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Research Statement

Summary

Digital media and AI are integral to modern life and have transformed the ways people connect, communicate, and socialize. Motivated by understanding the social and psychological impact of these technologies, my research program focuses on two complementary research lines: (1) Modeling and predicating psychological experiences from multimodal behavioral data collected through sensing technologies (e.g. mobile sensing), social media, and AI interaction, and (2) Examining the effects of social interactions, both human-human, and human-AI, on individual well-being. In my work, using computational modeling and statistical inference, I investigate how digital media and AI interaction plays out across contextual dimensions - spatial, social, physical vs. digital, and relational- and how person-aware factors moderate these dynamics. By integrating multimodal and contextual data, I develop predictive models of well-being outcomes, including affect, stress, loneliness, and empathy.

My research bridges my training in computer science and the field of communication to answer substantive research questions about social behavior, Human-AI interaction, media effects, social media, and well-being. In conducting my research, I employ a broad range of interdisciplinary methods in computer science, including machine learning, data mining, AI, large language models (LLMs), and network science. Additionally, I use statistical and causal inference, smartphone sensing, experience sampling, and multilevel modeling to analyze multimodal data and uncover patterns that offer insights into the complex interplay between human behavior, digital media, and psychological outcomes.

Predicting psychological experiences from communication and media behavior

In my first line of research, I focus on modeling and predicting psychological outcomes through digital media (e.g., smartphones, social media platforms) by capturing people's behavior as they go about their daily lives. Digital media have indeed transferred the way we communicate and share thoughts and feelings without being limited by time or location, allowing for continuous assessment of people's daily behavior and psychological experience. This state of affairs has had significant implications for both behavior and psychological experiences, yet more studies are required to fully understand the individual differences in how people experience and are impacted by these technologies. Examining these relations using empirical data provides better insight about human behavior and recommends interventions which may be beneficial for their subsequent psychological well-being.

Predicting emotions through smartphone data

In the early stages of my research, in "EmotionSensing: Predicting Mobile User Emotion" (Roshanaei et al., 2017; *ASONAM*), I examined whether smartphone usage patterns could reflect people's well-being by predicting emotions from smartphone logs. To this end, I developed an android app, EmotionSensing, and conducted a pilot study with five participants over one week, followed by a three-month longitudinal study with 27 college students. The app collected ecological momentary assessments (EMAs) of participants' emotions, locations, and activities several times per day, along with passively tracked data such as time, mobile app usage, ambient light, and GPS information. The study found that socializing and dining were linked to greater happiness, while studying was associated with less stress. Moreover, higher happiness was reported while using communication apps (e.g. text, email), whereas organization apps showed no significant emotional impact. Building on these findings, I applied machine learning techniques to classify

13 discrete emotions (e.g., happiness, sadness, anger). Overall, our multiclass classifier achieved 75% accuracy, higher than previous mood prediction models, and identified two informative attributes among others: gender and the presence of a secondary emotion. Furthermore, male classifiers generally performed better, and including a second emotion significantly improved both precision and recall. Along the same lines, in "Studying the attributes of users in Twitter considering their emotional states" (Roshanaei et al., 2015; *Soc. Netw. Anal. Min*), I analyzed behavioral differences between positive and negative Twitter users using a dataset of over 130,000 accounts. Our findings revealed that positive users tweet more, followed by negative users, and use Twitter for information sharing, while negative users engage more for interpersonal purposes. In "Having Fun?: Personalized Activity-Based Mood Prediction in Social Media" (Roshanaei et al., 2017; *Lecture Notes in Social Networks.*), a personalized classifier predicting users' emotional states achieved 80% accuracy, which highlights key factors such as gender, daily activities, and temporal patterns of online behavior for differentiating emotional states.

Examining user attributes and predicting affects using twitter data

In line with my second line of research, in "Studying the attributes of users in Twitter considering their emotional states" (Roshanaei et al., 2015; *Soc. Netw. Anal. Min*), I analyzed behavioral differences between positive and negative Twitter users using a dataset of over 130,000 accounts. Positive/negative users were identified by a higher ratio of positive/negative Tweets/ReTweets (TRT). Our analysis was done over two networks of positive and negative users by examining their engagement metrics (e.g., tweeting, retweeting, replying), social network metrics (e.g., degree distribution, reciprocity, clustering coefficient) and temporal patterns of online activities. Our findings revealed that positive users often had more followers, including negative and neutral ones. These users posted more frequently, and their tweets were more often retweeted by negative users. These findings suggest that positive users use Twitter for information sharing, while negative users engage more in expressing agreement and interpersonal interactions. Building on these findings, in "Having Fun?: Personalized Activity-Based Mood Prediction in Social Media", (Roshanaei et al., 2017; *Lecture Notes in Social Networks*), using machine learning techniques, I developed a personalized classifier to predict users' emotional states. This classifier achieved 80% accuracy, incorporating user profiles (e.g., gender, number of followers), engagement metrics, and temporal posting patterns, alongside extracted features like locations and psychological traits from posts via LIWC. Our findings suggested key factors for differentiating emotional states including gender, daily activities (e.g. exercising, studying), and temporal patterns of online behavior (e.g., time of day, day of week).

Predicting empathy through online personal stories

Expanding my second line of research, I investigated the role of *individual difference* in predicting and evoking empathic response to online personal stories. Every day, billions of users read about other people's experiences, but only some of these stories can reach and elicit reactions, promoting readers to empathize with storytellers and share their narratives. In "Paths to empathy: heterogeneous effects of reading personal stories online" (Roshanaei et al., 2017; *DSAA)*, I analyzed personal stories collected from college students and evaluated by M Turk participants, who rated their experienced empathy and identified the key factors that triggered these responses. Using trigger-based causal trees, to examine the variability in readers' reactions, our findings showed that the personality of the reader plays a significant role, extroverts were more likely to engage with positive and rewarding stories. Additionally, a reader's mood prior to reading influenced empathic engagement, as negative emotions increases engagement with positive stories, and heightened emotional arousal generally enhances empathetic responses. The results of this project can

provide valuable insights to help people create content that not only resonate with readers but also foster genuine empathy and social connection.

Examining the effects of social interactions on psychological experiences

In my second line of research, I investigate the impact of context-specific social interactions on psychological outcomes using a combination of behavioral, statistical and computational methods. Social interactions, along with the quality of social networks, are key predictors of well-being. My main goal in this line of research is to model and quantify the effects of context-specific social interactions on individuals' well-being using statistical and computational methods. To gain better insight, in some studies, I incorporate demographic factors (e.g., age), personality traits (e.g., extraversion), and psychological well-being metrics (e.g., anxiety) into the models. The results of these studies can inform the development of personalized interventions tailored to individuals or groups and design and develop recommender systems to promote social engagement and overall well-being.

Meaningful social interactions and well-being in context

In "Meaningful peer social interactions and momentary well-being in context" (Roshanaei et al., 2024; SPPS), I examined the impacts of engaging in meaningful social interactions on well-being in different contexts. In leading this paper, I collaborated with an interdisciplinary team of social scientists from Communication, Psychology, and Economics as part of the Stanford Communities Project (SCP). I analyzed large-scale longitudinal data collected over 3 years from 5,649 first-year students who provided social network data, psychological surveys, and ecological momentary assessments (215,209 observations) using a customized mobile app. using multilevel modeling, I investigated the moderation effects of social, spatial, and activity context in relation to subjectively meaningful social interactions and subsequent momentary well-being. The findings showed that meaningful interactions reduced stress and loneliness and improved affective well-being, but the benefits varied by context. For instance, interactions with weak ties were associated with less loneliness, compared to those occurring with strong ties. I am interested in applying these findings to design personalized interventions that encourage beneficial social behaviors and enhance the well-being of college students. In a similar vein, I have collaborated with the Stanford Communities Project team to examine the effects of "social microclimates" as a contextual factor that impacts student well-being (Courtney et al., 2021 in *Emotion*). Our findings show that students living in supportive and empathic dorm communities experienced less psychological distress, a finding that held when controlling for personality and the number of direct ties in their social networks.

Communication channels during meaningful interactions and its impact on close friendships

To understand how meaningful social interactions impact channel selection and relationship maintenance, I examined the relationship between media channels and relational tie strength, and the role of media channels in maintaining close friendships over times. In "Media Multiplexity in Everyday Meaningful Social Interaction: Communication Channels and Maintenance of Close Friendships" (Roshanaei et al., under review at *Communication Research*), I applied Media Multiplexity Theory and "one-with-many" (OWM) models, to analyze the interpersonal communication tendencies of a cohort of students during Fall 2022 (N = 1507 participants; ecological momentary assessments = 30,490). The findings indicated that while engaging in meaningful social interactions, young people used more communication channels with strong ties (e.g., close friends, romantic partners), often through phone calls and direct messages. In contrast, meaningful interactions with weak ties more often occurred in person or via video calls. Moreover, close friendships were more likely to be maintained months later when individuals used a greater variety

of channels in meaningful interactions with close friends. These findings indicate the crucial role of diverse communication channels for maintaining meaningful relationships, especially with close friends. While digital communication is preferred for strong ties, interactions with weak ties often occur in person or through video calls, and a variety of communication methods helps sustain these connections over time.

Effects of smartphone use on well-being

In line with my first line of research, examining the impact of digital media technologies on well-being, I'm exploring how smartphone use impacts individuals' well-being, focusing on how this influence varies across different contexts and the people involved. This nuanced approach could provide valuable insights into the personalized effects of smartphone use. In a current paper (Roehrick, Roshanaei et al., in preparation for submission to *Journal of Computer-Mediated Communication*), my colleagues and I are analyzing both mobile sensing and experience sampling data from a cohort of college students (N = 1,553 participants) to examine the effects of smartphone use frequency and duration on subsequent well-being. Using multilevel modeling, we found that a higher frequency of use was linked to increased momentary energy and contentment, while longer durations of use had no positive impact on momentary well-being. In fact, prolonged use was associated with increased feelings of loneliness and sadness, and a decrease in energy and contentment. However, our participants experience benefits and detriments to their well-being depending on how often they use their smartphone in certain contexts. Participants reported higher levels of loneliness and sadness when using their phones more frequently and for longer periods with strong ties, compared to when they were alone. Additionally, higher frequency of smartphone use was associated with higher levels of loneliness when participants were at public places compared to at home. The results emphasize the greater importance of context over frequency and duration when studying the effects of smartphone use on well-being and highlights the need for more focus on smartphone content.

Understanding human-AI interactions and empathy

Building on my initial research on social interactions and psychological well-being, I'm now exploring the how AI can support meaningful social engagement and influence overall wellbeing. As social AI agents become increasingly fluent and emotionally responsive, important questions raised about their psychological impact, especially during emotionally complex interactions such as empathic engagement. In a recent study, "Talk, Listen, Connect: How Humans and AI Evaluate Empathy in Responses to Emotionally Charged Narratives" (Roshanaei et al., accepted at *AI and Society*), I examined how humans and AI perceive empathy and identified the factors that evoke empathic responses to personal stories collected from college students. Our findings show that GPT-4 tends to overrate empathy with less variability compared to humans and suggest better performance in the affective dimension of empathy vs cognitive understanding. Utilizing the fine-tuned version of GPT-4, our results show its alignment with human empathy is greatly improved; however, it still struggles to fully grasp human experiences, particularly when responding to positive events or interacting with certain subgroups, such as women. These results underscore the importance of acknowledging both the benefits and limitations of AI agents and highlight the need to design ethically aware and emotionally responsive systems that support meaningful social connection and well-being. Following this project, and to further our understanding of empathy in AI contexts, I am now conducting an in-depth exploration of its linguistic dimensions. This study explores how humans and language models differentially respond to contextual cues, with the goal of uncovering the intricate links between empathic expression, cognitive processing, and situational awareness in both artificial systems and human communication.

Future Directions

In the next few years, I plan to build on my two existing lines of research in the following ways.

First, I plan to develop an AI-driven system using large language model (LLM) architectures to detect and interpret complex behavioral and emotional events from multimodal sources, including smartphone sensing logs, ecological momentary assessments (EMA), and self-reported affective states. The goal is to build personalized predictive models for daily well-being by designing a framework that enables LLM-based agent to perform high-level reasoning tasks using both smartphone-sensing and EMA data. This research aims to enhance our understanding of LLM capabilities in reasoning on multimodal behavioral data and to highlight key directions for interpreting complex real-world information.

Second, I seek to explore the role of social AI agents in social interactions and if these agents can support individuals' social and emotional needs in daily life. To that end, I plan to examine how socializing with AI agents, through both conversational agents (CAs) and gamified experiences, can foster meaningful social connections, enhance emotion regulation, and improve overall well-being among college students. By integrating generative AI, reinforcement learning, mobile sensing, and ecological momentary assessments, I aim to develop and evaluate a personalized AI agent that provides real-time, context-aware interventions to enhance social engagement, support emotion regulation, and improve psychological well-being both in the short term and over time. The system will evaluate well-being outcomes and continuously refine its emotion regulation strategies based on user interactions and personalize them to meet individual needs. This research aims to support college students in developing critical skills, such as emotion regulation, and meaningful social interaction, thereby strengthening their emotional well-being. Ultimately, building on these findings, I aim to develop a theory of Emotion Regulation in Human–AI Interaction (ERHAI) that explains how adaptive and emotionally responsive AI agents can support the acquisition and application of emotion regulation strategies, and evaluate whether these strategies extend to human-to-human interactions.

Third, I plan to investigate how individuals' online social activities, through social media or smartphone, or engaging with social AI agents, influences their offline social connections. For those who have a rich online social presence, do they have vibrant offline social lives that are magnified or complemented by their online lives? Or might a vibrant online social life be displacing opportunities for in-person interactions? I will explore whether socializing through digital platforms enhances or hinders a person's social interactions when they are co-occurring in-person? To evaluate the interplay between digital and physical socialization, I plan to conduct a longitudinal study by incorporating individuals' demographic and personality traits, along with EMA, and metrics of online social behavior (e.g., posting, call) within a cohort of college students. This study will examine the relationships between daily social interactions and activities and social behaviors through digital media and AI, and while assessing how dispositional factors influence these interactions. The findings will provide insights to examine the reciprocal relationship between offline and online social lives and demonstrate how these effects can vary widely among individuals.