

WASHINGTON UNIVERSITY IN ST. LOUIS
School of Engineering and Applied Science
Department of Computer Science and Engineering

Masters Project Examination Committee:
Tao Ju
Robert Pless
Bill Smart

TOOLS FOR VISUALIZING WEBCAM SCENES

by
David Ross

A masters project presented to the School of Engineering
of Washington University in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE

May 2009
Saint Louis, Missouri

ABSTRACT OF THE THESIS

Tools for Visualizing Webcam Scenes

by

David Ross

Master of Science in Computer Science

Washington University in St. Louis, 2009

Research Advisor: Professor Robert Pless

Webcams are pretty fucking awesome. Here's how to visualize them...

Acknowledgments

A special thanks goes to the many graduate students and distinguished faculty within my department who have reviewed this thesis and helped support the related research.

David Ross

Washington University in Saint Louis
May 2009

Contents

Abstract	ii
Acknowledgments	iii
List of Tables	vii
List of Figures	viii
Preface	ix
1 Introduction	1
1.1 Margins	1
1.2 Page Numbers	1
1.3 Body Text	2
1.4 Titles and Headings	2
1.4.1 Chapter Titles	2
1.4.2 Section Headings	3
1.4.3 Subsection Headings	3
1.4.4 Headings for Divisions Smaller than Subsections	3
1.5 Figures and Tables	4
1.6 Lists	4
1.7 Footnotes and Endnotes	4
1.8 Quotations	5
1.9 Equations	5
2 Principal Component Analysis	7
2.1 Front Matter	7
2.1.1 Title Page	7
2.1.2 Copyright Page	8
2.1.3 Abstract Page	8
2.1.4 Acknowledgments	9
2.1.5 Dedication	9
2.1.6 Table of Contents	9
2.1.7 List of Tables	10
2.1.8 List of Figures	10
2.1.9 List of Abbreviations	10
2.1.10 Glossary or Nomenclature	10

2.1.11	Preface	11
2.2	Text	11
2.3	Back Matter	11
2.3.1	Appendices	11
2.3.2	References	12
2.3.3	Vita	12
2.3.4	Short Title Page	12
3	Visualization Tools	13
3.1	Paranthetical References	13
3.1.1	Author-Date System	13
3.1.2	Numbered References	14
3.2	Reference List	14
4	Discussion	15
4.1	Paranthetical References	15
4.1.1	Author-Date System	15
4.1.2	Numbered References	16
4.2	Reference List	16
	References	17
	Vita	18

List of Tables

1.1	Thesis Formatting Options	6
2.1	Required and Optional Thesis Components (NOTE: If you have a multi-lined table label/title, then the 2nd and all additional lines should align with the first line, just like this one; plus, be sure that no words display to the far right hand side where the page numbers for your tables display, just as shown in this example.)	8

List of Figures

1.1	Just a Figure	3
-----	-------------------------	---

Preface

This guide contains the School of Engineering's rules for formatting theses and dissertations.¹ Departments, advisors, and committees may impose additional rules. In the past, students were required to study a similar (but much longer) set of rules and apply them to their theses. The Association of Graduate Engineering Students (i.e., AGES) has helped to prepare templates and style files that simplify thesis preparation. These files have been set up to produce acceptably formatted theses and dissertations using several popular word processing and text formatting programs. There should be one available in Microsoft WORD and another in L^AT_EX. Students can retrieve these files and their accompanying instructions from the Engineering Student Services' main web page. Check with Engineering Student Services (Lopata Hall, Room 303) if you have any questions. Students who create their own templates or style files are invited to submit these files for future use by others. This guide you are now reading can be downloaded (in either MS WORD formatted version or a L^AT_EX version) and can be utilized as a template for formatting your own theses. In short, the margin settings, pagination, table of contents logic, etc. are already established in the downloadable versions. You can simply replace the text within the template with your own text, thereby saving you much setup time. **NOTE:** This preface page is optional. A preface page is usually used to explain further details surrounding the background and motivation for the work. You can remove it completely, but then be sure the reference to this page is also removed from the Table of Contents. The majority of students do not include a preface page.

¹Throughout this guide, the word thesis refers to both theses and dissertations.

Chapter 1

Introduction

The following guidelines offer you some degree of flexibility in formatting your thesis. Options are summarized in Table 1.1. Whatever options you choose to use, you must use them consistently throughout document.

1.1 Margins

Your printed output must reflect a physically measurable left margin of at least 1.5 inches, with top, bottom, and right margins measurable at 1 inch. Some systems' settings produce varying results when printing to different printers, so be sure to measure your output. Remember, nothing (not even page numbers) should print in the margins.

1.2 Page Numbers

Number all pages in your thesis except the title page and the optional copyright page which might follow the title page. Number the “front matter” pages (i.e., the pages that come prior to the main body of text, prior to chapter 1) with lowercase Roman numerals, centered immediately above the bottom margin, and starting with the Roman numeral “ii”. Number the pages starting with the first page of the first chapter with Arabic numerals, also centered immediately above the bottom margin, and starting with numeral “1”.

1.3 Body Text

Use a 10, 11, or 12-point Garamond, Times Roman or Times New Roman font for your thesis text. (The MicroSoft WORD based “template” uses Garamond throughout, and is recommended whenever possible. The L^AT_EX version uses a high quality variation of the Times Roman font. Whichever is used, be consistent throughout your document..) Use 1.5 or double line spacing for most body text. Block quotes should be single spaced. Use either left justification with a ragged right edge, or full justification. Paragraphs may be set in a block style, with no indentation, or they may be indented up to 0.5 inch. Skip a line between paragraphs.

1.4 Titles and Headings

Titles and headings may be left-justified or centered. Capitalize the first letter of the first word and the first letter of each subsequent major word in a title or heading. Do not capitalize articles, prepositions, and conjunctions that are not the first word of a title or heading. For example, do not capitalize such words as the following: a, an, the, for, to, on, or. Formatting specifications for particular types of headings and titles are described below. You may use a plain or bold version of the body text font for all titles and headings.

1.4.1 Chapter Titles

Begin each chapter on a new page. You may start the chapter title below the top margin (1.5 inches from the top edge of the page), or you may leave some space and start the chapter title up to 3 inches from the top edge of the page. There are two options for formatting the chapter title:

- Type the word “Chapter” followed by the chapter number, skip a line, and type the chapter title on the following line; or
- Type the chapter number followed by the chapter title, all on the same line.

You may use a font size of up to 36 points for the chapter title.

1.4.2 Section Headings

You may use a font size of up to 24 points for the section headings. Type the chapter number and section number before the section title.

1.4.3 Subsection Headings

You may use a font size of up to 18 points for subsection headings. Type the chapter number, section number, and subsection number before the subsection title.

1.4.4 Headings for Divisions Smaller than Subsections

Use unnumbered headings for divisions smaller than subsections. You may use a font size of up to 14 points. Headings may be typed above or on the same line as the sections they label. You may use both styles within your thesis.

Run-in Headings To the left is an example of a run-in heading. Notice that it is typed on the same line as the section that it labels. It may be used for divisions smaller than subsections.

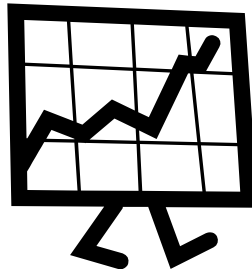


Figure 1.1: Just a Figure

1.5 Figures and Tables

Figures and tables must be referenced in the text by number. They must be numbered consecutively throughout each chapter, with the chapter number preceding each figure or table number. For example, the third figure in chapter 1 would be labeled Figure 1.3. You may either:

- Maintain one numbering sequence for figures and another for tables, and label figures with the word “Figure” and tables with the word “Table”; or
- Label both figures and tables with the word “Figure” and maintain one numbering sequence.

Place figures and tables as close to their references in the text as possible. Place a figure number and title below each figure (or table labeled as a figure). Place a table number and title above each table labeled as a table. In figures and tables, avoid using color and avoid text smaller than 10 points. Do not let figures or tables spill out into the margins. Figure 1.1 is an example figure.

1.6 Lists

You may include lettered, numbered, or bulleted lists in your thesis. Use consistent punctuation and capitalization throughout each list. Lists may be indented.

1.7 Footnotes and Endnotes

You may use footnotes or endnotes for brief notes that are not appropriate for the body of the text. Use either footnotes or endnotes consistently throughout your thesis. Position footnotes in 10 point type just above the bottom margin and page number. Use a short horizontal rule to separate footnotes from the text. Position endnotes at the end of each chapter. Type endnotes using the same font size and justification as

the body text. Single space within each footnote or endnote; double-space between footnotes or endnotes. Footnotes and endnotes should be consecutively number.

1.8 Quotations

You must use quotation marks and parenthetical references to indicate words that are not your own. Put quotation marks around short quotes. Put long quotes in separate single-spaced paragraphs, indented up to 1 inch from the left margin (these are called block quotations). Kate Turabian, editor of official publications and dissertation secretary at the University of Chicago for over 25 years, distinguishes short and long quotes as follows:

Short, direct prose quotations should be incorporated into the text of the paper and enclosed in double quotation marks: “One small step for man; one giant leap for mankind.” But in general a prose quotation of two or more sentences which at the same time runs to four or more lines of text in a paper should be set off from the text and indented in its entirety. . . . [8]

1.9 Equations

Equations may be set in-line with the text or numbered and placed in separate paragraphs. Use the same numbering style for equations as you would for figures and tables. Here is an example of an equation set in-line with a paragraph: $E = mc^2$. Here is an example equation placed in a separate paragraph:

$$E = mc^2 \tag{1.1}$$

Equation numbering and formatting should follow the usual convention of your discipline and be acceptable to your thesis committee.

Table 1.1: Thesis Formatting Options

Thesis Element	Formatting Options
title page font	12-point or 14-point Garamond, Times or Roman
table of contents chapter title font	bold or plain
first-level table of contents indentation	0 to 0.5 inch
second-level table of contents indentation	0 to 1.0 inch
body text font	10, 11, or 12-point Garamond, Times or Roman
body text line spacing	1.5 or 2
body text justification	left or full
paragraph indentation	0 to 0.5 inch
chapter title position	1.5 to 3 inches below top edge of page
chapter title style	heading preceded by the word “Chapter” and the chapter number or, heading preceded only by the chapter number
chapter title	10-pt to 36-pt font, centered or left-justified, plain or bold
section heading	10-pt to 36-pt font, centered or left-justified, plain or bold
subsection heading	10-pt to 36-pt font, centered or left-justified, plain or bold
unnumbered headings	10-pt to 36-pt font, centered or left-justified, plain or bold
table labels	label tables as “Table” or “Figure”
Parenthetical reference style	author-date system, numbered, or another style acceptable to your committee
Reference list style	any style acceptable to your committee

Chapter 2

Principal Component Analysis

This chapter describes the components of a thesis. You need not include all components described here, but you must follow the prescribed order for the components you do include. Table 2.1 lists the required and optional components in the order that they should appear. Your thesis should include three main parts: the front matter, the text, and the back matter. Each of these parts is described below.

2.1 Front Matter

The front matter includes all material that appears before the beginning of the main text. Number all “front matter” pages (except the title page and the optional copyright page) with lower-case roman numerals, centered just above the bottom margin. Each of the following sections should begin on a new page.

2.1.1 Title Page

Format the title page precisely as the title page to this document is formatted: include a 1.5-inch left margin, a 1-inch top margin, a 1-inch right margin, and a 1-inch bottom margin. Use a 12- or 14-point regular Garamond, Times or Roman font on this page. If you are writing a dissertation, substitute the word “dissertation” wherever the word “thesis” appears in this document. The date on the title page should reflect the month and year the degree will be awarded and should be one of the following months: December, May, or August. Do not number the title page.

Table 2.1: Required and Optional Thesis Components

Major Part	Thesis Component	Required	Optional
Front Matter	Title Page	•	
	Abstract Page	•	
	Copyright Page		•
	Dedication		•
	Table of Contents	•	
	List of Tables	(Rqrd if used)	
	List of Figures	(Rqrd if used)	
	List of Abbreviations		•
	Glossary of Nomenclature		•
	Acknowledgments		•
	Preface		•
Text	Chapters		•
Back Matter	Appendices		•
	References	•	
	Vita	•	
	Short Title Page	•	

2.1.2 Copyright Page

Include a copyright page if you plan to copyright your thesis. If used, the copyright page must be unnumbered, immediately following the title page. It should include three lines, centered on the page with regular body text font and spacing. The 1st line should be “copyright by”, the 2nd line should contain your full name. The 3rd line should contain the year the degree is to be awarded. Do not number the copyright page. If you are an Master’s candidate and would like to register your claim to copyright your thesis, you must make all arrangements independently. Doctoral students will complete a publishing agreement form which will give them a copyright registration option.

2.1.3 Abstract Page

The abstract must be 350 words or fewer. Format the abstract page precisely as done in this document. The abstract page always begins the document’s page numbering at “ii”.

2.1.4 Acknowledgments

An acknowledgments section should be included.. Use it to thank those who supported your research through contributions of time, money, or other resources. Type the word “Acknowledgments” in chapter title style at the top of page. If the acknowledgments fill more than one page, put the heading only on the first page. Number the page with a Roman numeral, centered at bottom, sequentially following the abstract page(s) Roman numeral(s).

2.1.5 Dedication

The dedication page is optional. If you decide to include a separate dedication page, make it short and center it on the page. If included, you should number it, placing the next logical/sequential Roman numeral at bottom of page, centered, as shown in this sample document.

2.1.6 Table of Contents

The table of contents must include the page numbers of all chapters and sections of your thesis. In addition, it may include the page numbers of all subsections. It must also include the page numbers of all front and back matter elements, unless otherwise specified. Chapter titles should appear flush left, section headings may be indented up to 0.5 inch, and subsection headings may be indented up to 1 inch. Chapter titles may be typed in plain or bold font. All titles and headings must be followed by a dot leader and a page number. The word “Contents” must appear in chapter title style at the top of the page. Be sure to align multi-lined chapter titles in the table of contents. For example, when a table of contents’ chapter or section title extends to a second line, be sure that the 1st character of the 2nd line aligns immediately under the 1st character of the title/chapter/section name on the line above it (i.e., as done in this sample document’s table of contents, and as specifically illustrated in the “list of tables” page for table 2.1). Make certain, too, that these long titles also align nicely within the body of text, where multi-lined chapter titles or section titles

should still break at a logical point and align in a manner allowing the titles to be read clearly without confusion. Sometimes, for long chapter or section titles, this will mean forcing a line break at a logical point. This cannot be automated, but relies on your own good judgment. A good example of a multi-lined title can be found at the top of Appendix ??; notice how the two lines are deliberately divided helping each phrase to be read easily and fluidly.

2.1.7 List of Tables

Include a list of tables only if your thesis actually contains tables. Format the list of tables the same way the table of contents is formatted, but put the word “List of Tables” in the heading.

2.1.8 List of Figures

Include a list of figures only if your thesis actually contains figures. Format the list of figures the same way the table of contents is formatted, but put the word “List of Figures” in the heading.

2.1.9 List of Abbreviations

Include a list of abbreviations only if you use abbreviations that are not common in your field. Arrange the list alphabetically. Type the word “List of Abbreviations” in chapter title style at the top of the page.

2.1.10 Glossary or Nomenclature

Include a glossary or nomenclature section only if your thesis contains technical words that are not commonly used by people in your field. Type the word “Glossary” or “Nomenclature” in chapter title style at the top of the page. The glossary or nomenclature section should consist of an alphabetized list of words and their definitions.

2.1.11 Preface

A preface is optional. If you include a preface, use it to explain the motivation behind your work. Format the preface the same way the acknowledgments section is formatted, but use the word “Preface” in the heading.

2.2 Text

The text part of the thesis should be divided into numbered chapters, sections, and subsections. Use Arabic numerals for this numbering. Divisions smaller than subsections may be used, but they should not be labeled with numbers. Place Arabic page numbers throughout the body of text centered just above the bottom margin.

2.3 Back Matter

Throughout the back matter, use the same Arabic page number formatting as used in the body of text section.

2.3.1 Appendices

Appendices may be used for including reference material that is too lengthy or inappropriate for the thesis text. If one appendix is included, an appendix title is optional. If more than one appendix is included, each one should be titled and lettered. In general, appendices should be formatted like chapters. However, they may be single spaced or include photocopied material. If photocopied material is used, you must add page numbers at the bottom, putting those page numbers in square brackets to indicate that they are not part of the original document.

2.3.2 References

The reference section should follow the final appendix (or the conclusion of the text if there are no appendices). Type the word “References” in chapter title format at the top of the page. Single space within references and double space between them. More information on formatting references is included in Chapter ??.

2.3.3 Vita

Your vita should include your name, relevant academic and professional achievements, and current month and year. It may also include your date and place of birth, publications, and professional society memberships. Your vita should be the last page of your thesis.

2.3.4 Short Title Page

The short title page should be prepared as described in Appendix ??.

Chapter 3

Visualization Tools

In the References section at the end of your thesis, list references cited using the style recommended in *The Chicago Manual of Style* [9] or another style acceptable to your committee. Insert parenthetical references where the reference material is referred to in the text. This chapter explains how to format references according to *The Chicago Manual of Style*. If you use a different style, you should obtain the appropriate style rules. For example, most journals periodically print instructions for authors that include reference style rules.

3.1 Parenthetical References

References should be cited at the position in the text where they are noted. *The Chicago Manual of Style* [9] recommends two systems for citations. You may use either of these systems or an alternative system acceptable to your committee.

3.1.1 Author-Date System

In this system, the last name of the author and the year of publication appear in parentheses following the quoted text. If the reference is alphabetized in the References section by its editor, publisher, or organization, then the name it is alphabetized under is used in place of the author. Some examples follow:

- Single author: (Smith 1993)

- Two authors: (Jones and Yang 1991)
- Three authors: (Jones, Smith, and Yang 1984)
- Four or more authors: (Johnson et al. 1994)
- Organization as author: (Association for Computing Machinery 1989)
- Two works referenced in one sentence: (Black 1994; Smith 1993)

3.1.2 Numbered References

In this system, the reference number appears in square brackets following the quoted text. This system is used throughout this document.

3.2 Reference List

References should be listed in alphabetical order by the last name of the first author (or organization or publisher, if no author is given). If the numbered reference style is used, the reference list should obviously be numbered as well. Several example references are listed in this document's reference list. Most of these references are taken from *A Manual for Writers of Term Papers, Theses, and Dissertations* [8].

Chapter 4

Discussion

In the References section at the end of your thesis, list references cited using the style recommended in *The Chicago Manual of Style* [9] or another style acceptable to your committee. Insert parenthetical references where the reference material is referred to in the text. This chapter explains how to format references according to *The Chicago Manual of Style*. If you use a different style, you should obtain the appropriate style rules. For example, most journals periodically print instructions for authors that include reference style rules.

4.1 Parenthetical References

References should be cited at the position in the text where they are noted. *The Chicago Manual of Style* [9] recommends two systems for citations. You may use either of these systems or an alternative system acceptable to your committee.

4.1.1 Author-Date System

In this system, the last name of the author and the year of publication appear in parentheses following the quoted text. If the reference is alphabetized in the References section by its editor, publisher, or organization, then the name it is alphabetized under is used in place of the author. Some examples follow:

- Single author: (Smith 1993)

- Two authors: (Jones and Yang 1991)
- Three authors: (Jones, Smith, and Yang 1984)
- Four or more authors: (Johnson et al. 1994)
- Organization as author: (Association for Computing Machinery 1989)
- Two works referenced in one sentence: (Black 1994; Smith 1993)

4.1.2 Numbered References

In this system, the reference number appears in square brackets following the quoted text. This system is used throughout this document.

4.2 Reference List

References should be listed in alphabetical order by the last name of the first author (or organization or publisher, if no author is given). If the numbered reference style is used, the reference list should obviously be numbered as well. Several example references are listed in this document's reference list. Most of these references are taken from *A Manual for Writers of Term Papers, Theses, and Dissertations* [8].

References

- [1] S. Akazawa. The scope of the Japanese information industry in the 1980s. In K. R. Brown, editor, *The challenge of information technology: Proceedings of the forty-first FID (Federation Internationale de Documentation) congress held in Hong Kong 13-16 September 1982*, pages 19–22, Amsterdam, New York, and Oxford, 1983. North Holland.
- [2] American Library Association, Young Adult Services Division, Services Statement Development Committee. Directions for library service to young adults. Chicago, 1978.
- [3] Gilberto Artioli. *Structural studies of the water molecules and hydrogen bonding in zeolites*. PhD thesis, University of Chicago, 1985.
- [4] B. G. F. Cohen. Human aspects in office automation. Technical Report NTIS, PB84-240738, National Institute for Occupational Safety and Health, Division of Biomedical and Behavioral Science, Cincinnati, 1984.
- [5] Martin Greenberger, Julius Aronofsky, James L. McKenney, and William F. Massy, editors. *Networks for research and education: Sharing of computer and information resources nationwide*. MIT Press, Cambridge, 1974.
- [6] Richard Jackson. Running down the up-escalator: Regional inequality in papua new guinea. *Australian Geographer*, 14:175–84, May 1979.
- [7] William Jr. Strunk and E. B. White. *The Elements of Style*. MacMillan Publishing Co., New York, 3rd edition, 1979.
- [8] Kate L. Turabian. *A Manual for Writers of Term Papers, Theses, and Dissertations*. University of Chicago Press, Chicago, 5th edition, 1987.
- [9] University of Chicago Press. *The Chicago Manual of Style*. University of Chicago Press, Chicago, 13th edition, 1982.
- [10] U.S. Department of Agriculture. *Will there be enough food? The 1981 yearbook of agriculture*. Government Printing Office, Washington, D.C., 1981.

Vita

David Ross

Date of Birth	July 21, 1987
Place of Birth	Manhasset, New York
Degrees	B.S. Magna Cum Laude, computer Science, May 1988 M.S. Computer Science, December 1990 D.Sc. (or Ph.D.) Some Department, May 2007
Professional Societies	Association for Computing Machines The Touring Society The Free Software Foundation
Publications	Student, I. D. (2005). \LaTeX document class for Sever Institute, <i>The \LaTeX J.</i> 10 (4): 323–336. Student, I. D. (2005). More \LaTeX wisdom, <i>Another \LaTeX J.</i> 42 (7): 100–101.

May 2009

Note: Use month and year in which your degree will be conferred.

Tools for Visualizing Webcam Scenes, Ross, M.S. 2009

NOTE: Short Title cannot exceed 35 characters, counting spaces.