Professional Informatics: Personalized, Data-Driven Professional Development

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In this work, we reframe personal informatics as **professional informatics (Pro-I)** to provide personalized professional development. While PI is often focused on individual, personal changes, Pro-I examines how data can influence multiple stakeholders involved (such as instructors and students in a classroom). We focus on the use of Pro-I for college instructors and how multimodal classroom data can promote behavioral change towards the improvement of teaching. We present how two systems, EduSense and Edulyze, can contribute to the adoption of Pro-I for instructors. In this workshop paper, we address two grand challenges of AI and PI: **personalization** and **the role of the human**. Within these challenges, we propose studies to address questions about Pro-I systems and perceptions of human agency, data privacy, and adoption.

CCS Concepts: • **Human-centered computing** → **Ubiquitous and mobile computing systems and tools**; **User studies**.

Additional Key Words and Phrases: personal informatics, education, classroom sensing, sensing systems

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1 INTRODUCTION

Personal Informatics (PI) can help in building self-awareness for substantial behavioral change. Research in PI predominantly centers on lifestyle habits such as fitness or finances [3, 5, 7, 11, 12]. PI has experienced both meteoric adoption and high rates of abandonment. For many, the continuous effort to maintain devices, collect and reflect on data, and to stay motivated in pursuit of lifestyle change quickly outweighs the perceived benefit. One untapped opportunity for PI is in the personalized professional development (PD) where extensive data can provide an objective and holistic view of one's performance.

We argue to reframe PI as **Pro-I (Professional Informatics)**. Through this lens, we explore whether self-sensing technology in support of behavior change would work effectively if applied to professionals with motivation to perform well at their jobs. This reframing is largely motivated by recent research in feedback systems for individual occupations including therapists, medical students, and teaching assistants, to name a few. In the process of reframing ProI, we identified three qualities of a profession that might make for a good match with Pro-I practices:

- Professions with ongoing training and with research detailing the most effective practices,
- Professions where work is performed in increasingly instrumented environments, and
- Professions where people do not currently have access to high quality feedback on their own performance

This research addresses two main grand challenges in the use of AI and PI: **Personalization** and **the Role of the Human**. First, we address the challenges of AI and PI in terms of human agency and privacy, particularly in professional

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contexts where multiple stakeholders are involved (*i.e.* nurses and patients, teachers and students, coaches and athletes, etc.). Second, we explore how AI and PI can provide contextual and personalized recommendations in professional contexts where professionals are motivated and have the capabilities to improve. We look specifically at the domain of teaching as teaching is a profession where teachers continuously undergo professional development and student evaluations remain the primary source of performance feedback. Here, we present an AI-driven sensing system and analytics engine to provide a first step towards the collection of Pro-I data. From this work, we pose open questions for further research in ProI and ProI systems.

2 GRAND CHALLENGES & OPEN QUESTIONS

Here we present our open questions towards the grand challenges of AI and Pro-I. We look specifically in the domain of teaching to provide implications for AI and Pro-I in other domains.

2.1 What is the role of the human? What are the values/tradeoffs of Pro-I systems for stakeholders?

In PI, individuals are largely in control of their own data. In Pro-I, multiple stakeholders are involved, and an individual's professional's behavior and performance impacts the behavior and performance of others. Given this ecosystem of stakeholders invested in the collection and viewing of data, an open question for AI+PI is about the control, ownership, and privacy of data. In an initial set of interviews, we asked professionals from various domains (high school teachers, law enforcement officers, nurses, and therapists) about their thoughts about Pro-I data usage. All professionals expressed interest in Pro-I data as a tool for reflection and feedback on their professional performance. In particular, Pro-I seemed to provide personalized PD without the extra time often needed for PD training. However, these professionals shared concerns about data sharing and privacy as well as the use of data for performance evaluation by supervisors. Continuing in this line of work, we ask what the role of multiple stakeholders might be in Pro-I data. We plan to conduct interviews with instructors, students, administrators, and PD professionals about their perceptions of data privacy, agency, and adoption of classroom sensing technologies and Pro-I systems. This work can provide implications for how Pro-I systems can be ethically designed and implemented in classroom settings and other professions.

2.2 How might personalized Pro-I affect self-efficacy to change behaviors and improve?

One issue in PI is that individuals often lose motivation to track and maintain their data [11]. Shifting PI to professional settings partly resolves this motivational issue since professionals are motivated to improve for their work. However, deriving actionable insights from data may be challenging, and people may need additional help in defining goals and the actions to take towards those goals [12]. We ask how Pro-I can bolster professionals' self-efficacy, their belief in their ability to take actions to achieve their goals [2]. From prior work in multimodal learning analytics and showing classroom data to teachers, reflecting on data may not be enough to enact significant behavioral change [4, 8]. We hypothesize that adaptive guidance can provide personalized and actionable feedback for instructors towards their improvement goals. In this research, we explore various forms of adaptive guidance including system-led guidance in which a system proactively provides feedback and suggestions [10, 13] and user-led guidance in which a user asks for specific guidance, similar to search-based mechanisms [6, 9]. We examine the drawbacks and benefits of differences in timing of personalization, including real-time guidance in which instructors can receive alerts and feedback during a class session or after instructors have had time to reflect on their class session. With these questions, we aim to examine how these forms of personalization might impact instructors' self-efficacy in making behavioral changes to improve teaching practices.

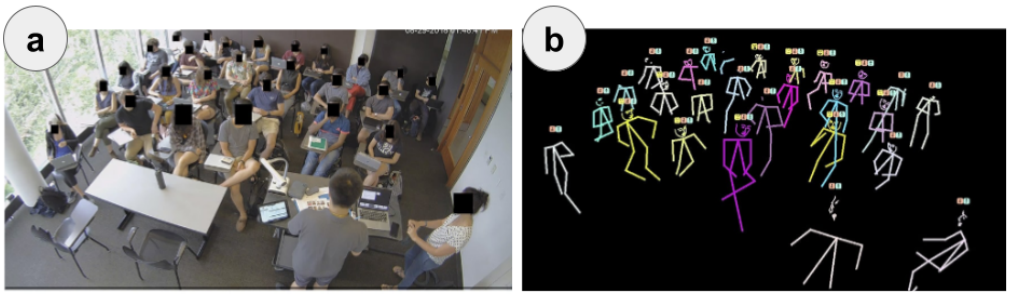

Fig. 1. EduSense cameras are positioned to capture both student and instructor raw video and audio data. (a) The raw video data is presented here for illustrative purposes to show the positioning of EduSense cameras in the classroom. (b) Users see an anonymized, processed version of the raw data that shows skeletal body keypoints for further.

3 EDUSENSE & EDULYZE: SYSTEMS TOWARDS PRO-I

Two of our existing systems contribute to the collection and visualization of Pro-I data in the classroom, which we draw upon to address our grand challenges. **EduSense** [1] serves as the primary sensing technology for our work. EduSense is a holistic, non-invasive sensing system installed within classrooms at CMU (Figure 1). It utilizes a pair of off-the-shelf cameras to collect high fidelity audio and video data to capture both instructor and student data. Raw video data is parsed through an visual scene parsing pipeline to collect body keypoints and gaze information for instructor and students, and raw audio data is utilized to capture speech versus silence patterns across time. The output from the scene parsing pipeline is utilized to train machine learning-based featurization modules that detects theoretically motivated features (*i.e.* body pose detection, hand raise detection, head orientation, classroom topology etc.) of interest. This wide variety of data can help answer pedagogically relevant questions. As a computer vision-based system, EduSense can capture data at a scale and precision far beyond that of human observation. EduSense enables automated classroom analytics and can provide continuous data on which instructional feedback and support systems can be built. **Edulyze** [14] is a novel analytics engine, which is built to support any underlying sensing system (like EduSense) that can capture multi-modal data. In the same way a step counter helps people maintain an awareness of their activity level, Edulyze provides rich analytics data for instructor self-reflection, for sharing with a community of practice and to personalize interactions with professional development consultants. It provides a unified schema to structure processed classroom data across various behavior modalities. These analytics are built into Edulyze. The configurable design of Edulyze means users can easily add their own behavioral modules to explore different associations in their data. As a design goal, Edulyze is a first step towards bringing in the quantified self or personal informatics into teaching, enabling instructors and other stakeholders to answer ever-growing questions around ephemeral behaviors and interactions in the classroom.

4 CONCLUSION

We see an opportunity for AI+PI to help instructors maintain an awareness of their teaching behaviors and their impact on student learning and engagement. From this work, we provide implications of how Pro-I might be incorporated into other professional settings where multiple stakeholders are impacted by individual behavioral changes. Through our open questions, we plan to investigate questions of agency, privacy, and adoption of Pro-I technologies towards the ethical design and implementation of AI-driven PI systems.

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