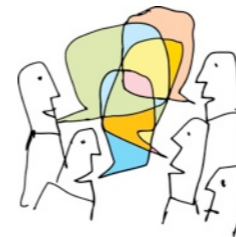# mConverse & mPuff

Human Sensing: Respiratory Measurements
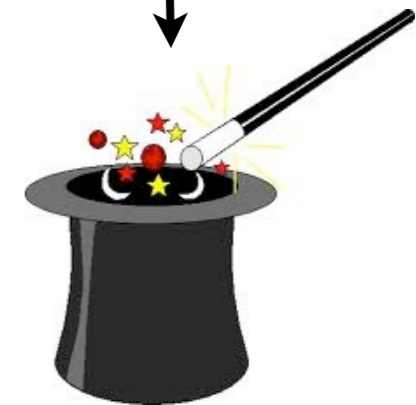
Benjamin Gröhbiel
2012

Overview

- Summary mConverse

- Another application: mPuff

- Conclusion

Idea

wears

mConverse: He's quiet.

mPuff: He's not smoking

Bigger picture

Social Sensing to Model
Epidemiological
Behavior Change

mConverse

mPuff

Social Sensing: Obesity,
Unhealthy Eating and
Exercise in Face-to-Face
Networks

BeWell: A Smartphone
Application to Monitor,
Model and Promote
Wellbeing

2010

2011

2012

- distinguish speaking, listening, quiet

- **Bad** audio: occlusion, privacy, energy

- Answer: Respiration measurements

- Computations on mobile phone

- First attempt: classifying listening

Challenges

- Confounding factors

- Chest band may become loose

- Classification despite missing data

mConverse at a glance

Data Collection | Feature examination | „novel ML model"
Training & Classification | Results | Experiment

| Data Collection | Feature examination | Training & Classification | Results | Experiment |

- Data Collection for Model Development

- 46h, 12 subjects

- Observer labeling states

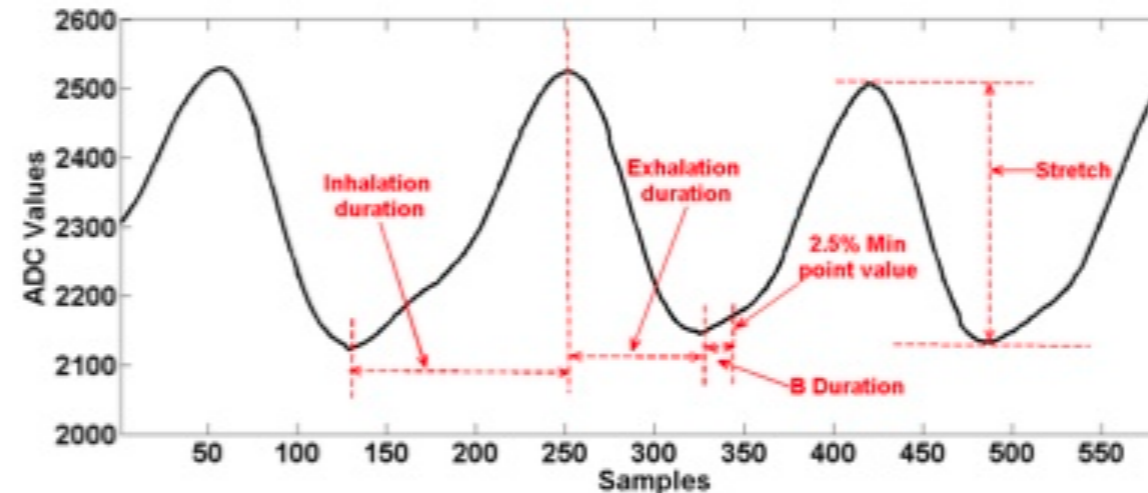- Feature identificiation (6)

- Feature selection (CFS filtering)

- Feature extraction

- Normalization

- 30sec windows

- Input: Filtered features

- Classifier (AdaBoost)

- 10-fold cross validation

- Hidden Markov Model to correct result

- Post-processing

classification

a	b	c	⟵ Classified as
0.8171	0.1200	0.0629	a=Quiet
0.0625	0.8068	0.1306	b=Listening
0.0461	0.0769	0.8769	c=Speaking

HMM + Post-processing

a	b	c	⟵ Classified as
0.9005	0.0706	0.0353	a = Quiet
0.1207	0.8275	0.0517	b = Listening
0.0238	0.0833	0.8929	c = Speaking

- 3.5 conversations / hour

- Most conversations between 0-8 min

- female participants speak more and more often :)

Your remarks

- Chest band no long-term sensor solution

- Battery life better, but...

- Detection of other states (drinking, smiling, laughing, crying)

mPuff

- same hardware
- detection of puffs
- more features (17)
- real application that **might** help people

Structure

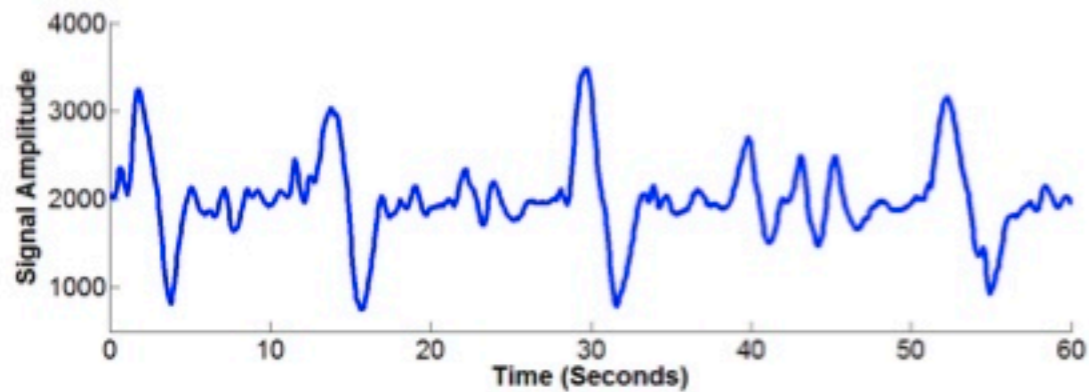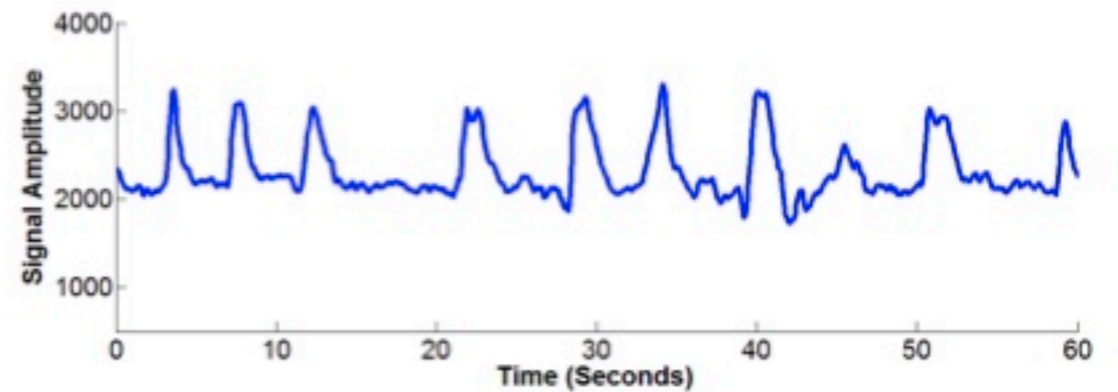Data Collection | Feature examination | Training & Classification | Results | Experiment
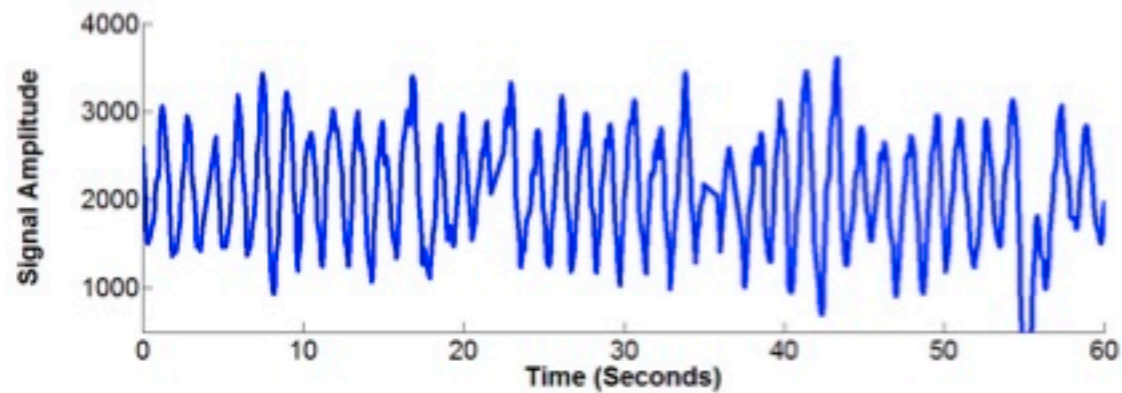
Feature selection

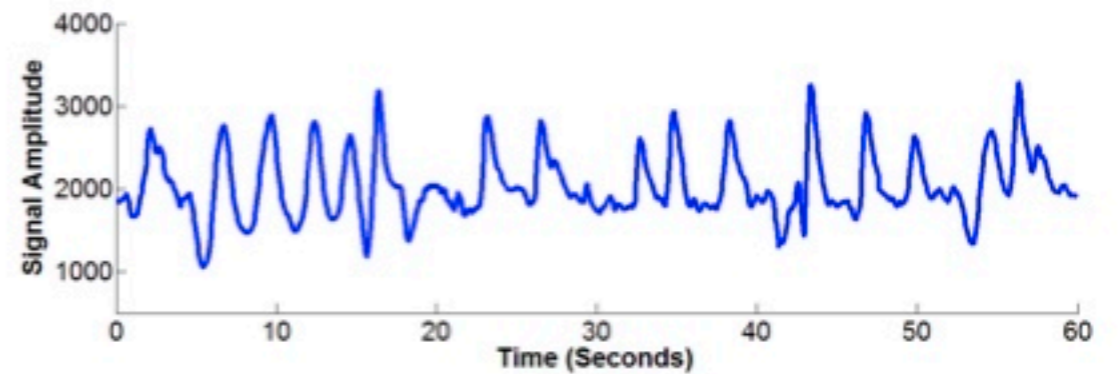confounding event would be could be stress

(a) Smoking

(b) Stress

(c) Running

(d) Conversation

Results puff detection

- supervised model: 84.5 % accuracy

- semi-supervised model: 86.7 % accuracy

- 96% puff detection during smoking session

Wrap-Up

- Respiratory measurements give interesting body insights

- There are solutions to privacy issues

- ~85% sensing accuracy

- Sensor unobtrusive? (price - advantages)

Thank You

- Questions?

- Comments?