and pedestrian datasets using **computer vision based feature matching**. Implemented and evaluated methods based on – (i) dominant colors using color quantization, (ii) color histograms, and (iii) color and scale invariants (**SIFT**). I was able to re-identify people after occlusions using these approaches.

Computer Graphics Lab, École Polytechnique Fédérale de Lausanne, Switzerland
SUMMER RESEARCH INTERN

Lausanne, Switzerland
May 2013 - Aug 2013

- Used RGB-D data from a depth sensor and 3D geometry to create a 3D mesh of a person's hand in real-time. Used **computer vision (HAAR) and 3D geometry** to detect a human hand in a video, align the hand and fingertips with the 3D hand model and place the model on the human hand such that the 3D model was able to capture the hand's performance.

Nanyang Technological University
PRESIDENT RESEARCH SCHOLAR (SOPHOMORE)

Singapore
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*

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.

Selected Skills

Programming	Python, Jupyter/ Collab, R, Matlab, Android, Swift (iOS), C/C++, Qt (with C++), Java, OCaml, Git
Data Science	Scikit-learn, Tensor Flow, Keras, XGBoost, Pandas, Numpy, Scipy, Pingouin, Statsmodels, NLTK, GenSim, SpaCy, CoreNLP, Apriori/Eclat for associative rule mining, Bootstrapping, ANOVA, ANCOVA, Mediation Analysis, SQL, SPSS
Machine Learning	Linear Regression, Logistic Regression, Random Forests, SVM, Naive Bayes, Lasso, ElasticNet, KNN, K-means, Gradient Boosting Machines, Adaboost, other bagging and boosting approaches, Deep Learning, Multi-armed bandits
NLP/Speech	Linear Discriminant Analysis, Latent Semantic Analysis, Word2Vec, Sentiment Analysis, Linguistic Inquiry and Word Count, OpenSMILE
Computer Vision	OpenCV, OpenFace, OpenGL, Point Cloud Library
Visualization	Matplotlib, Seaborn, Plotly, Tableau, D3.js
Web Dev	PHP, JSP, HTML, CSS, JavaScript, jQuery, Bootstrap, Django, REST APIs
UX Research	Qualtrics, User Interviews, Contextual Inquiry, Thematic Analysis, Eye Tracking, Usability Testing
Hardware	Arduino, Particle's Photon, Verilog (Hardware Description Language)
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.