

Andrius Grabauskas

**Measuring mutual information in
Neural Networks**

Computer Science Tripos – Part II

Robinson College

April 6, 2019

Proforma

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College: **Robinson College**
Project Title: **Measuring mutual information in Neural Networks**
Examination: **Computer Science Tripos – Part II, July 2001**
Word Count: **????¹**
Project Originator: **Dr. Damon Wischik**
Supervisor: **Prof. Alan Mycroft**

Original Aims of the Project

To write a demonstration dissertation² using \LaTeX to save student's time when writing their own dissertations. The dissertation should illustrate how to use the more common \LaTeX constructs. It should include pictures and diagrams to show how these can be incorporated into the dissertation. It should contain the entire \LaTeX source of the dissertation and the makefile. It should explain how to construct an MSDOS disk of the dissertation in Postscript format that can be used by the book shop for printing, and, finally, it should have the prescribed layout and format of a diploma dissertation.

Work Completed

All that has been completed appears in this dissertation.

Special Difficulties

Learning how to incorporate encapsulated postscript into a \LaTeX document on both Ubuntu Linux and OS X.

¹This word count was computed by `detex diss.tex | tr -cd '0-9A-Za-z \n' | wc -w`

²A normal footnote without the complication of being in a table.

Declaration

I, Andrius Grabauskas of Robinson College, being a candidate for Part II of the Computer Science Tripos, hereby declare that this dissertation and the work described in it are my own work, unaided except as may be specified below, and that the dissertation does not contain material that has already been used to any substantial extent for a comparable purpose.

Signed

Date

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Acknowledgements

This document owes much to an earlier version written by Simon Moore. His help, encouragement and advice was greatly appreciated.

Chapter 1

Introduction

1.1 Overview of the files

This document consists of the following files:

- `makefile` — The makefile for the dissertation and Project Proposal
- `diss.tex` — The dissertation
- `proposal.tex` — The project proposal
- `figs` — A directory containing diagrams and pictures
- `refs.bib` — The bibliography database

1.2 Building the document

This document was produced using $\text{\LaTeX} 2_{\epsilon}$ which is based upon $\text{\LaTeX}[?]$. To build the document you first need to generate `diss.aux` which, amongst other things, contains the references used. This is done by executing the command:

```
pdflatex diss
```

Then the bibliography can be generated from `refs.bib` using:

```
bibtex diss
```

Finally, to ensure all the page numbering is correct run `pdflatex` on `diss.tex` until the `.aux` files do not change. This usually takes 2 more runs.

1.2.1 The makefile

To simplify the calls to `pdflatex` and `bibtex`, a makefile has been provided, see Appendix B.1. It provides the following facilities:

```
make
```

Display help information.

make proposal.pdf

Format the proposal document as a PDF.

make view-proposal

Run **make proposal.pdf** and then display it with a Linux PDF viewer (preferably “okular”, if that is not available fall back to “evince”).

make diss.pdf

Format the dissertation document as a PDF.

make count

Display an estimate of the word count.

make all

Construct **proposal.pdf** and **diss.pdf**.

make pub

Make **diss.pdf** and place it in my **public.html** directory.

make clean

Delete all intermediate files except the source files and the resulting PDFs. All these deleted files can be reconstructed by typing **make all**.

1.3 Counting words

An approximate word count of the body of the dissertation may be obtained using:

```
wc diss.tex
```

Alternatively, try something like:

```
detex diss.tex | tr -cd '0-9A-Z a-z\n' | wc -w
```

Chapter 2

Preparation

This chapter is empty!

Chapter 3

Implementation

3.1 Verbatim text

Verbatim text can be included using `\begin{verbatim}` and `\end{verbatim}`. I normally use a slightly smaller font and often squeeze the lines a little closer together, as in:

```
GET "libhdr"

GLOBAL { count:200; all  }

LET try(ld, row, rd) BE TEST row=all
      THEN count := count + 1
      ELSE { LET poss = all & ~(ld | row | rd)
            UNTIL poss=0 DO
              { LET p = poss & -poss
                poss := poss - p
                try(ld+p << 1, row+p, rd+p >> 1)
              }
            }

LET start() = VALOF
{ all := 1
  FOR i = 1 TO 12 DO
  { count := 0
    try(0, 0, 0)
    writef("Number of solutions to %i2-queens is %i5*n", i, count)
    all := 2*all + 1
  }
  RESULTIS 0
}
```

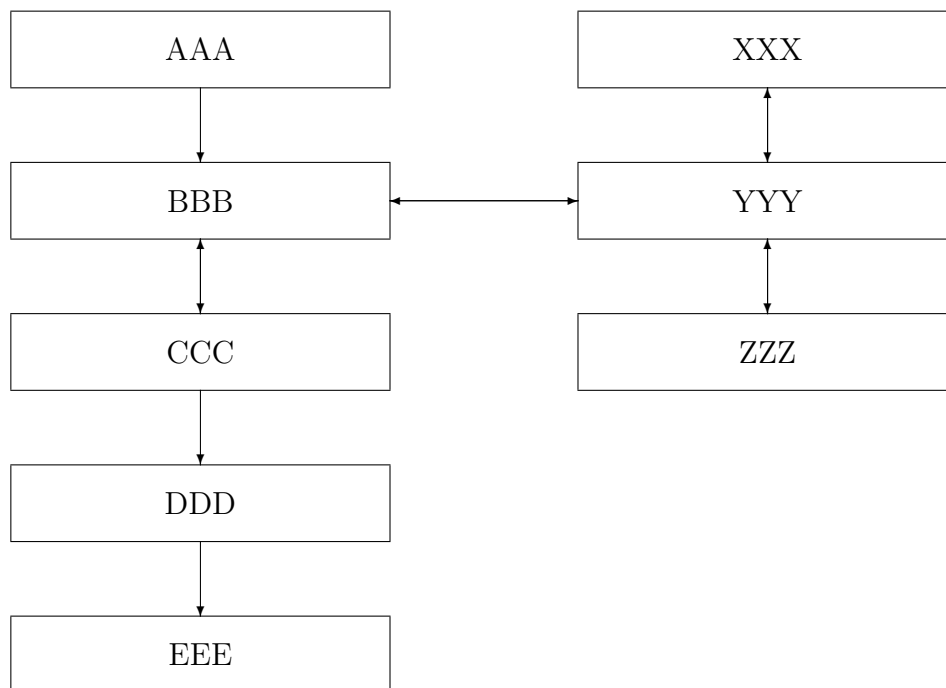


Figure 3.1: A picture composed of boxes and vectors.

3.2 Tables

Here is a simple example¹ of a table.

Left Justified	Centred	Right Justified
First	A	XXX
Second	AA	XX
Last	AAA	X

There is another example table in the proforma.

3.3 Simple diagrams

Simple diagrams can be written directly in \LaTeX . For example, see figure 3.1 on page 14 and see figure 3.2 on page 15.

3.4 Adding more complicated graphics

The use of \LaTeX format can be tedious and it is often better to use encapsulated postscript (EPS) or PDF to represent complicated graphics. Figure 3.3 and 3.5 on page 16 are

¹A footnote



Figure 3.2: A diagram composed of circles, lines and boxes.

examples. The second figure was drawn using `xfig` and exported in `.eps` format. This is my recommended way of drawing all diagrams.



Figure 3.3: Example figure using encapsulated postscript

Figure 3.4: Example figure where a picture can be pasted in

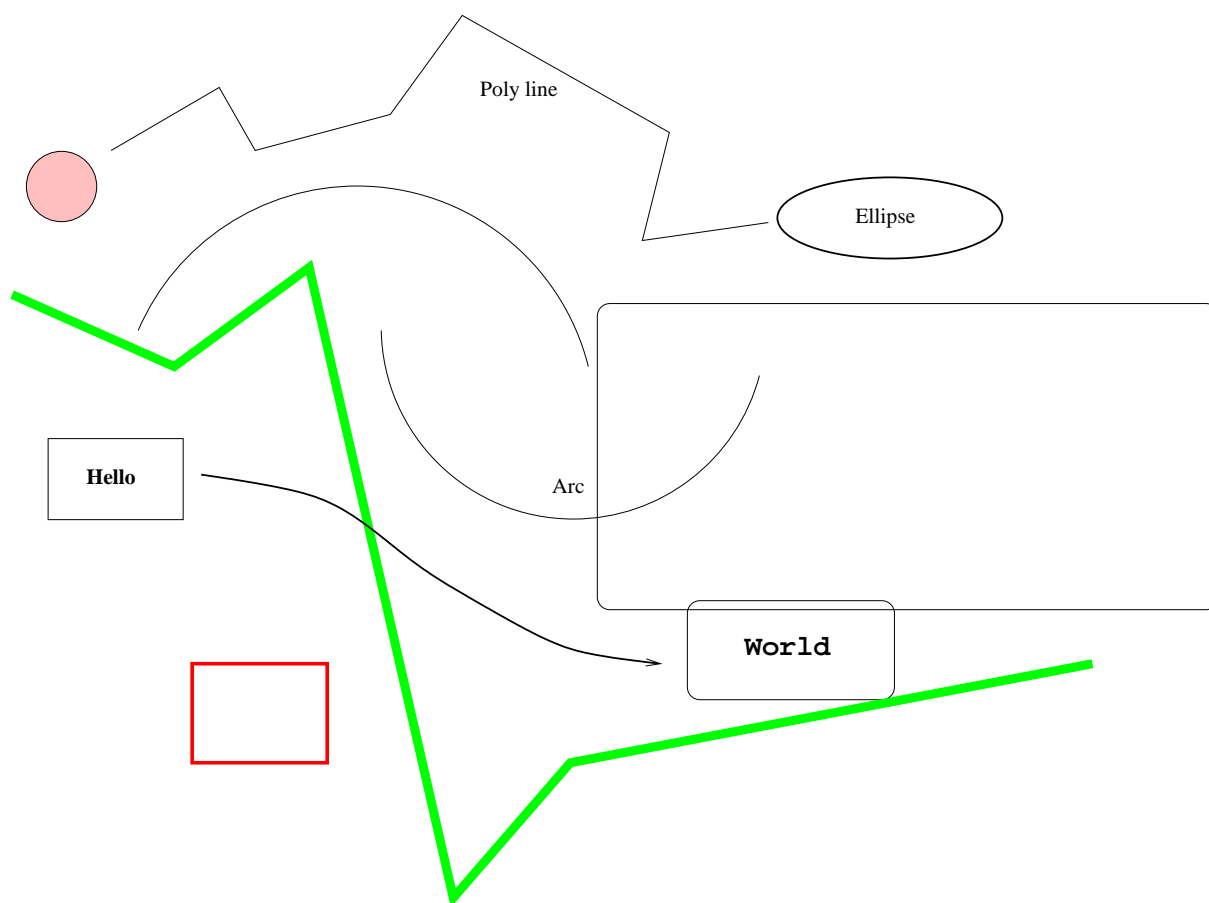


Figure 3.5: Example diagram drawn using `xfig`

Chapter 4

Evaluation

4.1 Printing and binding

Use a “duplex” laser printer that can print on both sides to print two copies of your dissertation. Then bind them, for example using the comb binder in the Computer Laboratory Library.

4.2 Further information

See the Unix Tools notes at

<http://www.cl.cam.ac.uk/teaching/current-1/UnixTools/materials.html>

Chapter 5

Conclusion

I hope that this rough guide to writing a dissertation in L^AT_EX has been helpful and saved you time.

Appendix A

Latex source

A.1 diss.tex

A.2 proposal.tex

```
% Note: this file can be compiled on its own, but is also included by
% diss.tex (using the docmute.sty package to ignore the preamble)
\documentclass[12pt,a4paper,twoside]{article}
\usepackage[pdftborder={0 0 0}]{hyperref}
\usepackage[margin=25mm]{geometry}
\usepackage{graphicx}
\usepackage{parskip}
\begin{document}

\begin{center}
\Large
Computer Science Tripos -- Part II -- Project Proposal\[\[4mm]
\LARGE
How to write a dissertation in \LaTeX\[\[4mm]

\large
M.~Richards, St John's College

Originator: Dr M.~Richards

14 October 2011
\end{center}

\vspace{5mm}

\textbf{Project Supervisor:} Dr M.~Richards

\textbf{Director of Studies:} Dr M.~Richards

\textbf{Project Overseers:} Dr F.~H.~King \& Dr A.~W.~Moore

% Main document

\section*{Introduction}

\emph{The problem to be addressed.}

Many students write their CST dissertations in \LaTeX\ -- and spend a
fair amount of time learning just how to do that. The purpose of this
project is to write a demonstration dissertation that provides
a starting point to show how it is done.
```

This core proposal document will be augmented by a separately-printed cover sheet at the front and a resource form at the end. Additional sheets for risk assessment and human resources may also need to be included.

This document will elaborate much of the material that is summarised on the additional sheets.

`\section*{Starting point}`

`\emph{Describe existing state of the art, previous work in this area, libraries and databases to be used. Describe the state of any existing codebase that is to be built on.}`

I am already able to write prose using the English language. I have an online dictionary, etc.

`\section*{Resources required}`

`\emph{A note of the resources required and confirmation of access.}`

For this project I shall mainly use my own quad-core computer that runs Fedora Linux. Backup will be to github and/or to an SVN repository on an external hard disk that is dumped to writable CD/DVD media. I have another similar computer to hand should my main machine suddenly fail. I require no other special resources.

`\section*{Work to be done}`

`\emph{Describe the technical work.}`

The project breaks down into the following sub-projects:

`\begin{enumerate}`

`\item The construction of a skeleton dissertation with the required structure. This involves writing the Makefile and making dummy files for the title page, the proforma, chapters 1 to 5, the appendices and the proposal.`

`\item Filling in the details required in the cover page and proforma.`

`\item Writing the contents of chapters 1 to 5, including examples of common \LaTeX constructs.`

`\item Adding an example of how to use floating figures and ‘‘encapsulated PostScript’’ or PDF diagrams.`

`\end{enumerate}`

`\section*{Success criteria}`

`\emph{Describe what you expect to be able to demonstrate at the end of the project and how you are going to evaluate your achievement.}`

The project will be a success if I have a completed dissertation with the correct chapter titles and I have achieved my other success criteria, which are to blah \ldots

`\section*{Possible extensions}`

`{\em Potential further envisaged evaluation metrics or extensions.}`

If I achieve my main result early I shall try the following alternative experiment or method of evaluation \ldots

```
\section*{Timetable}

\emph{A workplan of perhaps ten or so two-week work-packages,
as well as milestones to be achieved along the way. Provide a
target date for each milestone.}

Planned starting date is 16/10/2011.

\begin{enumerate}

\item \textbf{Michaelmas weeks 2--4} Learn to use X. Read book Y. Read papers Z.

\item \textbf{Michaelmas weeks 5--6} Do preliminary test of Q.

\item \textbf{Michaelmas weeks 7--8} Start implementation of main task A.

\item \textbf{Michaelmas vacation} Finish A and start main task B.

\item \textbf{Lent weeks 0--2} Write progress report. Generate corpus of
test examples. Finish task B.

\item \textbf{Lent weeks 3--5} Run main experiments and achieve working project.

\item \textbf{Lent weeks 6--8} Second main deliverable here.

\item \textbf{Easter vacation:} Extensions and writing dissertation main
chapters.

\item \textbf{Easter term 0--2:} Further evaluation and complete dissertation.

\item \textbf{Easter term 3:} Proof reading and then an early submission
so as to concentrate on examination revision.

\end{enumerate}

\end{document}
```


Appendix B

Makefile

B.1 makefile

B.2 refs.bib

Appendix C

Project Proposal

Computer Science Tripos – Part II – Project Proposal

How to write a dissertation in L^AT_EX

M. Richards, St John's College

Originator: Dr M. Richards

14 October 2011

Project Supervisor: Dr M. Richards

Director of Studies: Dr M. Richards

Project Overseers: Dr F. H. King & Dr A. W. Moore

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2. Filling in the details required in the cover page and proforma.
3. Writing the contents of chapters 1 to 5, including examples of common L^AT_EX constructs.
4. Adding an example of how to use floating figures and “encapsulated PostScript” or PDF diagrams.

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Possible extensions

Potential further envisaged evaluation metrics or extensions.

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8. **Easter vacation:** Extensions and writing dissertation main chapters.
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