ENTER YOUR TITLE

by

ENTER YOUR NAME

Enter Your Previous Degrees

A DISSERTATION

submitted in partial fulfillment of the
requirements for the degree

ENTER YOUR DEGREE NAME

Enter Your Department Name
Enter Your College Name

KANSAS STATE UNIVERSITY
Manhattan, Kansas

Graduation Year

Approved by:

Major Professor
Enter Your Major Professor's Name

Copyright

Abstract

Enter the text of your abstract in the abstract.tex file. Be sure to delete the text below before you submit your ETDR.

This template uses a separate file for each section of your ETDR: title page, abstract, preface, chapters, reference, etc. This makes it easier to organize and work with a lengthy document. The template is configured with page margins required by the Graduate School and will automatically create a table of contents, lists of tables and figures, and PDF bookmarks.

The file etdrtemplate.tex is the "master" file for the ETDR template. This is the file you need to process with PDFLaTeX in order to produce a PDF version of your ETDR. See the comments in the etdrtemplate.tex and other files for details on using the template. You are not required to use the template, but it can save time and effort in making sure your ETDR meets the Graduate School formatting requirements.

Although the template gives you a foundation for creating your ETDR, you will need a working knowledge of LaTeX in order to produce a final document. You should be familiar with LaTeX commands for formatting text, equations, tables, and other elements you will need to include in your ETDR.

Table of Contents

List of Figures viii

List of Tables ix

Acknowledgements ix

Dedication x

Preface xi

1 Chapter Title 1

1.1 Making References to Figures or Tables 2

1.2 Making a Reference to a Chapter Subsection 2

1.3 Making a Citation 2

2 This is Chapter 2 3

2.1 Page Number References 3

2.2 Referring to Sections Within Chapter 1 3

3 This is Chapter 3 4

4 Post-Processing Pipeline 5

4.1 Pipeline Overview 5

4.2 Stage 0 - Calculating Camera Pose 6

4.3 Stage 1 - Extracting QR Codes 6

4.4 Stage 2 - Creating Field Structure 6

4.5 Stage 3 - Extracting Plant Parts 6
4.6 Stage 4 - Locating Plants 6
4.7 Stage 5 - Saving Field Map 6

Bibliography 7

A Title for This Appendix 8

B Title for This Appendix 9

List of Figures

1.1 Optional: Short caption to appear in List of Figures 1

List of Tables

1.1 Caption to appear above the table 2

Acknowledgments

Enter the text for your Acknowledgements page in the acknowledge.tex file. The Acknowledgements page is optional. If you wish to remove it, see the comments in the etdrtemplate.tex file.

Dedication

Enter the text for your Dedication page in the dedication.tex file. The Dedication page is optional. If you wish to remove it, see the comments in the etdrtemplate.tex file.

Preface

Enter the text for your Preface page in the preface.tex file. The Preface page is optional. If you wish to remove it, see the comments in the etdrtemplate.tex file.

Chapter 1

Chapter Title

In this chapter there examples of various features you may want to incorporate into your document. Here's an example of a figure inserted into the text:

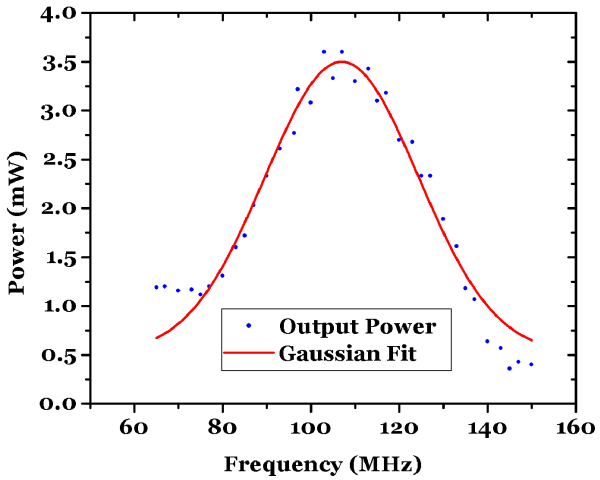

Figure 1.1: *Full caption to appear below the Figure*

See the file chapter1.tex for examples of the commands used to insert a figure or table, add a caption, etc. Here is an example of a table:

Table 1.1: *Caption to appear above the table*

Column 1 Heading	Column 2 Heading	Column 3 Heading
Col 1 Row 1	Col 2 Row 1	Col 3 Row 1
Col 1 Row 2	Col 2 Row 2	Col 3 Row 2
Col 1 Row 3	Col 2 Row 3	Col 3 Row 3

1.1 Making References to Figures or Tables

It is possible to create cross-references and hyperlinks to items or sections within your paper. For example, here is a reference to Fig. 1.1 mentioned at the beginning of this chapter and a reference to the Table 1.1.

1.2 Making a Reference to a Chapter Subsection

In this section, we refer back to text mentioned in Section 1.1 on page 2.

1.3 Making a Citation

Here's an example of a citation to a single work.[1] It's also possible to make multiple citations.[2;3]

This template uses BibTeX to manage and format citations. BibTeX is not the only way to create a bibliography within LaTeX, but it's generally considered to be the best option for long documents like a thesis or dissertation.[4] There are a few more sample citations in this paragraph so you can see examples of how in-text references are made and how the bibliography is formatted.[5] See the file "BibTeX Guide.pdf" for information on how to use BibTeX.

Chapter 2

This is Chapter 2

To refer to Chapter 1, use the slash ref command along with the "makereference" label which was assigned back at the beginning of Chapter 1.

2.1 Page Number References

It is possible to refer to a specific page number, such as page 1. Add a slash label command and a unique name for each page to be referenced later in the text.

2.2 Referring to Sections Within Chapter 1

It is possible to refer to sections within a chapter. Add a slash label command and a unique name with the section number for each section to be referenced later in the text. Her is an example of a figure in section 1.1 and an example of a table in section 1.2. In section 1.3, we looked at examples of bibliographic citations.

Chapter 3

This is Chapter 3

Here are more examples of references to previous sections. In Chapter 1 there were several sections, including section 1.1, section 1.2, and section 1.3.

Likewise, in Chapter 2, there are sections 2.1 and 2.2.

Chapter 4

Post-Processing Pipeline

Once the images are collected they must be converted into a field map. This task is accomplished by a set of scripts that are run in a pipeline fashion, where the output of one script is used as the input to the next. This chapter provides a general overview of the pipeline followed by a detailed explanation of each script.

4.1 Pipeline Overview

In this pipeline each script is referred to as a stage, where each stage accomplished one specified task. The main reason the post-processing is split into separate stages is several stages take a significant amount of time to run, so it's beneficial to not re-run the entire pipeline when changes are made. Each stage is summarized in the following list:

Stage 0 Calculate the position and orientation (pose) of each image.

Stage 1 Find and read QR codes in each images.

Stage 2 Create the structure of the field using the QR codes.

Stage 3 Detect leaves and plant markers in each images.

Stage 4 Cluster plant parts from stage 3 into possible plants, and filter out unlikely plants.

Stage 5 Assign individual numbers to plants and save final field map to a comma separated value (CSV) file.

The two stages that take the most time are 1 and 3 as they both deal with opening each image and searching through it. Even though these stages are similar, they are kept separate because having access to the field structure can significantly speed up the clustering step in 4.6

Conceptually the output of each intermediate stage consists of objects which directly relate to the field, for example QR codes, plants or rows. In reality the output is a single file containing the serialized representation of each object. This makes it trivial to pass these objects from one script to another.

The location of the code is listed in Appendix A. TODO include ref.

4.2 Stage 0 - Calculating Camera Pose

4.3 Stage 1 - Extracting QR Codes

4.4 Stage 2 - Creating Field Structure

4.5 Stage 3 - Extracting Plant Parts

4.6 Stage 4 - Locating Plants

4.7 Stage 5 - Saving Field Map

Bibliography

[1] J. Weiner, V. S. Bagnato, S. Zilio, and P. S. Julienne. Experiments and theory in cold and ultracold collisions. *Rev. Mod. Phys.*, 71:1–85, 1999. http://test4.com.

[2] W. D. Phillips, J. V. Prodan, and H. J. Metcalf. Laser cooling and electromagnetic trapping of neutral atoms. *J. Opt. Soc. Am. B*, 2:1751–1767, 1985. URL http://test3.com.

[3] M. M. T. Loy. Observation of population inversion by optical adiabatic rapid passage. *Phys. Rev. Lett.*, 32:814–817, 1974. URL http://test.com.

[4] P. L. Gould, P. D. Lett, P. S. Julienne, and W. D. Phillips. Observation of associative ionization of ultracold laser-trapped sodium atoms. *Phys. Rev. Lett.*, 60:788–791, 1988. URL http://test5.com.

[5] J. S. Melinger, A. Hariharan, S. R. Gandhi, and W. S. Warren. Adiabatic population inversion in i_2 vapor with picosecond laser pulses. *J. Chem. Phys.*, 95:2210–2213, 1991. URL http://test2.com.

Appendix A

Title for This Appendix

Enter the content for Appendix A in the appendixA.tex file. If you do not have an Appendix A, see comments in the etdrtemplate.tex file for instructions on how to remove this page.

Appendix B

Title for This Appendix

Enter the content for Appendix B in the appendixB.tex file. If you do not have an Appendix B, see comments in the etdrtemplate.tex file for instructions on how to remove this page.