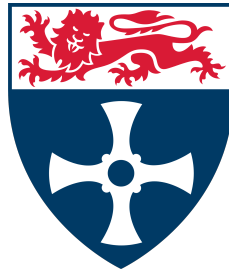


simple-thesis: a L^AT_EX class for PhD theses



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School of Computing

Newcastle University

A thesis submitted for the degree of

Doctor of Philosophy

Month Year

Dedication goes here

Abstract

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Acknowledgements

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Chapter 1. Introduction

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1.1 Background

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1.2 Aims and Objectives

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1.3 Thesis Introduction

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1.4 Summary

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Chapter 2. How to Use the Class

Use the provided directory structure for your content. Chapters and appendices should be placed in directories called `chapterX` and `appendixX` respectively.¹ Update `thesis.tex` where highlighted and build the PDF to create the thesis.

2.1 Package Options

oneside Double-sided is the default. Use the **oneside** option for a single-sided thesis.²

draft Use the **draft** option to add a word count, line numbers etc and enable to-do notes (see section 2.3). Remove the draft option to create the final thesis for printing.

pdf You may wish to also disseminate your thesis as a PDF. Use the **pdf** option to format the thesis for reading on screen.³

2.2 Thesis Formatting

2.2.1 Chapters and sections

Use the `\thesischapter` command to create a new chapter. Sections and sub-sections are created using `\thesissection` and `\thesissubsection` respectively. Chapter and section titles will be converted to Title Case when using these commands. Alternatively, the usual `\chapter`, `\section` and `\subsection` commands work as normal.

2.2.2 Tables and figures

Include tables and figures in the usual way. Captions should be placed at the bottom. L^AT_EX will look in the `images/` and `figures/` directories for graphics.

¹You can use a different structure but this may break the word count and PDF builds on GitHub.

²Single-sided theses appear to be more common. A double-sided thesis includes blank pages to ensure that chapters start on the right (i.e. odd) page. These blank pages can however look odd when viewing as a PDF – see the **pdf** option.

³Hyperlinks are shown in blue, pages with landscape tables/figures are rotated and blank pages inserted in two-sided theses are marked “This page is intentionally blank”. Margins are equalised to remove the binding edge.

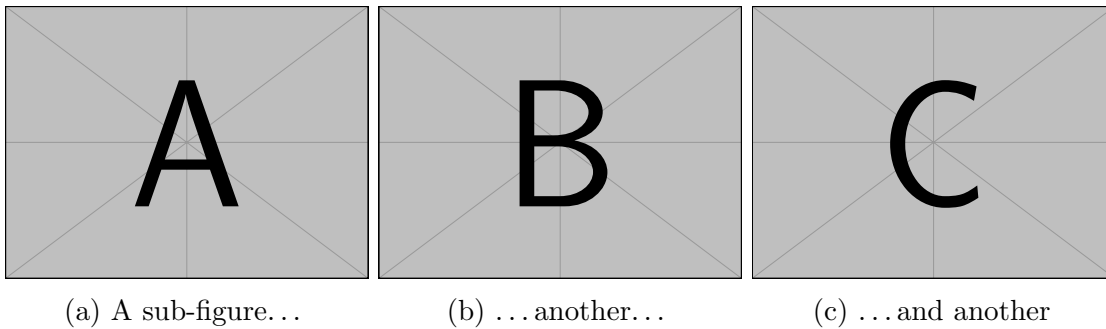


Figure 2.1: Example figure with three sub-figures. Larger margins and a smaller font are used to help distinguish captions from the main text.

	Metric A	Metric B	Metric C	Metric D
Model A	10.431	0.154	0.715	28.871
Model B	25.488	0.279	0.190	14.992
Model C	14.992	0.396	0.280	20.947
Model D	20.947	0.362	0.412	20.558
Model E	21.137	0.006	0.411	2.665
Model F	19.445	0.513	0.242	16.087

Table 2.1: Example table. Tables are formatted with `booktabs` and additional spacing between rows.

2.2.3 Mathematics

Use the `\vect`, `\matr` and `\tens` commands to format vectors, matrices and tensors respectively. These are all bold italic by default (\mathbf{x} , \mathbf{X} and \mathbf{X} respectively) and can be customised from lines 176 in `simple-thesis.cls`. The `isomath` package is used to comply with ISO 80000-2 e.g. sans-serif tensors.

The `amsmath`, `amssymb` and `amsthm` packages are used to typeset equations and theorems:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right) \quad (2.1)$$

Theorem 1. *Your theorem here.*

Proof. Your elegant proof. □

2.2.4 Cross-references

Insert cross-references using `\cref{label}` for “figure 2.1” or `\Cref{label}` for a capitalised reference e.g. “Figure 2.1”. Sub-figures can also be referenced e.g. figure 2.1a. See `cleveref` for more information.

2.2.5 Bibliography

The `biblatex`⁴ bibliography management package is used. Update `refs.bib` and use `\cite{}` or `\parencite{}` to insert a numbered reference e.g. [1]. Author names can be included using `\textcite{}` e.g. “LeCun *et al.* [1] state that ...”. The default citation style is `numeric-comp`⁵ which is similar to IEEE but compressed e.g. multiple authors show as “*et al.*” and multiple citations as [1, 2] or [1-3]. The bibliography style is `IEEE`⁶. These can be updated in `simple-thesis.cls`, see the “Bibliography” section.

2.2.6 Notation, acronyms and abbreviations

It is helpful to include a section with the definitions of any acronyms and abbreviations used in your work. This is automated using `glossaries`. When introducing a new acronym/abbreviation, define it with `\newacronym{tag}{acronym}{definition}`⁷, for example `\newacronym{nn}{NN}{neural network}`.

The acronym is inserted using `\gls{tag}`. The first instance of `\gls{nn}` shows as “neural network (NN)”. Subsequent uses are abbreviated with a hyperlink⁸ to the glossary e.g. “NN”. `\Gls{tag}` capitalises the initial letter of the abbreviation, and `\Glspl{tag}` and `\glspl{tag}` use the plural form.

The notation section is populated by adding definitions to `notation/notation.tex`. The `name` is required for sorting but the `symbol` and `description` are displayed, e.g.:

```
\newglossaryentry{n}{
  name={N},
  description={Set of natural numbers  $\{0, 1, 2, \dots\}$ },
  symbol={\ensuremath{\mathbb{N}}}
}
```

2.2.7 Index

An index is generated by including the `\index{topic}` command when you discuss a topic. Index entries can also have sub-items e.g. `\index{topic!subtopic}`. The index includes hyperlinks to the relevant page.

2.2.8 Quotes

Enclose quotes between `\begin{quote}[source]{author}` and `\end{quote}`. The `source` and `author` should be left empty if unused i.e. `\begin{quote}[]{}).`

⁴See https://www.overleaf.com/learn/latex/Bibliography_management_with_biblatex.

⁵See https://www.overleaf.com/learn/latex/Biblatex_citation_styles.

⁶See https://www.overleaf.com/learn/latex/Biblatex_bibliography_styles.

⁷The definition should be lower case and singular.

⁸To improve readability, glossary links are only highlighted in draft mode e.g. [NN](#).



Figure 2.2: Example landscape figure (image by Penny from Pixabay). Newcastle University thesis guidelines state the “*top of tables/figures printed sideways should align to the left of the page*”. The `rotating` package aligns them centrally and a bug prevents changing this (easily). If this is important to you, a workaround is to add `\vspace{Xmm}\hspace{0pt}` below the caption. Adjust `X` to push the table/figure up to the correct position.

	Metric A	Metric B	Metric C ¹	Metric D	Metric E	Metric F	Metric G ²	Metric H	Metric I	Metric J
<i>Results on first data set</i> ³										
Model A	0.226	0.101	10.233	26.374	24.131	0.088	10.431	0.154	0.715	28.871
Model B	0.141	0.639	2.667	5.598	21.113	0.116	25.488	0.279	0.190	14.992
Model C ⁴	0.416	0.992	29.190	12.098	16.279	0.127	14.992	0.396	0.280	20.947
Model D	0.107	0.033	4.021	19.004	17.760	0.388	20.947	0.362	0.412	20.558
<i>Results on second data set</i>										
Model A	0.597	0.319	22.949	5.168	23.286	0.569	21.137	0.006	0.411	2.665
Model B	0.157	0.365	25.848	12.653	20.702	0.180	19.445	0.513	0.242	16.087
Model C ⁴	0.707	0.181	26.791	15.969	17.307	0.129	17.946	0.553	0.695	19.445
Model D	0.496	0.861	26.956	20.050	13.525	0.272	2.665	0.902	0.291	7.472

¹ A note about metric C.² A note about metric G.³ Caveat about the first data set.⁴ Important point about model C.

Table 2.2: Example landscape table using `threeparttable` to add footnotes. Aligned using the same trick as figure 2.2 but centering the table would look better?

...there is a useful and meaningful distinction between text numerals and mathematical numerals. Text numerals are used in contexts like “1776” and “Chapter 5”..., where the numbers are essentially part of the English language; mathematical numerals, by contrast, are used in contexts like “the greatest common divisor of 12 and 18 is 6”, where the numbers are part of the mathematics.

Donald E. Knuth — Typesetting Concrete Mathematics

2.2.9 Formatting numbers

Note the difference between the two sets of numerals in the quote. Use `\oldnum` for “old style” numerals (0123456789). `\num` formats “lined” numerals (0123456789) for example with separating commas (`\num{1234567.890123} = 1,234,567.890 123`) or scientific notation (`\num{1.234e-5} = 1.234 × 10-5`). The `siunitx` package can also typeset units.

2.2.10 University logo

Replace `logo.png` in the `./images/` directory to update the title page logo.

2.3 To-Do Notes

To-do notes are provided by `todonotes`. Use:

- `\todonote{}` to create a to-do
- `\reference{}` to note a missing reference
- `\issue{}` to highlight a problem
- `\misc{}` for a miscellaneous note

When the `draft` package option is used, to-do notes are summarised on the first page. All to-do notes are disabled when producing the final thesis. Text can also be highlighted using `\hl{}`.

2.4 Building the PDF

2.4.1 GitHub Actions

The thesis is built each time you push the repository to GitHub!⁹ Go to the **Actions** tab, choose the commit (the top one is the most recent) and download by clicking `thesis-[TIMESTAMP]` under **Artifacts**.

⁹The main `.tex` file must be named `thesis.tex`, and the `introduction/`, `chapterX/`, `conclusion/` directory structure must be followed.

2.4.2 Locally

Type `make` in the thesis directory to build the PDF.¹⁰ This has been tested on Ubuntu with TexLive¹¹ and MacOS with MacTeX¹². If the document fails to build, try `make purge` to delete all output and intermediate files¹³.

`make standalone` builds a standalone PDF for a single chapter. See the example stub file `chapter1/chapter1-standalone.tex` which should be placed in each chapter directory.

If you are unable to use `make` or `latexmk`, or prefer to use a recipe in Visual Studio Code or TeXStudio:

1. To generate the word count files run:

```
texcount abstract/* *.tex -sum=1,0,1 -inc -out=wordcount.txt
texcount abstract/* -sum=1,0,1 -1 -out=wordcount.abstract
texcount introduction/* chapter/* conclusion/* -sum=1,0,1 -brief -out=wordcount.summary
texcount introduction/* chapter/* conclusion/* -sum=1,0,1 -1 -out=wordcount.total
```

2. To generate the bibliography, acronyms and index sections run:

```
pdflatex thesis.tex
biber thesis
makeglossaries thesis
makeindex thesis
```

3. To build the final thesis, you will need to run `pdflatex thesis.tex` at least another two times to add all the sections and update the table of contents.

¹⁰This uses `latexmk` to automate the build with the `pdflatex` engine, `biber` for references and the glossary/index configuration in `.latexmkrc`.

¹¹Ubuntu 18.04, 20.04 and 22.04 with TexLive installed using `sudo apt install texlive-full`. See <https://github.com/philipdarke/simple-thesis/issues/1#issuecomment-1256169085> if not using the full TexLive install.

¹²MacOS 12 Monterey, 13 Ventura and 14 Sonoma with MacTeX installed using `brew install --cask mactex-no-gui`

¹³The `make clean` command removes intermediate files only.

Chapter 3. Conclusion

Mauris sollicitudin dictum nulla eleifend pulvinar. Nulla sodales, tellus nec molestie tempor, ligula sem sollicitudin mauris, quis hendrerit enim ipsum ac metus. Proin at tincidunt purus. Cras rutrum vel tortor vel posuere. Aliquam erat volutpat. Nunc scelerisque maximus orci, ut maximus nisi congue vel. Fusce vitae lectus id arcu volutpat tristique semper nec sem.

3.1 Summary

Pellentesque elementum, risus ac pulvinar efficitur, mauris ipsum dictum sem, nec varius mauris neque at tellus. Quisque pulvinar sem eget est tempus cursus. Donec ipsum nunc, euismod quis sodales id, condimentum vel tellus. Nunc ultrices, tortor in placerat cursus, erat diam scelerisque odio, luctus bibendum velit ante ac est. Praesent fringilla sollicitudin felis sit amet auctor. Curabitur eros arcu, porta non laoreet vitae, feugiat at orci. Donec efficitur est in sodales pellentesque. Maecenas a elit nec ligula dictum tristique eget ac nibh. Duis in tempus erat, pretium blandit nisl. Sed a maximus leo.

Vestibulum ac ultrices ante, in gravida justo. In hendrerit tellus ac nibh suscipit, sed elementum sem mollis. Orci varius natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Morbi non semper orci, et ornare libero. Aliquam erat volutpat. Mauris interdum a tellus quis aliquam. Sed dignissim, tortor et accumsan dapibus, nisl nisl mattis magna, sit amet tincidunt eros lorem at ipsum. Sed a nunc sit amet quam venenatis sodales. Pellentesque ut ipsum neque. Phasellus accumsan tellus et purus semper, at sollicitudin neque pellentesque. Mauris varius erat et justo sodales, sit amet vulputate elit varius. Morbi quis dolor non ante dictum faucibus. Morbi aliquam pretium elit. Donec a ligula lacus.

3.2 Future Work

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Appendix A. Packages Used

Package	Used to...
<i>Typesetting</i>	
<code>anyfontsize</code>	Set font sizes e.g. 14pt headings
<code>emptypage</code>	Empty pages when printing two-sided
<code>enumitem</code>	Customise enumerate and itemize environments
<code>fancyhdr</code>	Customise headers and footers
<code>geometry</code>	Set page margins
<code>microtype</code>	Improve typesetting
<code>pdflscape</code>	Rotate landscape pages in PDF
<code>ragged2e</code>	Left-align bibliography
<code>setspace</code>	Change line spacing
<code>siunitx</code>	Format numbers and units
<code>titlecaps</code>	Typeset chapter and section headings in Title Case
<code>titlesec</code>	Customise headings
<code>tocbibind</code>	Include bibliography etc in table of contents
<code>xcolor</code>	Set colours
<i>Referencing</i>	
<code>biblatex</code>	Reference sources
<code>cleveref</code>	Format cross-references
<code>glossaries</code>	Create acronyms and abbreviations section
<code>hyperref</code>	Create hyperlinks
<code>hypcap</code>	Ensure hyperlinks point to top of tables/figures
<code>makeidx</code>	Create index
<code>url</code>	Easy website links
<i>Tables and figures</i>	
<code>array</code>	Format table cells
<code>booktabs</code>	Format tables
<code>caption</code>	Customise captions
<code>float</code>	Place table/figures with H
<code>graphicx</code>	Include figures

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<code>longtable</code>	Span long tables over pages
<code>multirow</code>	Format multi-row cells in tables
<code>rotating</code>	Add landscape tables and figures
<code>subcaption</code>	Add sub-captions to figures
<code>tabularx</code>	Control table widths
<code>threeparttable</code>	Add table footnotes
<i>Mathematics</i>	
<code>amsmath</code>	Typeset equations
<code>amssymb</code>	Typeset equations
<code>amsthm</code>	Typeset theorems/lemmas etc
<code>isomath</code>	Typeset tensors
<code>mathtools</code>	Some additional formatting tricks e.g. right aligned vectors
<i>Draft package option</i>	
<code>datetime2</code>	Add date/time in footer
<code>draftwatermark</code>	Add draft watermark
<code>lineno</code>	Add line numbers
<code>soul</code>	Highlight text
<code>todonotes</code>	Add to-do notes
<i>Other packages</i>	
<code>etoolbox</code>	Environment hooks etc
<code>ifdraft</code>	Control logic in class file
<code>ifthen</code>	Control logic in class file
<code>verbatim</code>	Include the word count file

Table A.1: Packages loaded by `simple-thesis` in a `longtable` environment spanning two pages.

Bibliography

- [1] Y. LeCun, Y. Bengio, and G. Hinton, “Deep learning,” *Nature*, vol. 521, no. 7553, pp. 436–444, May 2015. DOI: 10.1038/nature14539.

Notation

\mathbb{N} Set of natural numbers $\{0, 1, 2, \dots\}$

Acronyms and abbreviations

NN neural network

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