



Smartphone-based Biofeedback Breathing Training for Stress Management

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Publication date:

2018-01-30

Permanent link:

<https://doi.org/10.3929/ethz-b-000220927>

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Funding acknowledgement:

159289 - PathMate2 (NBE) (SNF)

Smartphone-based Biofeedback Breathing Training for Stress Management

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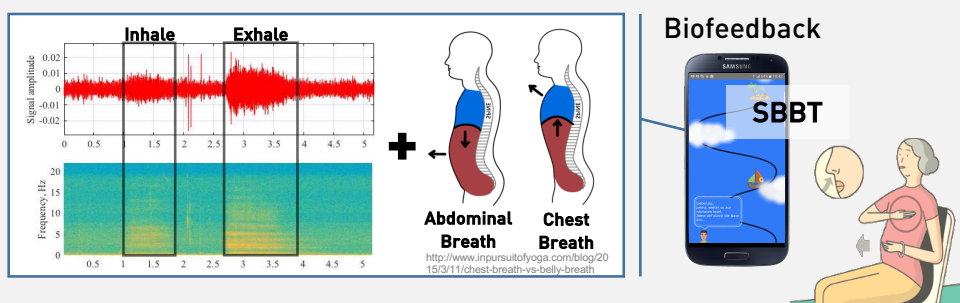
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1. Problem

Biofeedback-based Breathing Trainings (BBTs) shows significant effect on health (WAN10, DIL16). State-of-the-art BBTs require dedicated (high cost) **hardware** and **health professionals** which represent a significant barrier for their widespread adoption. It has been shown that a **smartphone microphone** has the ability to record audio signals from exhalation in a quality of professional respiratory devices (LAR12).

3. Research Framework

Justificatory knowledge from **physics** and **physiology (diaphragmatic breathing)** is applied as respiration is the only autonomic function you have direct control over.



5. Expected Results

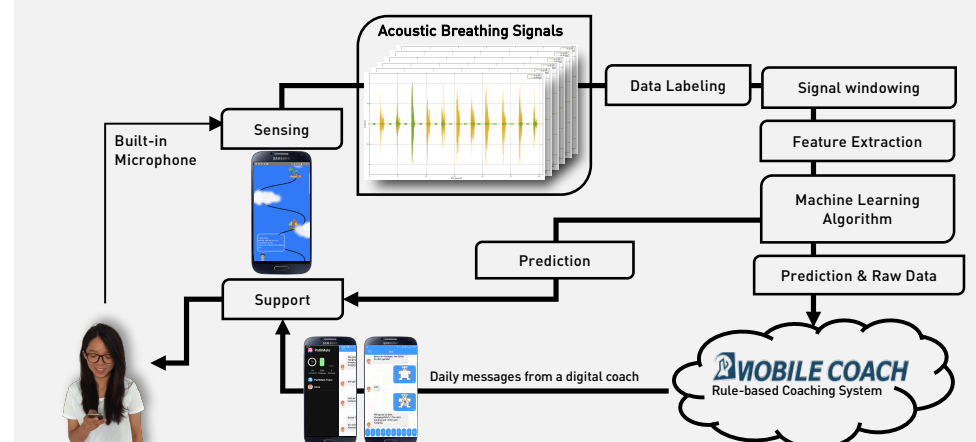
- A smartphone's acoustic sensor can obtain useful breathing signals which can be classified as inhale/exhale and chest/abdominal breathing.
- Evidence-based biofeedback can be generated based on the classification results.
- A positive effect of Smartphone-based Biofeedback can be observed through a designed intervention.

2. Research Question

To which degree of accuracy can a mobile application detect respiratory acoustic patterns in quasi real-time with a smartphone's microphone, thus capable of triggering adequate biofeedback?

4. Method: Design & Learning

- Data Collection:** Feasibility Study + Lab Study (47 subjects)
- Data Annotation:** Human Perception + Respiratory Belt
- Learning Algorithms:** (0. Signal pre-processing)
 - 1. Feature Extraction: Energy / Spectrogram / MFCC
 - 2. Classification: RF / HMM / ANN / RNN
 - 3. Evaluation: Leave-One-Out / Confusion Matrix
- Game-based Biofeedback Design:** Game + Visual + Audio



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