Martin Richards

How to write a dissertation in LaTeX

Computer Science Tripos – Part II

St John's College

March 23, 2015

Proforma

Name:	**Martin Richards**
College:	**St John's College**
Project Title:	**How to write a dissertation in LaTeX**
Examination:	**Computer Science Tripos – Part II, July 2001**
Word Count:	**1587**[1] **(well less than the 12000 limit)**
Project Originator:	Dr M. Richards
Supervisor:	Dr Markus Kuhn

Original Aims of the Project

To write a demonstration dissertation[2] using LaTeX to save student's time when writing their own dissertations. The dissertation should illustrate how to use the more common LaTeX constructs. It should include pictures and diagrams to show how these can be incorporated into the dissertation. It should contain the entire LaTeX source of the dissertation and the makefile. It should explain how to construct an MSDOS disk of the dissertation in Postscript format that can be used by the book shop for printing, and, finally, it should have the prescribed layout and format of a diploma dissertation.

Work Completed

All that has been completed appears in this dissertation.

[1] This word count was computed by `detex diss.tex | tr -cd '0-9A-Za-z \n' | wc -w`

[2] A normal footnote without the complication of being in a table.

Special Difficulties

Learning how to incorporate encapulated postscript into a LaTeX document on both Ubuntu Linux and OS X.

Declaration

I, [Name] of [College], being a candidate for Part II of the Computer Science Tripos [or the Diploma in Computer Science], hereby declare that this dissertation and the work described in it are my own work, unaided except as may be specified below, and that the dissertation does not contain material that has already been used to any substantial extent for a comparable purpose.

Signed [signature]

Date [date]

Contents

List of Figures

Acknowledgements

This document owes much to an earlier version written by Simon Moore. His help, encouragement and advice was greatly appreciated.

Chapter 1

Introduction

This dissertation describes the implementation and evaluation of an activity classifier using accelerometer data captured simutaneously from a smartphone and a smartwatch.

The classifier using data from both sources outperforms a classifier using only smartphone data, and the classifier that uses only smartphone data outperforms a classifier using only smartwatch data.

1.1 Motivation

Wearable devices are set to become the next big technology trend. Wrist-worn wearables, including smartwatches, formed the majority of the 21m wearable devices sold year. Analysts predict the Apple Watch will sell between 20m and 40m in its first nine months [4].

One of the primary appeals of wearables is their ability to sense. Like smartphones before them, smartwatches will enhance the ability to collect data about people. This data is important to consumers, who purchase specialised wearables to measure activity, sleep patterns and caloric intake. The data's research potential is also laudable — Apple's ResearchKit will allow medical researchers to access data about their patients with greater ease than ever before [3].

Accurate activity classification therefore has many academic and commercial applications. To be marketable, activity classification solutions must use current consumer devices. Though rudimentary activity classification is available on Android smartphones, an approach that utilises simutaneous collection from a smartphone and smartwatch has not been investigated in any detail.

This dissertation details the implemenation of accelerometer data collection using current consumer devices (an Android smartphone and Android Wear smartwatch), classifies a user's activities and compares this classification accuracy to using only smartphone data and using only smartwatch data.

1.2 Challenges

This project requires knowledge of a variety of disparate areas in computer science.

Writing software for mobile devices requires knowledge of their paradigms and nuances. Mobile devices are also subject to battery life and computational power constraints and particular care must be taken to build a solution that works in practice. A project that utilises built-in sensors also requires an understanding of the features and limitations of those sensors and good knowledge in the APIs that are provided to access them.

The sensors also output data at a high rate and care must be taken to correctly handle the performance and concurrency issues that may arise. Storage and transfer of large amounts of raw data, especially on a memory-limited device such as a smartwatch, also requires special consideration.

The data processing aspects of the project will require an understanding of digital signal processing, Fourier methods, artificial intelligence and machine learning, and statistics.

1.3 Related Work

Activity classification using accelerometer data from body-mounted devices is not a new topic: Bao et al. [1] detect physicial activities using five biaxial acceleometers worn on different parts of the body.

Long et al. [2] use a single tri-axial accelerometer placed on the wrist and use it to achieve an 80% activity classification accuracy in five activities. One of the more interesting highlights of Long et al. is that only 50% of all cycling in correctly classified.

Chapter 2

Preparation

This chapter is empty!

Chapter 3

Implementation

empty

3.1 Tables

Here is a simple example[1] of a table.

Left Justified	Centred	Right Justified
First	A	XXX
Second	AA	XX
Last	AAA	X

There is another example table in the proforma.

[1] A footnote

Chapter 4

Evaluation

4.1 Printing and binding

Use a "duplex" laser printer that can print on both sides to print two copies of your dissertation. Then bind them, for example using the comb binder in the Computer Laboratory Library.

Chapter 5

Conclusion

I hope that this rough guide to writing a dissertation is LaTeX has been helpful and saved you time.

Bibliography

[1] Ling Bao and Stephen S Intille. "Activity recognition from user-annotated acceleration data". In: *Pervasive computing*. Springer, 2004, pp. 1–17.

[2] Xi Long, Bin Yin, and Ronald M Aarts. "Single-accelerometer-based daily physical activity classification". In: *Engineering in Medicine and Biology Society, 2009. EMBC 2009. Annual International Conference of the IEEE*. IEEE. 2009, pp. 6107–6110.

[3] *ResearchKit for Developers*. Mar. 23, 2015. URL: `https://developer.apple.com/researchkit/`.

[4] "Wearable technology: The wear, why and how". In: *The Economist* (Mar. 14, 2015). URL: `http://www.economist.com/news/business/21646225-smartwatches-and-other-wearable-devices-become-mainstream-products-will-take-more`.