\textsc{\LaTeX} and Sweave without Tears

Yihui Xie

Graphics Working Group
Department of Statistics, Iowa State University

October 29, 2010
The Pain of Using \LaTeX, R and Sweave That You Dare Not Tell Others Which Is Similar to The Feeling When We Are Forbidden to Interpret Frequentist Confidence Intervals in A Natural Way, and How to Alleviate This Pain with LyX

Yihui Xie

Graphics Working Group
Department of Statistics, Iowa State University

October 29, 2010
Contents

1. \LaTeX

2. LyX

3. Sweave

4. pgfSweave
The Unbeatable \LaTeX

- really beautiful and high-quality output (how was \TeX invented? how many bugs have been found in \TeX?)
- a \LaTeX document is usually highly organized and the structure can be fairly compact (so users can hardly do “dirty” things)
- focus on writing instead of typesetting (because they are independent)
- infinite extensions...
- search for “Zombie Andrew Gelman” in Google and read section 4
- so experts recommend \LaTeX to us, and we begin to learn
But...

Theorem 1

*The King has no clothes.*
But...

Theorem 1

*The King has no clothes.*

Proof.

Do we need to prove? OK. Do you call a document like this “dressed”? `
\documentclass{article} \begin{document} \end{document}` ...
What’s wrong to be naked?

\footnote{I saw this in Jimmy John’s – not sure if it is a joke}
What’s wrong to be naked?

- it is illegal to be naked in public by Iowa law\textsuperscript{1}

\textsuperscript{1}I saw this in Jimmy John’s – not sure if it is a joke
What’s wrong to be naked?

- it is illegal to be naked in public by Iowa law\textsuperscript{1}
- error-prone!!
- time-consuming!!!
- evidence? Plenty of! Dr Nettleton’s 511, Dr Kaiser’s 601...

\textsuperscript{1}I saw this in Jimmy John’s – not sure if it is a joke
A hard-working student
So you start thinking...

- a little voice whispering in your mind:
So you start thinking...

- a little voice whispering in your mind:
Explanation of the stupid long title

- we feel natural to interpret a Frequentist CI as “the probability for the parameter to fall into this CI is 95%”
- we still wish we could do this, although they (professors) yelled at us not to be stupid
- we feel natural to write an article in a way that we can see it (as least roughly)
- but we see code, the all-mighty code, the glorious code, the you-name-it code...
Explanation of the stupid long title

- we feel natural to interpret a Frequentist CI as “the probability for the parameter to fall into this CI is 95%”
- we still wish we could do this, although they (professors) yelled at us not to be stupid
- we feel natural to write an article in a way that we can see it (as least roughly)
- but we see code, the all-mighty code, the glorious code, the you-name-it code...
- we begin to miss the lovely and cute Microsoft Word, but WAIT!
Theorem 2

*We don’t need to introduce LyX to experienced LaTeX users.*

**Proof.**

\(LyX \xrightarrow{a.e.} \LaTeX\) (we can export a LyX document to various formats)
Another introduction

Fact 3

$\text{LyX} \neq \text{Microsoft Word}$

Comments

This means you must not worry about your styles. Focus on writing what you intended to write! Don’t waste time on choosing \texttt{bold} or \texttt{italic} fonts or font size 10/12 or \texttt{styles} for Headings...
Fact 3

\( \text{\LaTeX} \neq \text{Microsoft Word} \)

Comments

This means you must not worry about your styles. Focus on writing what you intended to write! Don’t waste time on choosing bold or italic fonts or font size 10/12 or styles for Headings...

How much do you know about \LaTeX? 

I recommend \LaTeX{} to experienced \LaTeX{} users only, because they usually appreciate the compactness of code. Make sure you can write a minimal \LaTeX{} document without looking at any references, otherwise the above Fact might not be true.
The real introduction

- **LyX** is free software and works on various platforms
- relies on a working \LaTeX\ toolkit (e.g. \TeXLive under Linux, or Mik\TeX under Windows) since it is only a GUI front-end
- semi-WYSIWYG but that’s enough
- lots of “automatic” features, e.g. special characters, math symbols auto-completion, automatically load relevant \LaTeX\ packages, can specify settings in a GUI, you can see references, automatically update labels, run \texttt{pdflatex} twice if needed, automatically deal with images of various formats (GIF, JPEG, ...)

- can write papers, books, slides...
- bottom line: if you really don’t know how to do something in LyX, you can input the raw \TeX\ code in LyX (Ctrl + L)
Sweave as they introduced

- embed R code into a \LaTeX\ document (as an Rnw document)
- run R first to generate the real \LaTeX\ document (with R output included)
- compile to PDF
- everything in one document – generally we can reproduce a paper because the computation is transparent (so are the tools: they are free and open source)
An example

- see \texttt{?Sweave}
- a lot of options available
- two major issues for me:
  - graphics not satisfactory (control the size of a figure: \texttt{\setkeys{Gin}{width=0.8\textwidth}}; inconsistent fonts)
  - formatting the R code (either remove comments in code, or ask you to be responsible for the formatting: \texttt{keep.source = TRUE/FALSE}), so I provided a solution
pgfSweave for picky users

- produce graphics in the pgf format (I don’t really know much about it)
- pgf graphics is essentially \LaTeX\ code to reproduce the graphs
- this makes the quality of graphics unbeatable (can even use raw \LaTeX\ code in plots, e.g. as titles)
- natural to specify heights/widths of plots
- caching: built upon cacheSweave (cache for R objects), and supports caching for graphics too!
Connection between \LaTeX{} and R

- open source software packages are often friends with each other
- \texttt{\LaTeXX} has left a door open for other programs: converters
- embrace command lines!
- fortunately R can be run via command line as well (PATH for Windows users... \texttt{R -e an.expression})
Connection between LyX and R

- open source software packages are often friends with each other
- LyX has left a door open for other programs: converters
- embrace command lines!
- fortunately R can be run via command line as well (PATH for Windows users... `R -e an.expression`)
- so they said, “I see you”, as in Avatar
- the real background: literate programming (supported in LyX); LyX → Sweave (.Rnw) → \LaTeX (.tex) → PDF
The gory configuration

- although pgfSweave and LyX are very handy tools, it is not a trivial task to configure them to work together
- I spent several hours trying to automate this process:
Evidence

- I’m not a liar – I’ve been doing homework with LyX and (pgf)Sweave
- demo time!
Thank you!

- any questions, comments and *jokes* are welcome
- for more stories, drop by Snedecor 2215