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USING REGRESSION TECHNIQUES TO CORRELLATE WEATHER SIGNALS
WITH IMAGE SEQUENCES

by
Richard Speyer

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

MASTER OF SCIENCE

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ABSTRACT OF THE THESIS

Using Regression Techniques to Correlate Weather Signals with Image Sequences

by

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Master of Science in Computer Science

Washington University in St. Louis, 2009

Research Advisor: Professor Robert Pless

Reminders of what needs to be updated: After removing these comments, begin typing the body of your abstract here, double-spaced. It is acceptable if the body of the abstract continues onto the next page (as in this sample abstract), but the body of the abstract is limited to a maximum of 350 words (excluding the heading information listed above). NOTE: This sample abstract is too long, as it exceeds 350 words. The point-size of the body of the abstract can be set to 12 point (which is the text size of this sample comment-paragraph) or it can be reduced to 10 point if you prefer. Regardless of which specific point size you select, the abstract must remain double-spaced and it should not be bolded. If this is for your doctoral degree, be sure to change all occurrences of the word “thesis” to display as “dissertation”, and change “Master of Science” to “Doctor of Science” or “Doctor of Philosophy”, whichever applies. In the abstract heading above, make sure you use the year your degree is officially to be earned. Be sure to use your full name and your research advisors full name wherever appropriate, and be certain to use the correct title of your degree whenever referencing it. The title of your degree will not always be the same

as the title of your department or program, so please check with your departmental administrative assistant and advisor(s) to be sure you are using the correct degree title. Questions you may have about preparing your theses or dissertations are always welcomed at the Office of Engineering Student Services.

Note for Ph.D. Students: The formatting contained within this sample document can serve well in emulating the basic formatting needed for the Ph.D. dissertation. However, please remember that all Ph.D. students are ultimately responsible for meeting the Graduate School of Arts & Sciences' formatting guidelines. The GSAS thesis and dissertation guidelines are published on the Graduate School web site located with other documentation for GSAS policies and guides. Be sure to read all of the above notes/reminders on what needs to be updated as shown in this template documents title, copyright, and abstract pages. Ph.D. students will submit final dissertations and all materials to the Office of Graduate School of Arts and Sciences, and any questions about their dissertations should also be directed to that office.

Acknowledgments

An acknowledgments page should be included in your final thesis or dissertation. In the final copy, it should be placed immediately before the table of contents. If you wish to include a special dedication, then you may use the dedication to close the acknowledgments page or place it on the page that immediately follows the acknowledgments page.

It is appropriate to acknowledge sources of academic and financial support; some fellowships and grants require acknowledgment. Consequently, I would like to thank the Dean for having the foresight and vision necessary to understand the importance of funding the development of this sample thesis/dissertation template.

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.

Richard Speyer

Washington University in Saint Louis
May 2009

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Appendix A

The English Language and Other Confusing Things

While this guide answers most questions about how to format a thesis, it does not address questions about English grammar, use of abbreviations, punctuation, spelling, and other confusing subjects. Students should obtain a dictionary and a style of grammar book to refer to as questions arise. The dictionary is important because most electronic spelling checkers are not complete and do not contain definitions. (You may also need to refer to some of the references you cite for the spelling of technical terms.) The grammar or style book is useful for checking grammar and punctuation rules. A good style manual contains information about correct English usage as well as advice for preparing a manuscript. *A Manual for Writers of Term Paper, Theses, and Dissertations* [10] is one such concise and inexpensive manual based on the lengthy and more expensive *Chicago Manual of Style* [11].

The following rules will help you avoid three mistakes frequently made by students:

- Hyphenated words must begin and end on the same page.
- When a page break falls in the middle of a paragraph, at least two lines of text from that paragraph must appear on the second page.
- At least one line of text from a section or subsection must appear on the same page as the title of that section or subsection.

Appendix B

Procedures and Deadlines

Deadlines At least one semester prior to the semester in which you believe you will complete all requirements for your degree, please be sure to consult with your department's graduate administrative assistant or coordinator to be sure you are aware of all requirements and deadlines with regards to your thesis and the submission of your thesis. Deadlines are printed in the course listings schedule book and are posted online. If you cannot make certain deadlines, you may have to postpone your graduation accordingly. M.S. and D.Sc. students have a special deadline by which they must submit an initial draft of their thesis so that it can be reviewed for formatting, to make sure it conforms to the essential formatting requirements, as illustrated in this sample guide. Ph.D. students must follow the requirements of the Office of Graduate Students in Arts and Sciences (GSAS). The GSAS office does not have an special formatting deadlines, but you should still contact that office if you have questions about your formatting.

Oral Examination Each member of the oral examining committee must be given a copy of the thesis or dissertation, in final form, in sufficient time to study it before the oral examination. Members of the examining committee have the right to request rescheduling of the examination if these copies are not made available to them at least one week in advance of the scheduled examination date. Copier paper may be used for these preliminary copies.

Final Copies After the oral defense, final copies of the thesis or dissertation approved by the examination committee and department are to be distributed as follows,

on or before the date stated in the current academic calendar. All final copies must be printed using only one side on high-quality (either watermarked or specifying as having 10-25% cotton), 8.5 x 11 inch white paper, and minimum 20-pound weight. Students should submit their final materials to the office(s) listed in the first item below, plus all other materials itemized below should be submitted accordingly, if needed:

- Four copies of the thesis or dissertation need to be submitted as follows: Each should be placed in a separate manila envelope with a copy of the title page securely attached. One of these two will be retained in the Washington University library; another will be sent back to you after being professionally bound; the other two copies are for your advisor and department. Two copies (along with the following listed materials) get delivered to Engineering Student Services. Two copies get delivered to your department (also with the short title page included as listed immediately below—although, none of the other additional items listed further below are needed for the department copies). **NOTE FOR PH.D. STUDENTS:** All four copies get delivered to the GSAS Office. See GSAS dissertation guidelines from their web site.
- a loose sheet containing (1) a short title of 35 letters or less (including spaces), (2) the author's last name, (3) the degree, and (4) the year of its award, centered on the page and punctuated as in the example.¹ This short title sheet is to be placed at end of your thesis/dissertation.
- one extra loose copy of the abstract (this applies to doctoral students only), double spaced, for publication in Dissertation Abstracts.
- one extra loose copy of the title page (this applies to doctoral students only) for the microfilming contract.
- the original and a photocopy of the University Microfilms Inc. publishing agreement contract (this applies to doctoral students only). This contract is available from the Engineering Student Services web site. If a registration to your claim to copyright is desired, attach a certified check, cashier's check, or money order for the current price listed in the University Microfilms contract. Personal checks

¹See the sample short title page for this document

are not accepted. The microfilming contracts are available in Lopata 324. The check or money order should not have an expiration date.

Four copies in all are to be submitted, as per details listed above. See the first bulleted item for full details. Please follow instructions carefully. Contact Engineering Student Services if you have questions. Ph.D. students may contact the Graduate School of Arts and Sciences.

Appendix C

Thesis Format Checklist

NOTE: If you have significantly varied formatting from that which is shown in this document, please complete this form and submit it to Engineering Student Services when you submit your thesis for format review.

Author's Name: _____

Title page font: ____ 12 point ____ 14 point

Table of contents chapter titled font: ____plain ____bold

First level table of contents indentation (0 to 0.5 inch): _____

Second level table of contents indentation (0 to 1 inch): _____

Body text font: ____10 point ____11 point ____12 point

Body text line spacing: ____ 1.5 ____ 2

Body text justification: ____left ____full

Paragraph indentation (0 to 0.5 inch): _____

Chapter title position (1.5 to 3 inches below top edge): _____

Chapter title style: ____with word “Chapter” ____without word “Chapter”

Chapter title: ____ (10 to 36 point) ____ plain ____ bold
____ centered ____ left justified

[illegible][illegible][illegible]

Label tables as: ____Table ____Figure

Reference list style (parenthetical, etc.): _____

Appendix D

Special Notes for L^AT_EX Users, Including a Demonstration of Wrapping Appendix Titles

It is strongly recommended that you use this file as a template for your thesis, since it greatly simplifies conforming to the required formatting standards.

There are several important points that students using the L^AT_EX version of this template should verify before submitting a thesis.

D.1 Front Matter

Much of the front matter (i.e., the Roman numbered pages) is automatically generated. Use `\renewcommand` command to customize the fields of these templates. For example, `\renewcommand{\thesisauthor}{your name here}` will customize the author name.

Most authors will need to customize the `\thesismonth`, `\thesisyear`, `\thesisauthor`, `\thesisauthorlastname`, `\thesisdefensedate`, `\thesistitle`, `\thesisshorttitle`, `\thesisdepartment`, `\thesisfield`, `\thesisadvisor`, and `\thesiscommittee` fields. Examples of these can be seen in the sample `thesis-main.tex` file.

You must also specify `phdthesis`, `dscthis`, or `mastersthesis` when selecting the `\documentclass`. An example can also be seen in the sample `thesis-main.tex` file.

D.2 Table of Contents and Bibliography

The Table of Contents is automatically generated. `latex` should be run twice in succession after making any changes to the Table of Contents.

Due to the way \LaTeX formats the Table of Contents, long appendix titles will not automatically wrap and indent properly. If you need to use a long appendix title, you must manually wrap and indent the appendix's table-of-contents entry. The `\wrappedappendix` command is defined in this template to assist with this; an example is seen at the top of the sample `thesis-appendixD.tex`. This requirement only applies to appendix titles: other section titles will automatically wrap properly, including entries in the List of Tables and List of Figures.

If changes need to be made to the Table of Contents' formatting, you can use the `\addtocontents` command to insert some formatting commands directly into the Table of Contents page. More significant changes can be made by editing the `.toc` file that \LaTeX automatically generates. However, editing this file by hand is not recommended unless absolutely necessary, since it will automatically be re-generated the next time \LaTeX is run.

Like the Table of Contents, the Bibliography is automatically generated. After editing the bibliography file, you should run `latex`; run `bibtex`; and re-run `latex` twice in succession.

D.3 Captions

Multiline captions will not automatically be centered. To correct this, place `\usepackage[center]{caption}` in the document preamble. The sample `thesis-main.tex` already includes this command.

D.4 Widows and Page Breaks

L^AT_EX may create widows if you have a paragraph followed by a list. To get rid of this widow, you must force L^AT_EX to break the page somewhere else. Either insert a `\newpage` command before the paragraph, or insert a `\samepage` command between the paragraph and the list.

L^AT_EX may also create widows in the Tables of Contents. You can force L^AT_EX to break the page in a more convenient location by inserting `\addtocontents{toc}{\newpage}` before the corresponding `\chapter`, `\section`, `\subsection`, or `\subsubsection` command in the text.

Excluding these two situations, L^AT_EX should not create orphans or widows. However, in some situations it may place page breaks at strange places — such as several inches above the bottom margin — in order to avoid creating orphans or widows. You can fix this by altering the `\clubpenalty` or `\widowpenalty`, or by manually adding `\newpages` where L^AT_EX guesses incorrectly.

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Vita

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Learning to Find Signals in Image Sequences, Speyer, M.S. 2009