

# Writing papers and thesis using $\text{\LaTeX}2\text{e}$

## Part II: Writing papers and thesis using $\text{\LaTeX}$

Krishna Kumar <sup>\*1</sup>

<sup>1</sup>Cockrell School of Engineering  
The University of Texas at Austin

$\text{\LaTeX}$ for Beginners

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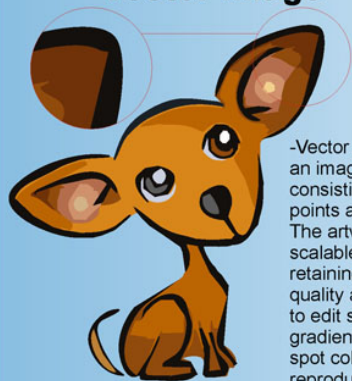
<sup>1</sup>krishnak@utexas.edu

# Outline

- 1 Graphics
  - Raster v Vector graphics
  - Better quality figures
  - Including figures
- 2 Tables
  - Formatting tricks
- 3 Referencing using bibT<sub>E</sub>X
  - BibT<sub>E</sub>X
- 4 PhD Thesis Template

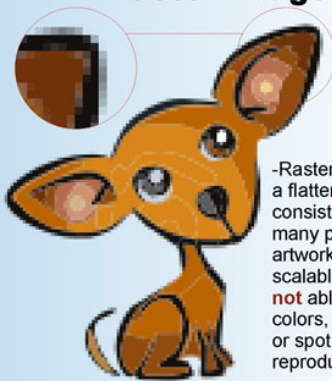
# Vector graphics vs. Raster images

## Vector Image



-Vector Artwork is an image consisting of points and paths. The artwork is scalable while retaining image quality and is able to edit size, gradients, and spot color reproduction.

## Raster Image



-Raster Artwork is a flattened image consisting of many pixels. The artwork is **not** scalable and is **not** able to edit colors, gradients, or spot color reproduction.

- Use **inkscape** to generate vector graphics

# Colour blindness



The colours of the rainbow asviewed by  
a person with no colour vision deficiencies



The colours of the rainbow asviewed by  
a person with deuteranopia



The colours of the rainbow asviewed by  
a person with protanopia



The colours of the rainbow asviewed by  
a person with tritanopia

- Making graphs with colour-blind viewers in mind - Charlotte Houldcroft  
<https://kks32.github.io/latex/articles/colour-blindness/>
- Use **GNUPlot** to generate vector graphics of your plots. Make sure the plots have different line styles so it works well on a black and white print.

# Figures

- $\text{\LaTeX}$  can be easily extended using a *package* to typeset images.
- To use graphics in your  $\text{\LaTeX}$  document use `\usepackage{graphicx}`
- Always use relative scaling to specify the width of the figure, i.e.,  
`[width = 0.75\textwidth]`
- Never ever use absolute values to scale your images!
- Set either the width or the height of the image. Or use `scale`

```
\begin{figure}  
\includegraphics[width=0.75\textwidth]  
                {figs/minion}  
\end{figure}
```



# Figures

- For captioning a figure, you can use `\usepackage{caption}`
- tweak the location, label, separator: `[labelsep=space, tableposition=top]{caption}`
- I prefer to centre the figure. To do that use `\centering`
- You can use `\cref{fig:minion}` to cross reference the figure. Requires package `cleveref`

```
\begin{figure}
\centering
\includegraphics[width=0.75\textwidth]
                 {figs/minion}

\caption[Minion]{
    Dave the Minion from Despicable Me!}
\label{fig:minion} % Unique identifier
                   % for cross-reference

\end{figure}
```



Figure: Dave the Minion from  
Despicable Me!

# `\begin[option]{figure}`

---

Parameter	Position
-----------	----------

---

<code>h</code>	Place the float here, i.e., approximately at the same point it occurs in the source text (however, not exactly at the spot)
<code>t</code>	Position at the top of the page.
<code>b</code>	Position at the bottom of the page.
<code>p</code>	Put on a special page for floats only.
<code>!</code>	Override internal parameters LaTeX uses for determining "good" float positions.
<code>H</code>	Places the float at precisely the location in the LaTeX code. Requires the float package. This is somewhat equivalent to <code>h!</code>

---

# Subcaption

I can cite Wall-E (see fig. 2b) and Minions in despicable me (fig. 2c). Figure 2 lets me cite the whole figure.

```
\begin{figure}
\centering
\begin{subfigure}[b]{0.3\textwidth}
\includegraphics[width=\textwidth]
{figs/TomandJerry}

\caption{Tom and Jerry}
\label{fig:TomJerry}
\end{subfigure}
\begin{subfigure}[b]{0.3\textwidth}
\includegraphics[width=\textwidth]{figs/WallE}
\caption{Wall-E}
\label{fig:WallE}
\end{subfigure}
\begin{subfigure}[b]{0.3\textwidth}
\includegraphics[width=\textwidth]{figs/minion}
\caption{Minions}
\label{fig:Minnion}
\end{subfigure}
\caption{Best Animations}
\label{fig:animations}
\end{figure}
```



(a) Tom and Jerry



(b) Wall-E



(c) Minions

Figure: Best Animations



# Exercise 6: Pictures

Click to open this exercise in **Overleaf**

- In  $\text{write}_{\text{LATEX}}$  create a new folder `figs` and move your figures in to `figs` folder.
- Format the King's college picture. Change it's location: (top, bottom, here, new page) and rescale the figure.
- Arrange Tom, Walle and Dave inside a single figure environment vertically.
- Cross-reference the figures (using `cleveref`).
- Create a list of figures. Use `\listoffigures`.

Click to open my solution

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# Tables

- Tables in  $\text{\LaTeX}$  take some getting used to.
- The argument specifies column alignment — left, center, right.

```
\begin{tabular}{lcr}  
Item & Qty & Unit \ $ \\  
Widget & 1 & 199.99 \\  
Gadget & 2 & 399.99 \\  
Cable & 3 & 19.99 \\  
\end{tabular}
```

Item	Qty	Unit \$
Widget	1	199.99
Gadget	2	399.99
Cable	3	19.99

- Don't use vertical lines, it's ugly. Use `\begin{booktabs}` to create horizontal lines. Never use `\hline`

```
\begin{table}[h]  
\caption{Cost}  
\begin{tabular}{lrr} \toprule  
Item & Qty & Unit \ $ \ \midrule  
Widget & 1 & 199.99 \\  
Gadget & 2 & 399.99 \\  
Cable & 3 & 19.99 \ \bottomrule  
\end{tabular}  
\label{t:cost}  
\end{table}
```

Table: Cost

Item	Qty	Unit \$
Widget	1	199.99
Gadget	2	399.99
Cable	3	19.99

- Use an ampersand `&` to separate columns and a double backslash `\` to start a new row (like in the `align*` environment that we saw in part 1).

# Table Environment

Option	Description
<code>l</code>	left-justified column
<code>c</code>	centered column
<code>r</code>	right-justified column
<code>p{'width'}</code>	paragraph column with text vertically aligned at the top
<code>m{'width'}</code>	paragraph column with text vertically aligned in the middle
<code>b{'width'}</code>	paragraph column with text vertically aligned at the bottom
<code>\&amp;</code>	column separator
<code>\\</code>	start new row (additional space may be specified)
<code>\cmidrule{i-j}</code>	partial horizontal line beginning in column i and ending in column j

# Exercise 7: Tables

Click to open this exercise in **Overleaf**

- Use `tabularx` package for tables with paragraph text.
- Never use `\hline` or `\cline`, use `\toprule`, `\midrule`, `\bottomrule` and `\cmidrule{i-j}`
- Visual table editor: <https://www.tablesgenerator.com/>

Click to open my solution.

# A badly formatted table

```
\begin{tabular}{|l|c|c|c|c|}
\hline
& \multicolumn{2}{c}{Species I} &
    \multicolumn{2}{c}{Species II} \\
\hline
DM & mean & SD & mean & SD \\
\hline
\hline
I1MD & 6.23 & 0.91 & 5.2 & 0.7 \\
\hline
I1LL & 7.48 & 0.56 & 8.7 & 0.71 \\
\hline
I2MD & 3.99 & 0.63 & 4.22 & 0.54 \\
\hline
I2LL & 6.81 & 0.02 & 6.66 & 0.01 \\
\hline
CMD & 13.47 & 0.09 & 10.55 & 0.05 \\
\hline
CBL & 11.88 & 0.05 & 13.11 & 0.04 \\
\hline
\end{tabular}
```

	Species I		Species II	
DM	mean	SD	mean	SD
I1MD	6.23	0.91	5.2	0.7
I1LL	7.48	0.56	8.7	0.71
I2MD	3.99	0.63	4.22	0.54
I2LL	6.81	0.02	6.66	0.01
CMD	13.47	0.09	10.55	0.05
CBL	11.88	0.05	13.11	0.04

# A nice looking table

```
\begin{tabular}{l c c c c}
\hline
\multirow{2}{*}{DM}
& \multicolumn{2}{c}{Species I}
& \multicolumn{2}{c}{Species II} \\
\cline{2-5}
& mean & SD & mean & SD \\
\hline
I1MD & 6.23 & 0.91 & 5.2 & 0.7 \\
I1LL & 7.48 & 0.56 & 8.7 & 0.71 \\
I2MD & 3.99 & 0.63 & 4.22 & 0.54 \\
I2LL & 6.81 & 0.02 & 6.66 & 0.01 \\
CMD & 13.47 & 0.09 & 10.55 & 0.05 \\
CBL & 11.88 & 0.05 & 13.11 & 0.04 \\
\hline
\end{tabular}
```

DM	Species I		Species II	
	mean	SD	mean	SD
I1MD	6.23	0.91	5.2	0.7
I1LL	7.48	0.56	8.7	0.71
I2MD	3.99	0.63	4.22	0.54
I2LL	6.81	0.02	6.66	0.01
CMD	13.47	0.09	10.55	0.05
CBL	11.88	0.05	13.11	0.04

# An even nicer looking table

```
\begin{tabular}{l c c c c}  
\toprule  
\multirow{2}{*}{DM}  
    & \multicolumn{2}{c}{Species I}  
    & \multicolumn{2}{c}{Species II} \\  
\cmidrule{2-5}  
    & mean & SD & mean & SD \\  
\midrule  
I1MD & 6.23 & 0.91 & 5.2 & 0.7 \\  
  
I1LL & 7.48 & 0.56 & 8.7 & 0.71 \\  
  
I2MD & 3.99 & 0.63 & 4.22 & 0.54 \\  
  
I2LL & 6.81 & 0.02 & 6.66 & 0.01 \\  
  
CMD & 13.47 & 0.09 & 10.55 & 0.05 \\  
  
CBL & 11.88 & 0.05 & 13.11 & 0.04 \\  
\bottomrule  
\end{tabular}
```

DM	Species I		Species II	
	mean	SD	mean	SD
I1MD	6.23	0.91	5.2	0.7
I1LL	7.48	0.56	8.7	0.71
I2MD	3.99	0.63	4.22	0.54
I2LL	6.81	0.02	6.66	0.01
CMD	13.47	0.09	10.55	0.05
CBL	11.88	0.05	13.11	0.04



# Formatting tables

- Use `tabulary` package for tables with paragraph text.
- Never use vertical lines in your table. It looks ugly!
- Use `booktabs` package for rules instead of lines.
- Never use `\hline` or `\cline`, use `\toprule`, `\midrule`, `\bottomrule` and `\cmidrule{i-j}`.
- Use `\centering` to center your tables, do **NOT** use `\begin{center}` and `\end{center}` as it adds additional white space

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- Put your references in a .bib file in 'bibtex' database format:

```
@Article{Jacobson1999Towards,  
  author = {Van Jacobson},  
  title = {Towards the Analysis of Massive Multiplayer Online  
          Role-Playing Games},  
  journal = {Journal of Ubiquitous Information},  
  Month = jun,  
  Year = 1999,  
  Volume = 6,  
  Pages = {75--83}}  
  
@InProceedings{Brooks1997Methodology,  
  author = {Fredrick P. Brooks and John Kubiawicz and  
          Christos Papadimitriou},  
  title = {A Methodology for the Study of the  
          Location-Identity Split},  
  booktitle = {Proceedings of OOPSLA},  
  Month = jun,  
  Year = 1997}
```

- Most reference managers can export to bibtex format.

- Each entry in the .bib file has a *key* that you can use to reference it in the document. For example, Jacobson1999Towards is the key for this article:

```
@Article{Jacobson1999Towards,
  author = {Van Jacobson},
  ...
}
```

- It's a good idea to use a key based on the name, year and title.
- L<sup>A</sup>T<sub>E</sub>X can automatically format your in-text citations and generate a list of references; it knows most standard styles, and you can design your own.

- Use the natbib package<sup>2</sup> with `\citet` and `\citep` for textual and parenthetical citations, respectively.
- Reference `\bibliography` at the end, and specify a `\bibliographystyle`.

```
\documentclass{article}
\usepackage[authoryear]{natbib}
\begin{document}

\citet{Brooks1997Methodology}
show that \ldots. Clearly,
all odd numbers are prime
\citep{Jacobson1999Towards}.

\bibliography{bib-example}
% if `bib-example' is the name of
% your bib file

\bibliographystyle{plainnat}
% try changing to abbrunat

\end{document}
```

Brooks et al. [1997] show that .... Clearly, all odd numbers are prime [Jacobson, 1999].

## References

Fredrick P. Brooks, John Kubiawicz, and Christos Papadimitriou. A methodology for the study of the location-identity split. In *Proceedings of OOPSL* June 1997.

Van Jacobson. Towards the analysis of massive multiplayer online role-play games. *Journal of Ubiquitous Information*, 6:75–83, June 1999.

<sup>2</sup>There is a new package with more features named biblatex but most of the articles templates still use natbib.

# Exercise 8: Formatting a Paper

Click to open this exercise in **Overleaf**

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- Reference styles:

[https://www.overleaf.com/learn/latex/Biblatex\\_bibliography\\_styles](https://www.overleaf.com/learn/latex/Biblatex_bibliography_styles)

[https://www.overleaf.com/learn/latex/Bibliography\\_management\\_with\\_biblatex](https://www.overleaf.com/learn/latex/Bibliography_management_with_biblatex)

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# PhD Thesis Template

Detailed instructions on how to use the template

Write your PhD Thesis online

Click to open the template in **Overleaf**

or use it off-line

View the template in github