Some Placeholder Title

A Master Thesis

written by

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The code for this project is available at
`https://github.com/vmstavens/in_hand_pose_estimation`

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Abstract

Some abstract text explaining the goal, methods and conclusion of the project.

Contents

Acknowledgements

My acknowledgements

Acronyms

cobots collaborative robots.

Terms

collaborative robots (cobots) [some description].

Chapter 1

Introduction

1.1 Context

As of 2022 humanity has developed tools for unprecedented growth in wealth and technology on a global scale. In such times a great deal of consumerism and interconnection is present with people needing product produced faster and more consistently than ever. As one would expect, this creates a high demand for manufacturers to reliably and consistently being able to provide products, while also remaining flexible, as the demand for different product change rapidly. In order to provide great volumes of products, manual labor has is essential as assembly, transport and manipulation processes rely on these. Due to these types of manual labor being largely done by unskilled workers, automation alternatives are being adopted which provides benefits. These include for the employer: Avoid having to pay monthly salaries to unskilled labored individuals doing manual tasks, here the automation solution only requires electrical energy and potential supervision by a qualified individual. Potential risks are also involved when hiring humans as the workforce can be inconsistent due to human error\cite or left out due to illness etc. Considerations with regards workers rights such as working conditions and wage also needs not to be considered. These cause production limitations in the form of stand still hours, such as bathroom and lunch breaks along with after work hours and holidays. This replacement of manual labor also benefits the employee, as boring and physically wearing work is automated, enabling the employees to take on different and less wearing roles. While the issue of labor unemployment becomes apparent solutions which provide support to already hired workers have been developed, such as collaborative robots (cobots)\cite. When implementing automation of production lines using robotics, certain categories of problems are revealed. These include: Assembly, alteration and pick-and-place, the last being the one of interest in this project.

1.2 Problem Description

For a robot to be capable of performing pick-and-place operations tasks it must consists of the following parts: The robot manipulator which is the robot arm, an end effector being the hand of the robot used to interact or manipulate objects of interest, sensors to obtain data from the environment and provide context to solve the given task and controllers to control the robot's motion. Pick and place robots are used in a wide variety of different fields such as sorting of waste [1] handling of food [2][3] and factory bin picking [4] [5] [6]. The solutions in these industries are examples of subcategories under the pick and place problem, namely sorting and bin picking. Since both of these are sub categories of the pick and place problem, they fundamentally follow the same sequential four phases from start to end. These steps being pre-grasping, grasping, transport, and placement [5]. The pre-grasp phase involves localizing the object(s), potentially estimating their pose and executing the trajectory in order to move the end effectors grasp, collision free to said object(s). Here different potential grasp can be considered in order to determine the best pose for the end effector

1.3 Thesis Overview

Chapter 2

State of the Art

2.1 Problem 1 - Tactile Perception

What is tactile perception? Why is it relevant?
How is a tactile sensor constructed [7] what different types exist and which one is present in the model provided.
"Representations of tactile data are commonly either inspired by machine vision feature descriptors"
often used in computer vision context, where each tactile image
Addressing the problem

2.2 Problem 2 - Pose Estimation

2.3 Problem 3 - In-Hand Manipulation

Chapter 3

Tactile Perception

3.1 Introduction

Here we write the introduction for problem 1.

3.2 Related Work

Here we cite the related work by `\cite{source-label}` like this [7]

Chapter 4

Pose Estimation

4.1 Introduction

Here we write the introduction for problem 2.

4.2 Related Work

Here we cite the related work by `\cite{source-label}` like this [7]

Chapter 5

In-Hand Manipulation

5.1 Introduction

Here we write the introduction for problem 3.

5.2 Related Work

Here we cite the related work by `\cite{source-label}` like this [7]

Chapter 6

System Integration

6.1 Introduction

Here we write the introduction for the system integration.

Chapter 7

Discussion

Chapter 8

Conclusion

Bibliography

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Appendix A

Appendix A Title