Utrecht University

Doctoral Thesis

Human Acitivity Recognition Using Accelerometer Data

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A thesis submitted in fulfilment of the requirements for the degree of Master of Science

in the

Research Group Name
Department or School Name

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Declaration of Authorship

I, R.Q. Vlasveld, declare that this thesis titled, 'Human Acitivity Recognition Using Accelerometer Data' and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

Signed: _____

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"Thanks to my solid academic training, today I can write hundreds of words on virtually any topic without possessing a shred of information, which is how I got a good job in journalism."

Dave Barry

UNIVERSITY NAME (IN BLOCK CAPITALS)

Abstract

Faculty Name
Department or School Name

Master of Science

Human Acitivity Recognition Using Accelerometer Data

by R.Q. Vlasveld

The Thesis Abstract is written here (and usually kept to just this page). The page is kept centered vertically so can expand into the blank space above the title too...

Acknowledgements

The acknowledgements and the people to thank go here, don't forget to include your project advisor...

Contents

List of Figures

List of Tables

Abbreviations

LAH	**L**ist **A**bbreviations **H**ere
PCA	**P**rinciple **C**omponent **A**nalysis

Physical Constants

Speed of Light $c = 2.997\ 924\ 58 \times 10^8\ \mathrm{ms}^{-\mathrm{S}}$ (exact)

Symbols

a	distance	m
P	power	W (Js^{-1})
ω	angular frequency	rads^{-1}

For/Dedicated to/To my...

Chapter 1

Introduction

1.1 Outline

- Context of research (human activity recognition), real-world applications
- Current methods, wrapper vs. filter methods
- Problem statement with current filter methods (which follows from Chapter 3 which goes in-depth with methods).
- Purpose of this research. E.g. "Find a better algorithm for short-activity segmentation"
- Relate to real-world applications

Chapter 2

Literature review

2.1 Outline

- Literature review about Temporal Segmentation (previous draft was more about classification)
- Consider methods for the context of filter-methods for classification
- Take a loot at 3-4 different kind of methods for change detection:
  - Dimensionality reduction
  - Density-ratio estimation
  - Support Vector Machines (?) - if there are more sources about this
  - CUSUM - or other more traditional methods
- With each method, shortly look at characteristics, strengths and weaknesses and consider applicability to accelerometer sensor data

2.2 Change-detection by Dimensionality Reduction / Covariance structure

2.3 Change-detection by Density-Ratio Estimation

2.4 Change-detection by Support Vector Machines

2.5 Change-detection by Cumulative Sum

Chapter 3

Change detection by Density-Estimation

3.1 Outline

- In-depth analysis on one of the methods of Chapter 2
- This method (e.g. Density-Ratio estimation) will be the basis for the real research
- Explain why this methods seems worthy and interesting
- Look at problems when applied to accelerometer sensor data
- *The problems discovered here will give rise to the problem statement at the Introduction / beginning of research*
- Opens the possibility for own method

Chapter 4

Proposed method

4.1 Outline

- Based on the problem statement with current research as stated in Chapter 3
- Adjust method to needs
- Explain using graphs, pseudo-algorithms. Make clear distinction in origin of ideas and why to apply

Chapter 5

Result

5.1 Outline

- Compare proposed method with methods of Chapter 2
- Provide plots, tables, graphs, error rates, precision, etc.
- Apply to a multiple of data, to compare to previous research - use that data
- Give theoretical analysis about performance. Big-O, memory, run-time, precision.
- This sections needs programmed implementations of own method and the ones compared

Chapter 6

Real-world applications

6.1 Outline

- Apply proposed method to real-world applications, such as
  - Daily life activity recognition (as the original context of this thesis is)
  - PowerHouse sensor data
  - Stock data?
- Relate back to filter vs. wrapper methods - give results with different methods?

Appendix A

Appendix Title Here

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Bibliography