3D Reconstruction for Everyday Things

by

Kai Wu

Bachelor of Engineering, Beijing University of Posts and Telecommunications

2014

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

Master of Applied Science

in

THE FACULTY OF APPLIED SCIENCE

(Electric and Computer Engineering Department)

The University of British Columbia

(Vancouver)

April 2017

Abstract

This document provides brief instructions for using the `ubcdiss` class to write a UBC-conformant dissertation in LaTeX. This document is itself written using the `ubcdiss` class and is intended to serve as an example of writing a dissertation in LaTeX. This document has embedded Unique Resource Locators (URLS) and is intended to be viewed using a computer-based Portable Document Format (PDF) reader.

Note: Abstracts should generally try to avoid using acronyms.

Note: at University of British Columbia (UBC), both the Graduate and Postdoctoral Studies (GPS) Ph.D. defence programme and the Library's online submission system restricts abstracts to 350 words.

Preface

At UBC, a preface may be required. Be sure to check the GPS guidelines as they may have specific content to be included.

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Glossary

This glossary uses the handy `acroynym` package to automatically maintain the glossary. It uses the package's `printonlyused` option to include only those acronyms explicitly referenced in the LaTeX source.

GPS Graduate and Postdoctoral Studies

PDF Portable Document Format

URL Unique Resource Locator, used to describe a means for obtaining some resource on the world wide web

Acknowledgments

Thank those people who helped you.

Don’t forget your parents or loved ones.

You may wish to acknowledge your funding sources.

Chapter 1

Introduction

- brief background intro, provide context of the problem
- motivation
- contributions

1.1 Problem definition

The problem can be described as: find a small set of visual and geometric properties, from which an descriptive abstraction is formed to find the best-suited algorithm(s) to reconstruct the target object.

1.1.1 Scope

1.1.2 Data

1.2 Outline

- Introduction
- Related Work

- A new taxonomy of 3D Reconstruction, in Chapter 2. (based on visual/geometric cues instead of traditional approaches: static/dynamic, or spatial/temporal)
- Model of 3D reconstruction, in Chapter 3
- A benchmark for 3D reconstruction algorithms, in Chapter 4
- Interpretation of 3D Reconstruction Models 3

1.3 Organization

We organize this thesis as follows:

Chapter 2

A new taxonomy of 3D Reconstruction

The taxonomy proposed in this chapter defines the 3D reconstruction space based on the visual cues that 3D reconstruction techniques utilizes. This taxonomy transforms the 3D reconstruction problem from one requiring knowledge and expertise of specific algorithms in terms of how and when to use them, to one requiring knowledge of the visual and geometric properties of the target object.

2.1 Stereo correspondence

Multi-view Stereo

Structured Light

2.2 Shading

Shape from Shading

Photometric Stereo

2.3 Silhouette

Shape from Silhouette

2.4 Texture

Shape from Texture

2.5 Defocus

Shape from focus

Chapter 3

Model of 3D Reconstruction

- A formal definition of 3D reconstruction and extend this definition into the applied domain.
- representation of the inputs and outpus
- visual and geometric properties used by various techniques

3.1 Definition

Give a formal and applied definition of 3D reconstruction

3.2 Representation

- inputs: image types
- outputs: representations of 3D models

3.3 Description

visual and geometric properties considered

- texture coverage
- albedo

- specularity
- sub-surface scattering
- translucency
- metalness
- roughness
- concavity
- depth-discontinuity

3.4 Expression

provide a means of specifying both the desired representation of the problem, as well as the conditions under which the reconstruction is occuring.

Chapter 4

A benchmark of 3D Reconstruction Techniques

No relevant benchmark evaluates 3D reconstruction across a range of possible techniques exists.

Chapter 5

Interpretation of 3D Reconstruction Model

From the analysis of how algorithms perform on images which contain similar properties, a single algorithm can be definitively chosen based on which performed best on the training images.

Three techniques from different categories have been implemented. They are: PMVS, example-based PS, gray-code SL.

Bibliography

Appendix A

Supporting Materials

This would be any supporting material not central to the dissertation. For example:

- additional details of methodology and/or data;
- diagrams of specialized equipment developed.;
- copies of questionnaires and survey instruments.