THESIS

COLORADO STATE UNIVERSITY LATEX THESIS TEMPLATE

Submitted by

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Master's Committee:

Advisor: Advisor Name
Co-Advisor: Co-Advisor Name

First Member
Second Member
Third Member

ABSTRACT

COLORADO STATE UNIVERSITY LATEX THESIS TEMPLATE

This document aims to get you started typesetting your thesis or dissertation in LaTeX. It serves both as a sample and as the documentation for this package. Please review the entire document for helpful tips about formatting your thesis or dissertation. To get started writing your thesis, copy *sample.tex* to something like *thesis.tex* and begin inserting your own content.

ACKNOWLEDGEMENTS

I would like to thank the CSU Graduate Student Council and the CSU Graduate School for initiating, commissioning and supporting this project. I would also like to thank Nicole Ramo for her support and ensuring that we followed through with this project to completion. I would like to thank Leif Anderson, who created and supported the previous LaTeX template for a number of years. Although I have never met Leif, his work was invaluable in the creation of this package and has helped many students get their thesis approved by the CSU graduate school. Finally, I would like to thank everyone who helps to contribute to this package. Your work will help many CSU graduate students to create professional, beautiful and compelling theses and dissertations using LaTex. Last but not least, thank you to the creators and maintaners of LaTeX for creating a fantastic typesetting tool.

DEDICATION

I would like to dedicate this thesis to my dog fluffy.

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Chapter 1

Introduction

Thank you for downloading the Colorado State University (CSU) LaTeX document class and template for theses and dissertations. The goal of this document is to get users of the LaTeX typesetting systems started on their thesis. Users of other typesetting or word processing systems, e.g., MS Word or LibreOffice, will likely not find this package useful. This document serves both as a guide for using this package and as a sample template to get you started. Please review the entire document for useful information on typesetting your thesis or dissertation. After reading over this guide, copy *sample.tex* to something like *thesis.tex* and *sample.bib* to *sample.bib* and begin inserting your own content.[1]

This package was created with the support of the CSU Graduate Student Council and the CSU Graduate School. These entities are not, however, able to provide troubleshooting support for LaTeX. Instead, it is intended that this document will be supported by its community of users and by the students themselves, that's you! You may want to consider locating other LaTeX users in your department or college. Also, Google and the LaTeX Stack Exchange are excellent resources for troubleshooting.

This document is currently hosted on GitHub at https://github.com/idfah/csuthesis. If you run into any bugs, shortcomings or other problems with this package, please feel free to submit a bug report. If you are able to provide a fix yourself, pull requests are very much appreciated. Chapter 5 of this document also provides solutions to some common problems that you may encounter when typesetting your thesis in LaTeX. Please look this section first when trying to troubleshoot a problem. If this section does not address your problem and you later discover a solution, please submit a pull request on GitHub that includes a description of your problem and the solution. This will help others who encounter the same problem in the future.

[1] Don't forget to change the *bibliography* command to reference *thesis.bib*

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Chapter 2

The Thesis Document Class

This package includes a LaTeX document class called *thesis.cls*, which extends the *book.cls* that is included with standard LaTeX distributions. Many of the features that work in *book.cls* will also work in *thesis.cls*; however, the setup of the title and other preliminary pages and various aspects of the document's formatting have been modified. Note that *thesis.cls* passes the following options to *book.cls*: **oneside**, **openany**, **letterpaper**, **12pt**. This means that your thesis will have a 12pt font and does not leave extra space on odd pages for binding. Also, *thesis.cls* provides a few extra options and commands that may be useful. These features are described in detail below.

2.1 Required Packages

You will need to have several LaTeX packages installed in order for *thesis.cls* to work correctly. While most standard LaTeX distributions include these packages, some systems may require you to install them. In Linux with texlive, for example, you may need to locate some of these packages (they are typically called something like texlive-packagename).

- **geometry** This package is required for setting up your document's margins.
- **setspace** This package is required to enable double spacing.
- **pdflscape** or **lscape** These packages are required for inserting landscape pages. **pdflscape** is required if you are compiling directly to pdf (using the pdf class option described below) and **lscape** is required if you are not compiling to pdf.
- **fontenc** and **times** These packages are required for setting up the default *times* font. Note that you may use a different font, if you choose, by loading the corresponding package after loading the document class.
- **footmisc** This package is required for setting up footnotes.

- **caption** This package is required for formatting captions around figures and tables.
- **tocloft** This package is required for formatting the table of contents and similar pages.
- **cite** This package is required for citing various things, including tables figures and references.

2.2 Document Class Options

The *thesis.cls* document class also provides a number of options that can be specified when the class is loaded. The following class options are supported:

- **bachelor** This sets the formatting style to be suitable for an undergraduate Honor's Thesis.
- **master** This sets the formatting style to be appropriate for a graduate Master's Thesis.
- **doctor** This sets the formatting style to be appropriate for a graduate PhD Dissertation.
- **showframe** This shows a frame around the page at the margins, headers and footers. This can be useful for debugging problems with your margins, e.g., if your top margin is too large.
- **nopdf** This prevents the use of features that are specific to pdf output formats. Specify this option if you are using a different format, such as PostScript.
- **subfigure** This enables compatibility with the *subfigure* package. Note that *subfigure* is now depreciated in favor of the *subfig* package, which is supported by default.

2.3 Preliminary Pages

A number of commands are provided by *thesis.cls* to create the various preliminary pages that must be included in your thesis, e.g., title page, copyright page, abstract, table of contents, et cetera. The following commands provide information to *thesis.cls* about the contents of your preliminary pages and should be specified before `\begin{document}`.

- **\title** This command takes a single argument giving the title of your thesis.

- **\author** This command takes a single argument giving the name of the author.
- **\email** This command takes a single argument giving the author's email address.
- **\department** This command takes a single argument giving the name of the author's department, e.g., Department of Computer Science.
- **\semester** This command takes a single argument giving the semester during which the thesis will be defended, e.g., Summer 2017.
- **\advisor** This command takes a single argument giving the name of the author's advisor, do not include Dr. or Professor.
- **\coadvisor** This is an optional command that takes a single argument specifying the author's co-advisor. Omit this command if you don't have a co-advisor.
- **\committee** This command takes a single argument giving the name of a member of the author's committee. Use this command repeatedly to specify additional committee members.
- **\mycopyright** This command takes a single argument giving the text to display on the copyright page. Ask the graduate school for more information on choosing the copyright that is right for you.
- **\abstract** This command takes a single argument giving the text to display on the abstract page.
- **\acknowledgements** This command takes a single argument giving the text to display on the acknowledgements page.

After you have finished your preamble and specified `\begin{document}`, you give the `\frontmatter` command to indicate the beginning of the preliminary pages. You may then use the following commands to actually insert each preliminary page:

- **\maketitle** Makes the title page.

- **\makemycopyright** Makes the copyright page.
- **\makeabstract** Makes the abstract page.
- **\makeacknowledgements** Makes the acknowledgements page.
- **\tableofcontents** Makes the table of contents.
- **\listoftables** Makes the list of tables (optional).
- **\listoffigures** Makes the list of figures (optional).

The source code of this document also provides an example of how to add your own preliminary pages, such as a dedication or list of symbols.

2.4 Front, Main, Back and Appendix Regions

Please note that *thesis.cls* requires you to denote the various regions of your document using the same conventions as *book.cls*. The following commands denote the beginning of each corresponding region:

- **\frontmatter** This command denotes the beginning of the preliminary pages, such as the title page, copyright page, table of contents, et cetera.
- **\mainmatter** This command denotes the beginning of the main thesis text. This is where you will write the bulk of your thesis.
- **\backmatter** This command denotes the beginning of unnumbered supplementary material. Notably, this includes your bibliography.
- **\appendix** This command denotes the beginning of any appendices that you may wish to add. Appendices are created just like chapters but are labeled differently. Note that the CSU graduate school requires any appendices to come after the bibliography, which differs from the typical behavior of *book.cls*.

Chapter 3

Figures and Tables

This section gives some examples of how to insert figures and tables into your thesis. Note that there are many variations on this and you should have the flexibility to do what you need. The most important thing to keep in mind is that captions go below figures and above tables.

3.1 Figures

In Figure 3.1, we see a demonstration of particle swarm optimization being applied to the Rosenbrock banana function. See the source code of this document for sample usage.

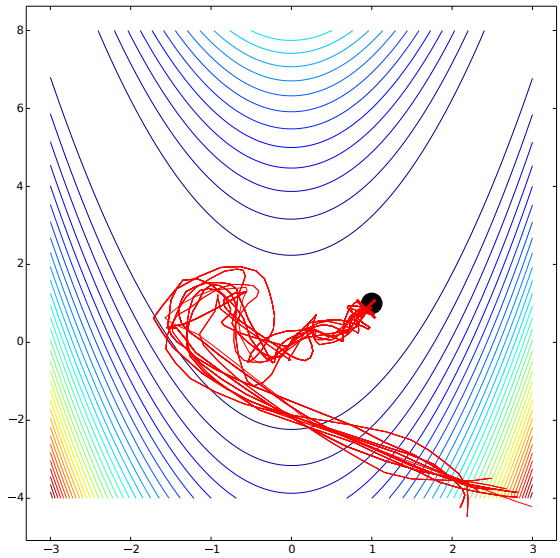
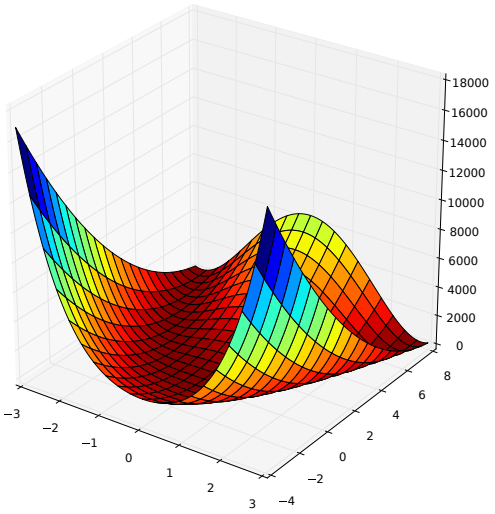


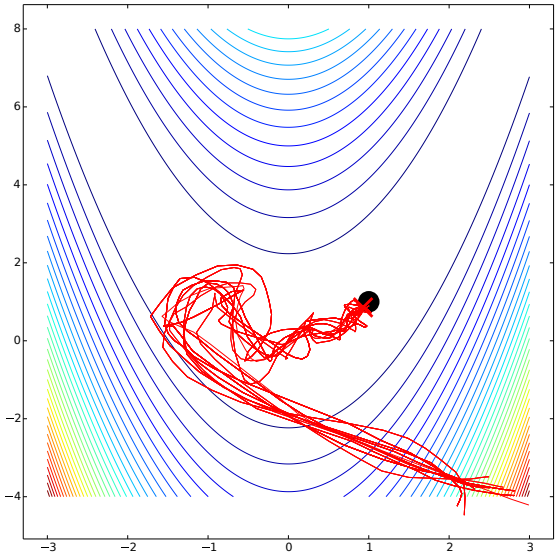
Figure 3.1: A particle swarm optimizing the Rosenbrock banana function.

3.1.1 Subfigures

In Figure 3.2, we again see particle swarm optimization applied to the Rosenbrock banana function. Now we have two figures, Figure 3.2a and Figure 3.2b. See the source of this document for sample usage.



(a) The Rosenbrock banana function.



(b) Path of the particles.

Figure 3.2: Using PSO to optimize the Rosenbrock banana function. (a) The function to optimize. (b) The path of the particles as they find the global minima.

3.2 Sideways Pages

The thesis guidelines allow horizontal pages for extra wide tables and figures. *thesis.cls* provides the **sidewayspage** environment for inserting a single sideways page. See the source of this document for sample usage.

Note that the sideways page currently needs some work. If things are too big to fig to fit, it will break and you will need to reduce the size of your figure or table.

3.3 Tables

In Table 3.1, we see an example of a simple table using the *booktabs* package. Note that other packages are available and allowed for making your tables if you prefer something different. Table captions go above the table. See the source of this document for sample usage.

Table 3.1: A table of groundbreaking results. The caption goes above the table.

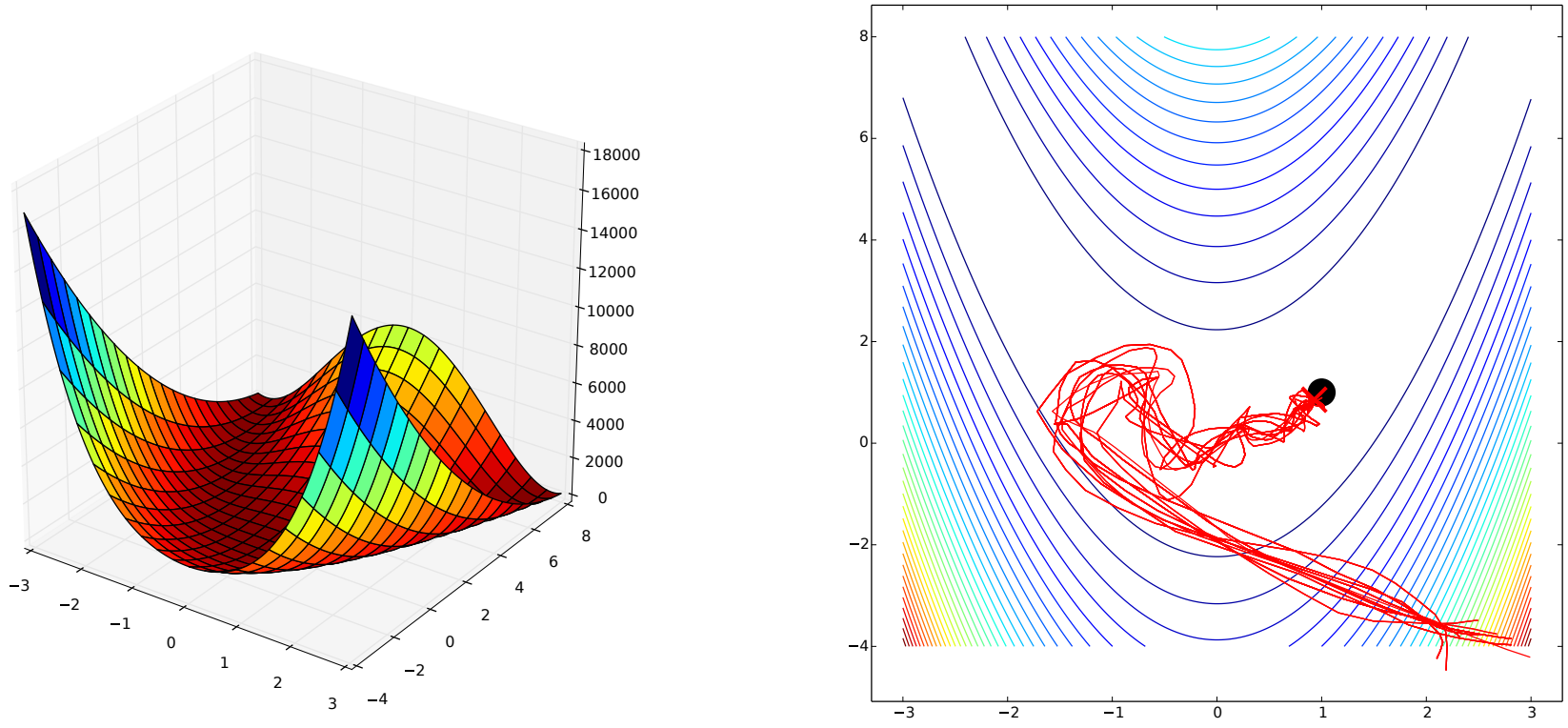
Data-A	Data-B	Data-C	Data-D
0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5
0.5	0.5	0.5	0.5
Mean	0.5	0.5	0.5

3.4 Equations

Your equations should work as expected. For example,

$$\mathbf{z}(t) = \phi(\mathbf{H}\bar{\mathbf{x}}(t) + \mathbf{S}\mathbf{z}(t-1)), \tag{3.1}$$

where $\mathbf{z}(t)$ is the output of some function at time t. We typically reference equations as (3.1).



(a) The Rosenbrock banana function.

(b) Path of the particles.

Figure 3.3: Using PSO to optimize the Rosenbrock banana function. (a) The function to optimize. (b) The path of the particles as they find the global minima.

Chapter 4

Creating References and Citations

4.1 Citation[2]

The **\cite** command can be used to reference sources from your bibliography. For example, this sentence cites a number of articles [1–5].

A reference in a section headings must be listed as a footnote. This section heading contains an example of such a citation.

4.2 Footnotes

The **\footnote** command can be used to insert footnotes.[3]

4.3 Bibliography

BibTeX is an excellent tool for managing your bibliography and is used in this example. See the companion *sample.bib* file for examples of how to place entries in your bibliography. LaTeX will then automatically generate your Bibliography section.

thesis.cls is tested with BibTeX and the standard *unsrt* style of references but, in general, other bibliography packages and styles should work.

[2]This is an example of a citation contained in a footnote [2].

[3]this is a sample footnote.

Chapter 5

Formatting Tips and Tricks

5.1 Widows and Orphans

Widows and orphans occur when a single line of text from the beginning or end of a paragraph end up alone at the top or bottom of a page. Orphans and windows are not allowed in your thesis or dissertation and the graduate school will flag them. *thesis.cls* sets all possible penalties to attempt to prevent LaTeX from generating orphans and widows. In some pathological cases, however, they may still occur. If you find yourself in this position, you have several options:

1. Reword your text. I know, you shouldn't have to change your text for formatting purposes, but often this is the easiest way.

2. Change the size of a figure or table or shift things around a bit.

3. Insert a **\clearpage** command to start the next page directly before the culprit paragraph.

4. Try tweaking the values of **\clubpenalty** and **\widowpenalty**. Note, however, that this might cause widows and orphans to spring up elsewhere in your document.

5.2 Margins

The graduate school is very strict about enforcing 1" margins. Before submitting your thesis, try passing the **showframe** argument to *thesis.cls*. This will show a frame around each page that will help you troubleshoot your margins. If you see anything outside this box, be sure to fix it.

Note that figures and tables do not have to be perfectly flush with the margins but cannot violate them. Note, however, that figures often have an extra margin built in from the program that generated the plot. These margins can lead to large extra spaces that are occasionally flagged by the graduate school. Try and remove the margins when you generate your figures. Alternately, look at tools like inkscape, gimp or photoshop for trimming the margins in your figure files.

If you have a very long word that flows into the side margin,[4] you can typically correct the problem by applying the **\sloppy** command to a single paragraph. This will loosen the LaTeX typesetting rules and allow the margin requirements to be met. See this paragraph in the source of this document for an example. Note that you should reverse the effects of sloppy using the **\fussy** command at the end of the paragraph. Using sloppy rules everywhere will lead to odd-looking spacing.

If the sloppy approach does not work for you, consider manually entering a line break using

after the offending word or equation.

[4]this should generate an "overfull hbox badness" warning

Bibliography

[1] Elliott Forney and Charles Anderson. Classification of EEG during imagined mental tasks by forecasting with elman recurrent neural networks. *International Joint Conference on Neural Networks (IJCNN)*, pages 2749–2755, 2011.

[2] Department of Compter Science at Colorado State University. CEBL: Colorado EEG and Brain-Computer Interface Laboratory. http://www.cs.colostate.edu/eeg/main/software/cebl3, March 2016.

[3] Elliott Forney. Electroencephalogram classification by forecasting with recurrent neural networks. Master's thesis, Department of Computer Science, Colorado State University, Fort Collins, CO, 2011.

[4] Elliott M. Forney, Charles W. Anderson, William J. Gavin, Patricia L. Davies, Marla C. Roll, and Brittany K. Taylor. Echo state networks for modeling and classification of EEG signals in mental-task brain computer interfaces. Technical report, Colorado State University, Department of Computer Science, Department of Computer Science, 1100 Center Avenue Mall, Fort Collins, CO 80523, November 2015.

[5] Simon Haykin. *Neural networks and learning machines*, volume 3. Pearson Upper Saddle River, NJ, USA:, 2009.

Appendix A

License

Colorado State University LaTeX Thesis Template

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