

Self-Learning Digital Health Interventions: How to Learn from Personal Data with an Application to Cough Monitoring

Filipe Barata¹, Peter Tinschert², Gabriella Chiesa³, Niklas Elser³, Tobias Kowatsch² & Elgar Fleisch^{1,2}

¹ETH Zurich, ²University of St.Gallen, ³CSS Insurance

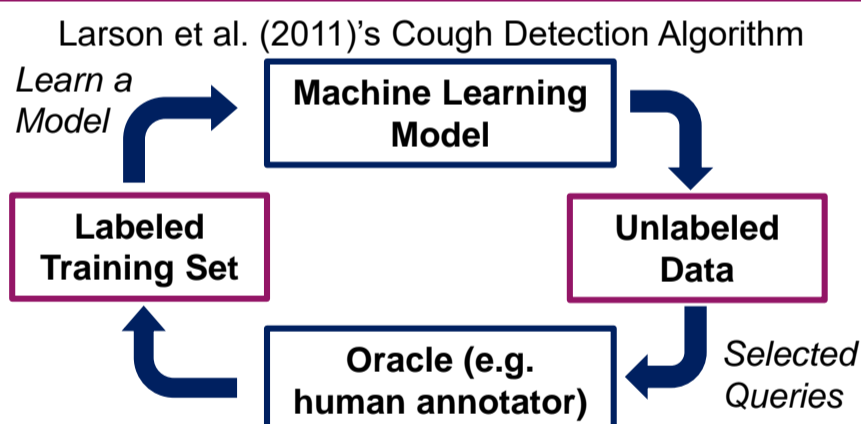
1. Problem

Sensing applications, such as smartphone-based **cough monitor** systems, can objectively monitor disease symptoms. However, the general applicability of those systems lack the capability to tailor to the **personal** disease symptom fingerprint.

2. Research Question

Can we **improve** the individual specific **accuracy** of a general coughing detection model by continuously including **personal data** and employing **active learning**?

3. Research Framework



4. Method

Data acquisition included a population of 47 subjects (33 female, 14 male). Audio signals were **recorded** by means of five different devices and their built-in microphones:

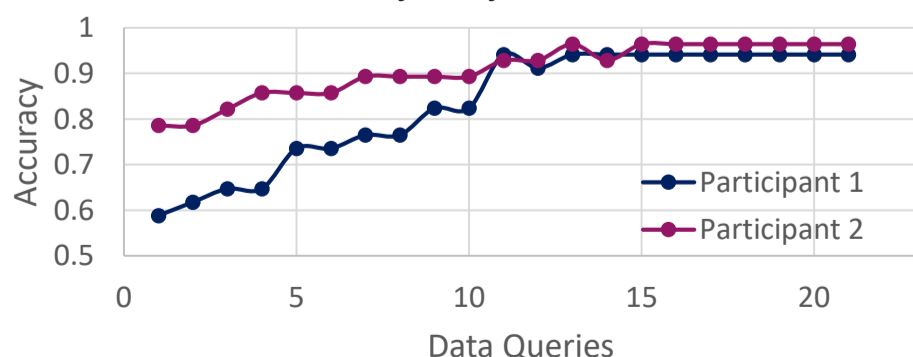
- 2 Android phones and 1 iPhone
- Android tablet
- Studio microphone



The participant were instructed to **intentionally cough** and perform various **control sounds** (i.e. throat clearing, induced laughter and speech) while being recorded.

5. Results

Preliminary results include data from 8 participants. Evaluation of the initial coughing model yielded an accuracy of 84.2%. Active learning, however, further increased accuracy beyond 94 %.



References

- Larson, E. C., Lee, T., Liu, S., Rosenfeld, M., & Patel, S. N. (2011). Accurate and privacy preserving cough sensing using a low-cost microphone. In *Proceedings of the 13th international conference on Ubiquitous computing* (pp. 375-384). ACM.
- Settles, B. (2010). Active learning literature survey. *University of Wisconsin, Madison*, 52(55-66), 11.