



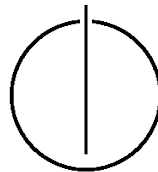
FAKULTÄT FÜR INFORMATIK

DER TECHNISCHEN UNIVERSITÄT MÜNCHEN

Mater's Thesis in Biomedical Computing

**The Big Work - Deformable object detection  
in underwater imaging**

Andrés Sánchez







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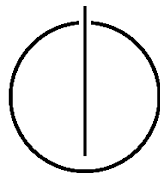
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The Big Work - Deformable object detection in  
underwater imaging

Deformierbare Objekterkennung in Unterwasser-Bilder

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Date:	November 27, 2013





I hereby declare that this thesis is entirely the result of my own work except where otherwise indicated. I have only used the resources given in the list of references.

München, den 26. Mai 2014

Andrés Sánchez



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## Acknowledgments

If someone contributed to the thesis... might be good to thank them here. to the person that support me all the time, My lovely Wife Karin, who understand me almost always





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## Abstract

An abstracts abstracts the thesis!

The monitoring of fish for stock assessment in aquaculture, commercial fisheries and in the assessment of the effectiveness of biodiversity management strategies such as marine protected Areas and closed area management has been thriving since the 1980s. as does area continuously grows, it becomes important to develop a remote monitoring system to estimate the biomass of the large number of fishes bred in cages, since around 80% of all sales of farmed fish are arranged pre-harvest, that mean, the profit on the sale directly depends on correct estimations of weight, size distribution and total biomass. Therefore automated and relatively affordable tools for biomass estimation have to be developed.

Here, we will rely on complex stereo camera system, composed of time of flight range camera and CCD grayscale camera, that film fishes in the cage for certain period of time. in order to estimate the biomass, the volume of the fish has to be estimated. this can be achieved by first detecting and segmenting the fish in every grayscale image of the incoming video stream and then translate this found fish contour to the range image obtaining a estimation of the volume. to find the algorithm that is in line with our problem, we need to understand the challenge in detecting fishes. they include the motion of the fish which makes the object of interest deformable, the location of the fish respect to the camera and occlusion caused by having multiple fishes in every available frame.

In this project, we concentrate on the first step that is detection of the fish that undergo deformation in grayscale images. Inspired by recent works in we develop a similar approach for fish detection. we use a

We evaluate the proposed method by computing difference between the label dataset with the predicted result, in addition, we cluster the results from different camera locations and found that when the sagittal plane is parallel to the image plane, the tracking algorithm provide the best result. Finally, we show that .

Therefore, this thesis accomplished the following:

define recent work

define algorithm

show improvement

define accomplish, if there are somethings



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# Outline of the Thesis

## **Part I: Overview**

### CHAPTER 1: INTRODUCTION

This chapter presents an overview of the thesis and its purpose. Furthermore, it will discuss the sense of life in a very general approach.

### CHAPTER 2: RELATED WORKS

No thesis without theory.

## **Part II: Methods**

### CHAPTER 3: THEORETICAL BACKGROUND

This chapter presents the requirements for the process.

### CHAPTER 4: IMPLEMENTATION

This chapter presents the requirements for the process.

## **Part III: Results and Conclusion**

### CHAPTER 5: RESULTS AND DISCUSSION

This chapter presents the requirements for the process.

### CHAPTER 6: CONCLUSION

This chapter presents the requirements for the process.



**Part I.**

**Overview**





# 1. Introduction

Here starts the thesis with an introduction. Please use nice latex and bibtex entries [1]. Do not spend time on formating your thesis, but on its content.

## 1.1. Motivation

As we progress from livelihood fisheries to aquaculture industries, the global production and demand of fishes has drastically increased over several decades. According to \_\_\_\_\_

add literature

## 1.2. Problem Statement

There is no need for a latex introduction since there is plenty of literature out there.

## 1.3. Next Section

There is no need for a latex introduction since there is plenty of literature out there.



## **2. Related Work**

Here starts the thesis with an introduction. Please use nice latex and bibtex entries [1]. Do not spend time on formating your thesis, but on its content.

### **2.1. Related Work**

There is no need for a latex introduction since there is plenty of literature out there.



## **Part II.**

# **Methods and Implementation**



## 3. Methods

Here starts the thesis with an introduction. Please use nice latex and bibtex entries [1]. Do not spend time on formating your thesis, but on its content.

### 3.1. Theorical Background

There is no need for a latex introduction since there is plenty of literature out there.

### 3.2. Notation and Symbols

There is no need for a latex introduction since there is plenty of literature out there. here should go all the symbols and notation especifics used in this work, .... vamos que se puede

### 3.3. Camera Geometry

There is no need for a latex introduction since there is plenty of literature out there.





## 4. Implementation

Here starts the thesis with an introduction. Please use nice latex and bibtex entries [1]. Do not spend time on formating your thesis, but on its content.

### 4.1. Fish Model

There is no need for a latex introduction since there is plenty of literature out there.

### 4.2. Linemod

There is no need for a latex introduction since there is plenty of literature out there.



## **Part III.**

# **Results and Conclusion**



## 5. Results and Discussion

Here starts the thesis with an introduction. Please use nice latex and bibtex entries [1]. Do not spend time on formating your thesis, but on its content.

### 5.1. Results and Discussion

There is no need for a latex introduction since there is plenty of literature out there.



## 6. Conclusion

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### 6.1. Discussion

There is no need for a latex introduction since there is plenty of literature out there.

### 6.2. Conclusion

There is no need for a latex introduction since there is plenty of literature out there.





# Appendix



## **A. Detailed Descriptions**

Here come the details that are not supposed to be in the regular text.



# Bibliography

- [1] Leslie Lamport. *LaTeX : A Documentation Preparation System User's Guide and Reference Manual*. Addison-Wesley Professional, 1994.