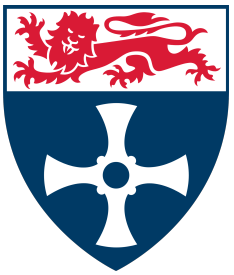
simple-thesis: a LaTeX class for PhD theses



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School of Computing

Newcastle University

A thesis submitted for the degree of

Doctor of Philosophy

Month Year

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Dedication goes here

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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.

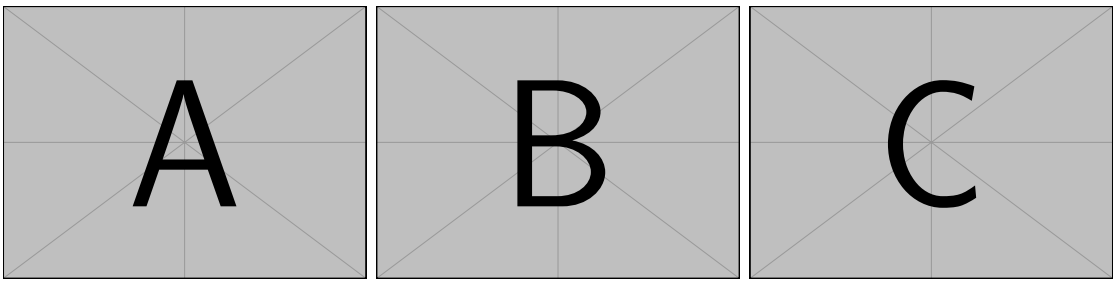
2.2.2 Tables and figures

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

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

[2] Single-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.

[3] Hyperlinks 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.



(a) A sub-figure... (b) ...another... (c) ...and another

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 ($\boldsymbol{x}$, $\boldsymbol{X}$ and $\boldsymbol{\mathsf{X}}$ 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:

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

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.

[4] See https://www.overleaf.com/learn/latex/Bibliography_management_with_biblatex.
[5] See https://www.overleaf.com/learn/latex/Biblatex_citation_styles.
[6] See https://www.overleaf.com/learn/latex/Biblatex_bibliography_styles.

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
Results on first data set[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
Results on second data set										
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?

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 hyperlink[8] 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}[]{}`).

> ...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 exam-

[7] The definition should be lower case and singular.
[8] To improve readability, glossary links are only highlighted in draft mode e.g. NN.

ple 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`.

2.4.2 Locally

Type `make` in the thesis directory to build the PDF.[10] This has been tested on Ubuntu with TexLive[11] and MacOS with MacTeX[12]. If the document fails to build, try `make purge` to delete all output and intermediate files[13].

`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.

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

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

[11] Ubuntu 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.

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

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

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.

Chapter 3. Conclusion

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3.1 Summary

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3.2 Future Work

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Appendix A. Packages Used

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

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

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Notation

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

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Acronyms and abbreviations

NN neural network

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