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

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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

Larson et al. (2011)’s Cough Detection Algorithm

Learn a Model

Machine Learning Model

Labeled Training Set

Unlabeled Data

Oracle (e.g. human annotator)

Selected Queries

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
