UNIVERSITÄT DUISBURG-ESSEN
FAKULTÄT FÜR WIRTSCHAFTSWISSENSCHAFTEN
INSTITUT FÜR INFORMATIK UND WIRTSCHAFTSINFORMATIK
LEHRSTUHL FÜR PERVASIVE COMPUTING

Bachelorarbeit

Application of Radio Tomographic Imaging to Sparse Systems Deployed in Indoor Environments

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Contents

Abstract

The function of the abstract is to summarize, in one or two paragraphs, the major aspects of the entire bachelor or master thesis. It is usually written after writing most of the chapters.

It should include the following:

- Definition of the problem (the question(s) that you want to answer) and its purpose (Introduction).
- Methods used and experiments designed to solve it. Try to describe it basically, without covering too many details.
- Quantitative results or conclusions. Talk about the final results in a general way and how they can solve the problem (how they answer the question(s)).

Even if the Title can be a reference of the work's meaning, the Abstract should help the reader to understand in a quick view, the full meaning of the work. The abstract length should be around 300 words.

Abstracts are protected under copyright law just as any other form of written speech is protected. However, publishers of scientific articles invariably make abstracts publicly available, even when the article itself is protected by a toll barrier. For example, articles in the biomedical literature are available publicly from MEDLINE which is accessible through PubMed. It is a common misconception that the abstracts in MEDLINE provide sufficient information for medical practitioners, students, scholars and patients[citation needed]. The abstract can convey the main results and conclusions of a scientific article but the full text article must be consulted for details of the methodology, the full experimental results, and a critical discussion of the interpretations and conclusions. Consulting the abstract alone is inadequate for scholarship and may lead to inappropriate medical decisions[2].

An abstract[**?**, **?**, **?**, **?**] allows one to sift through copious amounts of papers for ones in which the researcher can have more confidence that they will be relevant to his research. Once papers are chosen based on the abstract, they must be read carefully to be evaluated for relevance. It is commonly surmised that one must not base reference citations on the abstract alone, but the entire merits of a paper.

Chapter 1

Introduction

[You should answer the question: What is the problem?]

This paragraph should establish the context of the reported work. To do that, authors discuss over related literature (with citations[1]) and summarize the knowledge of the author in the investigated problem.

ToDo: how to make citations

An introduction should answer (most of) the following questions:

- What is the problem that I want to solve?
- Why is it a relevant question?
- What is known before the study?
- How can the study improve the current solutions?

To write it, use if possible active voice:

- We are going to watch a film tonight (Active voice).
- A film is going to be watched by us tonight (Passive voice).

The use of the first person is accepted.

1.1 Motivation

A good introduction usually starts presenting a general view of the topic and continues focusing on the problem studied. Begin it clarifying the subject area of interest and establishing the context (remember to support it with related bibliography).

[1] To cite a work in latex

1.2 Problem definition

Additionally, focuses the text on the relevant points of your investigation and problems that you want to solve, relating them with the first part.

1.3 Thesis/Diplom/Bachelor/Master Structure

Present your work to the reader giving a brief overview of what is going to cover every chapter. Write only general concepts, no more than one or two sentences per chapter should be necessary.

Chapter 2

Materials and Methods

This section is to clarify the pre-existing tools, defining what was developed in this field until now, and why this tool was used instead of others.

The general structure is the following:

- Definition of the specific tool(s) studied (robots, sensor nodes, smart-phones). When relevant, pre-existing experiments.
- Definition of the context of use (indoor/outdoor, humans/animals/robots, with/without connection).
- Definition of used protocols (How the data are collected, when, etc.)

2.1 Wireless Sensor Networks

A wireless sensor networks are a collection of low-cost, low-power and multifunctional sensor nodes that are placed inside a to be monitored area

2.2 Radio Tomographic Imaging

2.3 Timeslots

2.4 Testbed

The testbed is a wireless sensor network set up in the third floor of the SA building at the University Duisburg Essen. It covers on half of the whole floor containing a main corridor, two laboratories, two side corridors leading to three offices each, an elevator, seven smaller storage rooms and one server room. All in all the area is 531m^2.

2.4.1 Motes

2.4.2 TinyOs

Chapter 3

Approach

To eliminate the delay timeslots include to prevent errors a different approach is suggested in this thesis which is based on predefined predecessors for each node. Therefore a node will be able to send a message directly after receiving a message from its predecessor. Since the network is widely spread and not every node hears all the other nodes the challenge is to create a fitting schedule that defines a predecessor for each node. To archive this a first calibration phase that figures out which node is in the range of which is needed. Then the collected information about the network need to be gathered at a control point so that the schedule can be created. When the schedule is created it needs to be spread inside the network so every node knows its predecessor. When every node know the schedule the data sampling can begin. To do so the first node in the schedule can send a message. When all the nodes send its message there will be another data collection to gather the collected information at the control point for further processing (localising). Then the next round can start.

3.1 Control Point

The control point is a computer with high processing power. It is used to process the informations gathered from the network. This means it will create the schedule...

3.2 Calibration

To find out the existing links between nodes the calibration phase is needed. Moreover this phase will establish paths from each node to the sink. On these paths data can be send to gather it at the sink.do so each node will just start sending messages in no specific pattern. These message include a value that describes the quality of the path that node has to the sink and the next hop of the node which is the next node along the path. When a node receives a message it will add the sending node into a neighbourlist including the data bout its next hop. By including the data of the next hop we make

sure that the path is known into both directions. Then it will compare its own path quality with the received one. If the received path quality is higher the path of the node will adjusted. It will set its own next hop the the sending node and set its new path quality accordingly.

3.2.1 Path Quality

The path quality is a mixture of the hops a path has and the signal strength between the nodes on that path. The signal strength is divided into an interval. Each interval gets a value. If a node receives a message it will assign the value according to the received signal strength and the defined interval and add this value to the path quality given inside the message.

3.3 Collection

3.4 Creating the Schedule

3.5 Spreading the Schedule

3.6 Sampling

Chapter 4

Implementation

Explain what you did to implement your solution, problems that occurred and how you fixed them. If they are interesting, include some relevant parts of the implementation (most relevant pieces of code and so on).

4.1 Java Application

4.2 Calibration

4.3 Collection

4.4 Creating the Schedule

4.5 Spreading the Schedule

4.6 Sampling

Chapter 5

Evaluation

In this chapter you should describe the previous (if possible) and final experiments performed on the implementation.

Every single experiment should be explained individually, providing to the reader information about the meaning of the experiment, the expected (theoretical) results, the final results, the comparison between them and others (if possible) and the conclusions.

Each experiment should include a description, covering (when possible) the following information:

- Significant physical features (obstacles present on the environment, human presence, temperature, humidity, possible noise sources, computational speed of the machine, etc.)
- The precise location of the experiment (latitude and longitude, room number or citation to a description of the used laboratory).
- Sampling design (variable(s) measured, transformation performed to the data, samples collected, replication, comparative with a Ground Truth system, collecting data protocol).
- Analysis design (how the data are processed, statistical procedures used, statistical level to determine significance).

The provided information should be sufficient to allow other scientists to repeat your experiment in the same conditions. Thus, the use of standard and well-known equipment could only be represented by a simple sentence, but the non-standard equipment should be described in detail, citing the source (vendor) and most important characteristics.

To write it, try to use the third person when describing the experiments and results. Avoid to use first person. Past tense should be the dominant conjugation (the work is done and was performed in the past).

Note: Graphics represent really well data, use them! (Matlab or Octave could be useful for that).

Chapter 6

Discussion

The meaning of this paragraph is to interpret the results of the performed work. It will always connect the introduction, the postulated hypothesis and the results of the thesis/bachelor/master.

It should answer the following questions:

- Could your results answer your initial questions?
- Did your results agree with your initial hypothesis?
- Did you close your problem, or there are still things to be solved? If yes, what will you do to solve them?

Chapter 7

Acknowledgements

(This part is optional, and it could be completely excluded by deleting
\include {content/chapters/chapter7}
from the Firstname_Lastname_Diplom_Master_arbeit.tex file)

This paragraph could mention people or institutions that supported you to some extent with your work or friends and relatives that supported you during your study period.

Erklärung

German

Hiermit versichere ich, dass ich die vorliegende Bachelorarbeit selbständig verfasst, keine anderen als die angegebenen Quellen und Hilfsmittel benutzt, sowie Zitate kenntlich gemacht habe.

English

I hereby declare that I have written this Bachelor thesis independently, using no other than the specified sources and resources, and that all quotations have been indicated.

Essen, January 17, 2017
(Place, Date)

Jan Nauber