

Human-Machine Partnership to Maximize Utilization of Labeling Budget in Multi-Task Active Learning

CPS: Small: Human-in-the-Loop Learning of Complex Events in Uncontrolled Environments

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<https://ghasemzadeh.com/project/human-in-the-loop-learning/>



Overview

- Design a multi-task active learning framework for human health monitoring during physical activity and stress using wearable sensors
- Take into account burden of data annotation on end-users
- Consider limited data availability for model training
- Integrate both the model and end-users in effective labeling

Challenge Content

- How to gather data in uncontrolled settings?
- How to train multi-task learning model with limited data without compromising performance?
- How to overcome the challenges of very low labeled seed data in wearable setup?
- What would be an efficient way to develop human-machine partnership to label data?
- What are the bases of evaluation?

Key Innovation

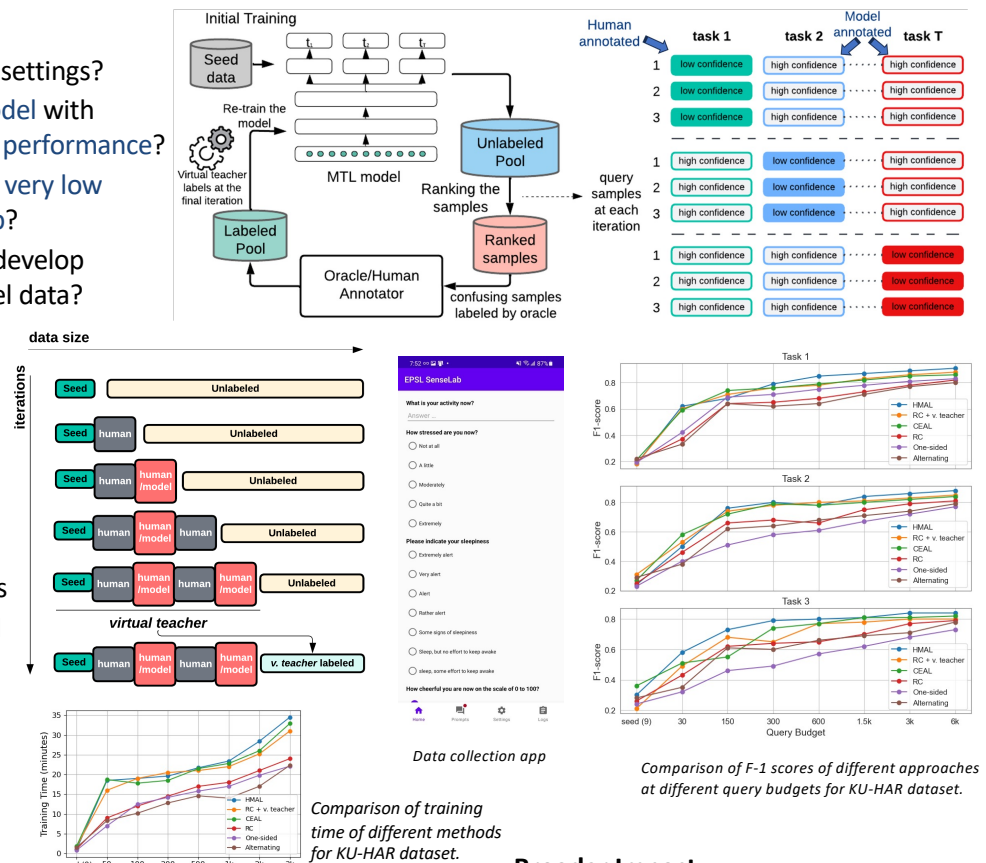
- Design active learning algorithms to minimize burden of data labeling
- Develop multitask learning algorithms to enhance efficiency of underlying machine learning models
- Predictive models to detect physical activity type, or stress levels
- Overcome poor performance by efficiently labeling data through human machine collaboration

Broader Societal Impact

- Chronic disease management and prevention
- High-precision physical and mental health interventions
- Improved quality of life
- Physical activity and diet interventions in free living environments
- Access to care in rural and remote settings

Scientific Impact

- Advancing knowledge of human-in-the-loop machine learning design for CPS
- Mixed initiatives that balance human input and algorithm performance
- Closed-loop systems with physiological sensing, model confidence, and data availability



Education & Outreach

- Involving undergraduate students such in research
- Holding webinars for community college students
- Mentoring high school students through ASU Science and Engineering Experience program
- Graduate course on “embedded machine learning”

Broader Impact

- Potential to reduce costs and improve physical and mental health outcomes
- More than 75% of all health care costs are due to chronic conditions in the US
- 6 in 10 American adults live with a chronic condition
- One person dies every 33 seconds in the US from CVDs