# A Short Tutorial on Preparing Academic Writing using LaTeX

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9 February 2022

**Abstract**

This document briefly describes the process of writing general academic manuscripts using LaTeX. General academic writing is any type of writing made for academic purposes. Academic writing can be considered as a form of communication and dissemination of knowledge in the scientific community, and generally has a standard structure. One of the tools that can be used to prepare academic writing is LaTeX. LaTeX is a software system for document preparation based on the TeX typesetting program. With LaTeX authors can focus their efforts on the content of the text rather than on the visual appearance.

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# 1 Introduction

This article briefly describes the process of writing general academic manuscripts using LaTeX. This article was prepared with a LaTeX document which can also be used as a template by other authors. Therefore, this article also serves as a brief guide for others in preparing various kinds of academic writings using the templates that have been provided.

The current article, however, is not an introduction nor a tutorial on LaTeX. It is also not a manual for writing in general. Interested readers should seek for writing or LaTeX manual or tutorial, instead. A comprehensive handbook on the topic of academic writings can be found in [2], whilst a more specific theme on writing a thesis (which can be applicable for all level of studies including undergraduate, master, doctoral, or post-graduate in general), for example, can be found in [3]. For LaTeX readers can consult online resource such as [4].

## 1.1 Academic Writing

General academic writing is any type of writing made for academic purposes. Academic writing can be considered as a form of communication and dissemination of knowledge in the scientific community, and generally has a standard structure.

There are various types of academic writing: books, essays, scientific articles, theses/dissertation, academic reports such as assignments, and so on. Some of the characteristics shown by academic writing include discussing and solving a problem, systematic writing structure, and supported by logical arguments. If academic writing presents the results of research conducted by the author, then the academic writing must also be done using a valid method.

It is common to recommend that the writing should be structured following the IMRaD method [5]; it refers to a written material that is divided into four main sections:

- Introduction
- Methods
- Results
- Discussions

In addition to these sections, it is also common to include an ‘Analysis’ section after presenting the ‘Results’; hence, the lowercase ‘a’ in the IMRaD method.

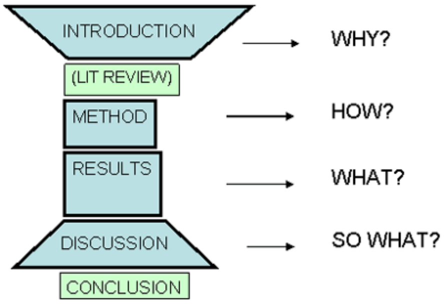


Figure 1: IMRaD structure for standard academic writings

Followings are brief explanation on each of these sections. More detailed will be given in the appropriate section of this template. A short, figurative illustrations of this structure is given in Figure 1.

The Introduction part should provide readers with the context of the current writing, or with the research/project question (for research article or thesis), followed by some explanation of the significance/importance of the author's work/findings, and might also include some review of background or known information on the topic in the writing. Sometimes, the background review can be expanded into its own section, namely Literature Review (or Background, or Theory, or anything similar).

In the Methods section, we describe our methods for gathering information and explain our sources of information, both primary and secondary. For example, if we use some codes from other sources, then we can explain this in a little more details in this Methods section. If we also use other people datasets for our work, then we can also outline these datasets and mention it in the References. We can also elaborate our method using any of these tools: flow chart, mind map, gantt chart, etc. It is important to remember that we have to present and compile our results in a manner that is coherent and easy to follow.

The Results section describe what we have found out from our work/assignment. we have to develop each findings thoroughly, as this is the main section of our written document. we might also include some statistical data and analysis as well as some results from our survey/interview, if applicable.

The Discussion should explain the significance of our findings, describe how they support our answers to the project/assignment, and also mention any limitations of our work.

Let this be an example how to put our introduction section in writings for student's assignment. For example, our task is to simulate hybrid image construction such as given in [6]. State clearly what was asked in the project/assignment. Then, describe briefly how we organised our work/task to answer the given task/assignment. Sometimes, it is also important to explain why we have chosen a particular way to solve the given problem/assignment.

## 1.2 LaTeX typesetting tool

One of the tools that can be used to prepare academic writing is LaTeX. LaTeX is a software system for document preparation based on the TeX typesetting program. With LaTeX authors can focus their efforts on the content of the text rather than on the visual appearance.

If we do not have LaTeX and decide to install one in our machine, we can get a LaTeX distribution (all common OS) from `www.latex-project.org/get/`

If we do not want to have LaTeX installed in our machine, we can run the LaTeX compilation directly from the Overleaf project. First, we have to copy the whole project into our Overleaf project. For the current article, this can be done by downloading the template as zip file, expand locally, and re-upload the files onto our empty Overleaf project. Make sure that all the image files in our Overleaf project are put in the `img` folder. After that, we can immediately run the project.

Bear in mind that online LaTeX engine such as Overleaf does have some limitations. For example, if for some reason our LaTeX compilation run longer than expected (probably because the project is quite large, or we have included a complex LaTeX command in our document), then Overleaf might have run into trouble and refuse to process our document.

If we need help with LaTeX please consult various online help such as https://en.wikibooks.org/wiki/LaTeX

### 1.3 Template

The template used to prepare this article is available as an Overleaf project in https://www.overleaf.com/read/svsqnggjqpj. In the project folder, it is also available as a zip file. Interested readers can download the zip file, extract its content in a folder in their machine, and prepare the document from that working folder. The zip file consists of the raw LaTeX document `acadlatex.tex`, `references.bib`, `bpmn-events.sty` and `tikz-bpmn`, accompanied by a subfolder `img` that contains all the source images used in this article.

## 2 Methods: how to use this template

Following the Introduction section given in Section 1, we have to elaborate what we have done in the project/assignment. In this Methods section, we have to explain the way by which we have acquired our results/answers. In the context of current article, we are going to explain how this article is prepared or typeset.

### 2.1 Compilation

There are at least two ways we can make use of this template, depending on whether we have LaTeX engine installed in our systems.

If we have one, then we can download the whole project (folder) into our local machine. To compile from command line, we can execute the following command from the same folder/directory where we put our main LaTeX document (the one with *.tex extension):

```
> pdflatex acadlatex.tex
```

Alternatively, we could also compile the document from any LaTeX IDE we might have used in our system. This template has been compiled from inside the TexStudio[1] and TexShop[2] IDE, with backend using MacTeX[3]. For those using Windows OS, we can also use LyX[4], TexMaker[5], or TeXworks[6] using MikTeX[7] as backend engine.

For references to appear correctly instead of as '??', we must run the pdflatex command twice; in between, we might have to run bibtex command as well:

[1] https://texstudio.org
[2] https://pages.uoregon.edu/koch/texshop/
[3] http://www.tug.org/mactex/
[4] https://www.lyx.org
[5] https://www.xm1math.net/texmaker/
[6] http://www.tug.org/texworks/
[7] https://miktex.org

```
> pdflatex acadlatex.tex
> bibtex writeup
> pdflatex acadlatex.tex
```

## 2.2 Editing

To edit our document, we can use any LaTeX IDEs previously mentioned above; alternatively, we can always use simpler text editing software such as vi/vim, emacs, or Textpad/Notepad++.

When we edit our document, we have to put our names, credentials, and emails in the document preamble. All we have to do is to modify the appropriate detailed parts in the following lines:

```
\def\DocAuthor          {Irwan Prasetya Gunawan}
\def\MyEmail            {irwan.gunawan@bakrie.ac.id}
```

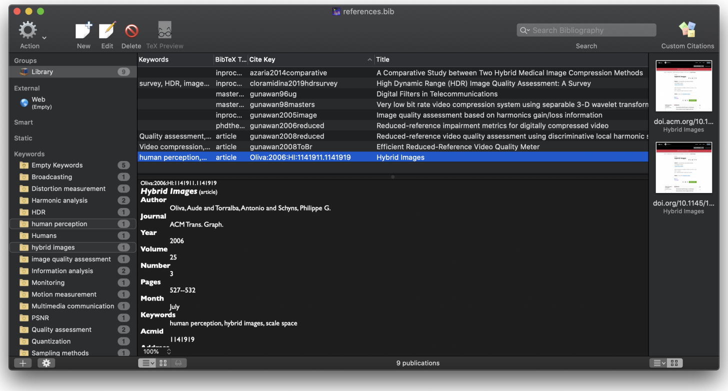
The detail of the document, such as document title, date, year, etc, must also be modified:

```
\def\ReportTitle        {Project X Writeup}     % Title
\def\CourseSemester     {6}                     % Semester
\def\AcadYear           {2021/2022}             % Academic Year
```

All of the above details is written in a standard LaTeX manner. For example, we can use line breaks (\\) to equalize the length of the title line

## 2.3 Reference management

The bibliographical data used in the References are managed by using BibDesk[8]. Similar application that runs on most platform is JabRef[9]. An illustration on reference management using BibDesk is given in Figure 2.



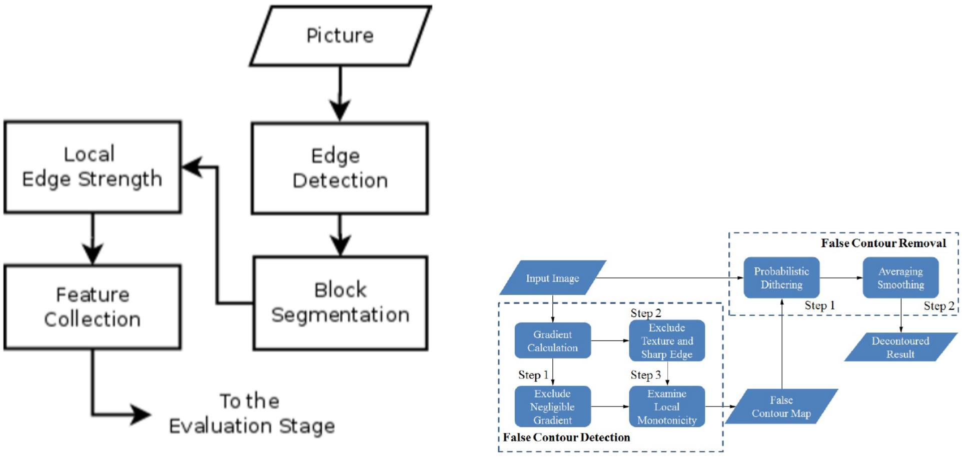
| Keywords | BibTeX T... | Cite Key | Title |
|---|---|---|---|
| | inproc... | azaria2014comparative | A Comparative Study between Two Hybrid Medical Image Compression Methods |
| survey, HDR, image... | inproc... | cloramidina2019hdrsurvey | High Dynamic Range (HDR) Image Quality Assessment: A Survey |
| | master... | gunawan96ug | Digital Filters in Telecommunications |
| | master... | gunawan98masters | Very low bit rate video compression system using separable 3-D wavelet transforn |
| | inproc... | gunawan2005image | Image quality assessment based on harmonics gain/loss information |
| | phdthe... | gunawan2006reduced | Reduced-reference impairment metrics for digitally compressed video |
| Quality assessment,... | article | gunawan2008reduced | Reduced-reference video quality assessment using discriminative local harmonic s |
| Video compression,... | article | gunawan2008ToBr | Efficient Reduced-Reference Video Quality Meter |
| human perception,... | article | Oliva:2006:HI:1141911.1141919 | Hybrid Images |

Oliva:2006:HI:1141911.1141919
***Hybrid Images*** (article)
**Author**
Oliva, Aude and Torralba, Antonio and Schyns, Philippe G.
**Journal**
ACM Trans. Graph.
**Year**
2006
**Volume**
25
**Number**
3
**Pages**
527--532
**Month**
July
**Keywords**
human perception, hybrid images, scale space
**Acmid**
1141919

Figure 2: Reference management using BibDesk

[8] https://bibdesk.sourceforge.io

[9] https://www.jabref.org



(a) Simple chart for feature extraction

(b) Simple chart for contour detection

Figure 3: Simple chart. we can also mention any sources for illustration; for example, the subfigure (a) was taken from [1]

### 2.4 Using Chart

We might want to include some chart to describe the steps we have taken in our project/assignment. Example of chart that we might include in our document is given in the followings. A simple flow chart might be given such as in Figure 3.

We can also use LaTeX package TikZ to create similar flowchart. This is given in the Figure 4. The LaTeX codes to produces this chart is given in the Appendix B.

The LaTeX package TikZ can also be used to produce mind map to express ideas or concepts in our methods. See the example given in Figure 5.

To elaborate schedule in our project/assignment, we might want to use Gantt chart. This can easily be produced using LaTeX package `pgfgantt` that should be declared in the document preamble. Examples are given in Figure 6 and Figure 7.

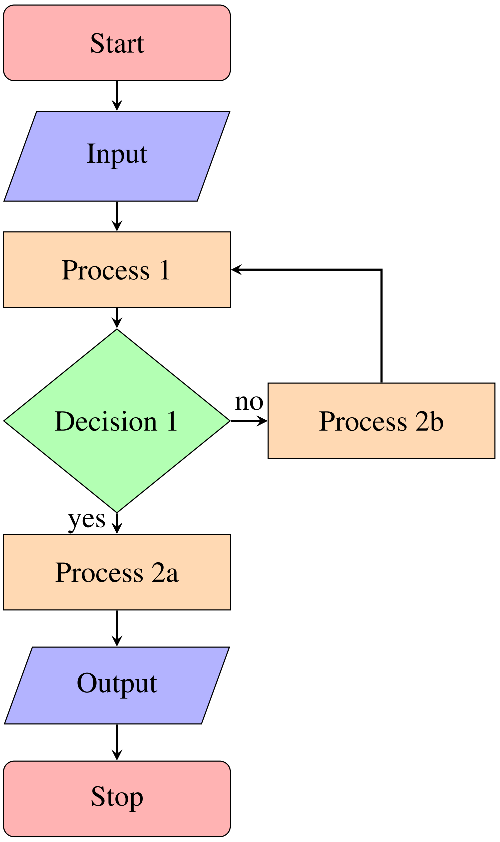


Figure 4: Another flowchart using LaTeX TikZ package

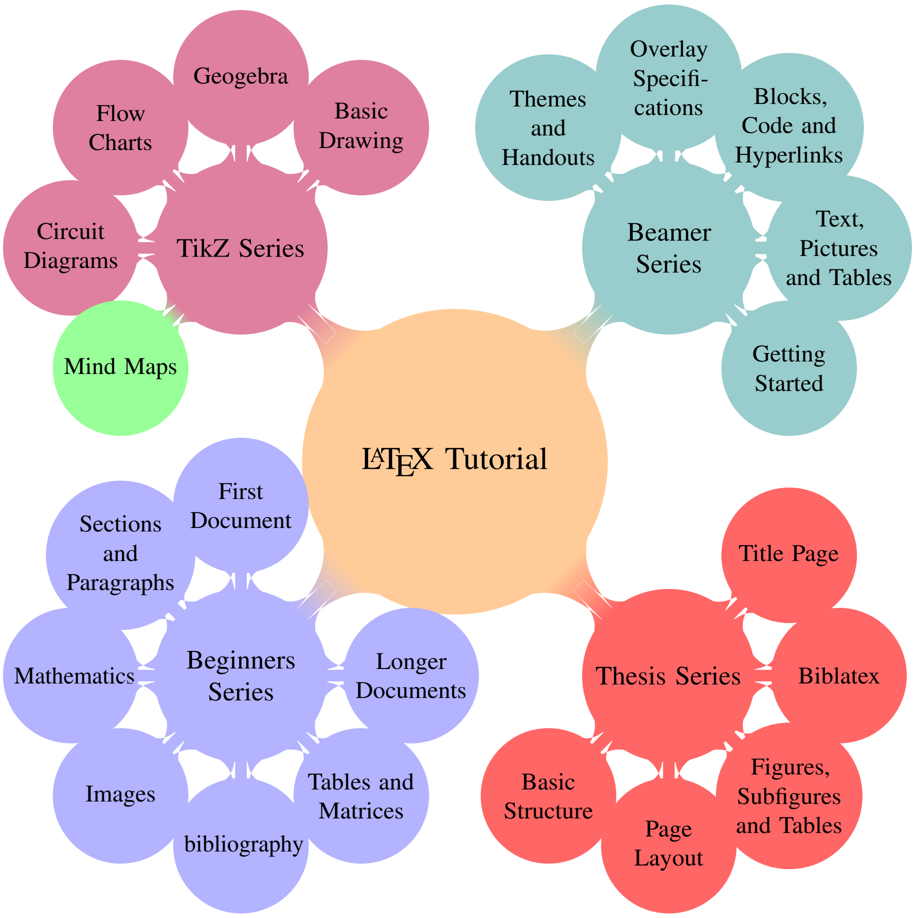


Figure 5: Mind map using LaTeX TikZ package

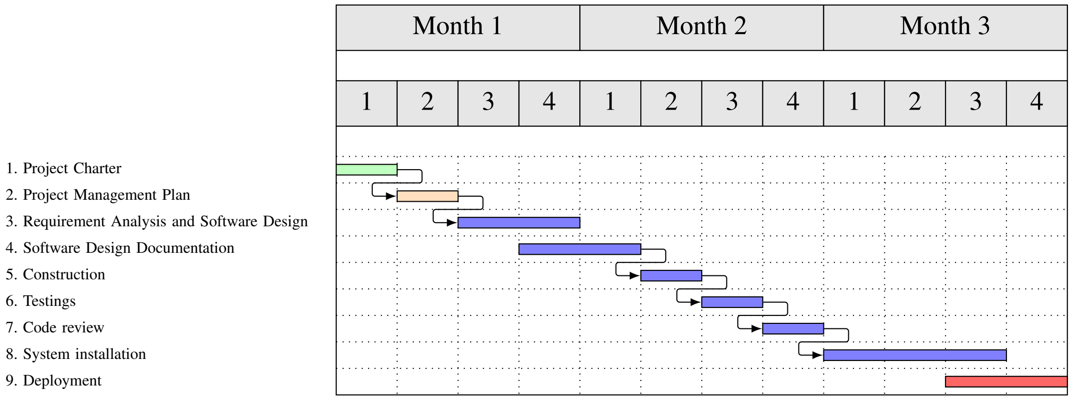


Figure 6: Project schedule

## 2.5 Code snippet

If we have some codes used in our project, then we can also explain it here. we can also put some code snippet that highlights an interesting point in our approach to the project/question; for example, such as given in the following Listing 1.

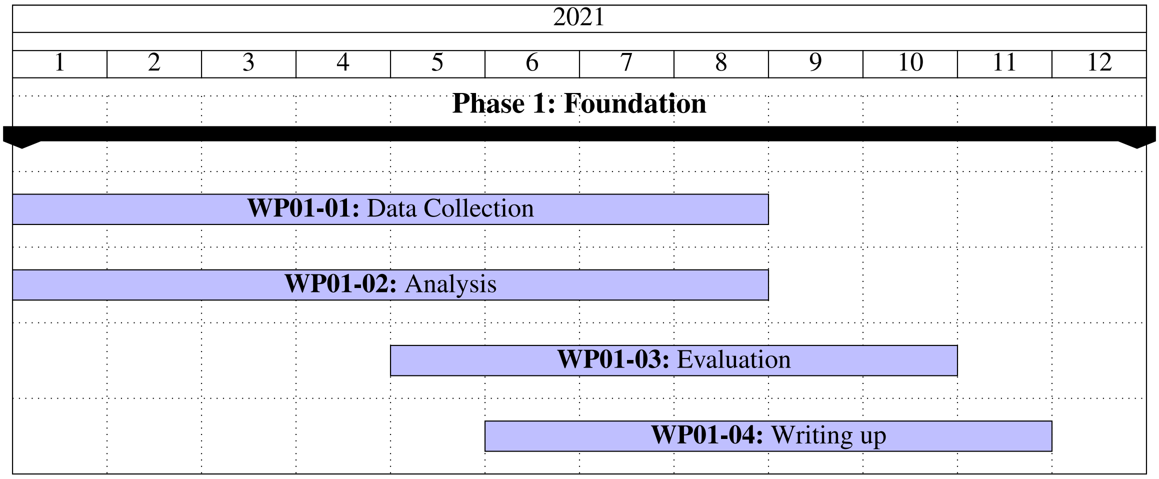


Figure 7: Another example of project schedule

Code Listing 1: Matlab Example

```matlab
one = 1;
two = one + one;
if two == 2
    disp( 'This computer is not broken.' );
end
```

Longer codes with different language styles can also be used; some examples are given in the Appendix B (see Listing 2 and Listing 3).

## 2.6 Mathematical equations

We might need to write down mathematical equation in our document. This can be done such as given in Equation 1.

$$a = b + c \tag{1}$$

Equation can also be written without its sequence number:

$$\begin{pmatrix} 0.3 & -0.1 & 0 \\ -0.1 & 0.8 & -0.3 \\ 0 & -0.3 & 0.8 \end{pmatrix} \begin{pmatrix} V_A \\ V_B \\ V_C \end{pmatrix} = \begin{pmatrix} 9 \\ -3 \\ 6 \end{pmatrix}$$

Examples of some useful phasor's complex identities written using aligned multi-equations are as follows:

$$\begin{aligned} 3 + j4 &= 5\angle 53.1^\circ \\ 1 + j &= \sqrt{2}\angle 45^\circ = \sqrt{2}\angle \tfrac{\pi}{4} \\ 1 + j\sqrt{3} &= 2\angle 60^\circ = 2\angle \tfrac{\pi}{3} \end{aligned}$$

We can also use the multiline mathematical equations, with or without sequence numbers:

$$\begin{aligned} y &= A \sin\left(\omega t \pm \theta\right) = A \sin\left(2\pi f t \pm \theta\right) \qquad (2) \\ &= A \sin\left(\frac{2\pi t}{T} \pm \theta\right) \\ x &= A \cos\left(\omega t \pm \theta\right) = A \cos\left(2\pi f t \pm \theta\right) \qquad (3) \\ &= A \cos\left(\frac{2\pi t}{T} \pm \theta\right) \end{aligned}$$

where

$$\begin{aligned} A &= \text{peak value or amplitude} \\ \omega &= \text{angular velocity in } \mathrm{rad/s} = 2\pi f t \\ f &= \text{frequency in cycle/s or } \mathrm{Hz} \\ T &= \text{periods in } \mathrm{s} \ = \frac{1}{f} \\ \theta &= \text{phase-angle in } \mathrm{rad} \end{aligned}$$

Note that in the above example, a special LaTeX package for writing SI units is also used.

## 2.7 Citation

We might also need to cite previous works or literatures in our document. This can be an article in a journal paper [7, 8], an article in a conference proceeding [9–11], or a thesis, whether it is undergraduate thesis [12], masters thesis [13], or PhD thesis [14].

## 2.8 Language usage

For the document, we can either use English or Bahasa Indonesia. Choose only one language for our document; so, please do not mix them.

Note that this template is written using LaTeX with English package language enabled. This can be seen from the preamble of this document where we use the following line of code:

```
\usepackage[english]{babel}
```

If we choose Bahasa Indonesia for our document, then we have to modify the above using `bahasa` as an option to the package:

```
\usepackage[bahasa]{babel}
```

When changing the option from `english` to `bahasa`, then the appropriate section names (such as ‘Abstract’, ‘Contents’, ‘List of Figures’, etc) will automatically be translated into its Indonesian counterparts (‘Ringkasan’, ‘Daftar Isi’, ‘Daftar Tabel’, etc).

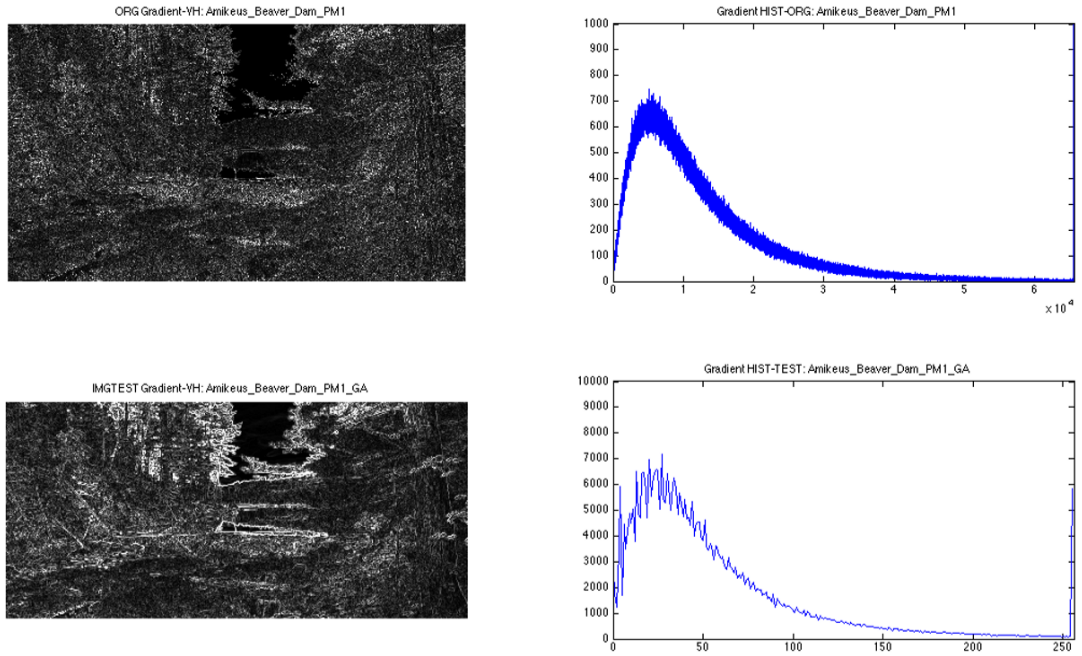


Figure 8: *Left:* My result was spectacular. *Right:* Curious.

# 3 Results

In this section, we should state and explain any results we have obtained from our simulation/-task/works in a clear, and concise, way. For example, we might want to list them numerically as follows:

1. Result 1 was a total failure, because...
2. Result 2 (Figure 8, left) was surprising, because...
3. Result 3 (Figure 8, right) blew my socks off, because...

Our results can also be summarized in Table 1. Use a table environment to outline any findings we might have wanted to highlight in our document. Longer table that spans more than one page is also possible; we can find an example of this in the Appendix A.

Table 1: Stunning revelation about the efficiency of my code.

| Condition | Time (seconds) |
|---|---:|
| Test 1 | 1 |
| Test 2 | 1000 |

## 4 Discussion

Reflect what we have done in our project with those found in the literature, especially those literature that we have put in the references.

In this section, we will explain what our results actually ‘mean’. How do they correlate with our initial research questions/project? What interesting relationships did we discover and how do we think this could be explained. we can also mention any limitations on our project/assignment and explain why the reasons for these limitations. The discussion could be ended with suggestions for future works. Following the discussion, we can have an independent header entitled ‘Conclusions’ in which our conclusions are stated in a straightforward manner.

## 5 Conclusion

Last but not least, it is common in any forms of academic writing to put a conclusion section here to wrap up our document. The conclusion serves as a closing mark for our argument.

## 6 Acknowledgement

If we had help from others during our project/assignment, then we can mention that here. If our report is a group effort, then we can also explain each member’s contribution to the final document.

## 7 References

[1] Irwan Prasetya Gunawan, Ocarina Cloramidina, Salmaa Badriatu Syafa’ah, Rizcy Hafivah Febriani, Guson Prasamuarso Kuntarto, and Berkah Iman Santoso. A review on high dynamic range (HDR) image quality assessment. *International Journal on Smart Sensing and Intelligent Systems*, 14(1):1–17, July 2021. doi: 10.21307/ijssis-2021-010. URL https://www.exeley.com/in_jour_smart_sensing_and_intelligent_systems/doi/10.21307/ijssis-2021-010.

[2] Rowena Murray and Sarah Moore. *The Handbook of Academic Writing: A Fresh Approach*. Open University Press, Berkshire, England, 2006.

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[5] IMRAD. IMRAD – Wikipedia, The Free Encyclopedia. https://en.wikipedia.org/wiki/IMRAD, 2022. [Online; accessed 9-February-2022].

[6] Aude Oliva, Antonio Torralba, and Philippe G. Schyns. Hybrid images. *ACM Trans. Graph.*, 25(3):527–532, July 2006. ISSN 0730-0301. doi: 10.1145/1141911.1141919. URL http://doi.acm.org/10.1145/1141911.1141919.

[7] Irwan Prasetya Gunawan and Mohammed Ghanbari. Efficient reduced-reference video quality meter. *IEEE Transactions on Broadcasting*, 54(3):669–679, September 2008. ISSN 0018-9316 (Print), 1557-9611 (Online). doi: 10.1109/TBC.2008.2000734. URL https://ieeexplore.ieee.org/document/4550733/.

[8] Irwan P Gunawan and Mohammed Ghanbari. Reduced-reference video quality assessment using discriminative local harmonic strength with motion consideration. *IEEE Transactions on Circuits and Systems for Video Technology*, 18(1):71–83, January 2008. ISSN 1051-8215 (Print), 1558-2205 (Online). doi: 10.1109/TCSVT.2007.913755. URL https://ieeexplore.ieee.org/document/4400126/.

[9] Irwan Prasetya Gunawan and Mohammed Ghanbari. Image quality assessment based on harmonics gain/loss information. In *IEEE International Conference on Image Processing (ICIP)*, volume 1, pages I–429. IEEE, 2005.

[10] Clarissa Philana Shopia Azaria and Irwan Prasetya Gunawan. A comparative study between two hybrid medical image compression methods. In *Proc. International Conference on Computer Systems (ICCS)*, volume 1, pages 38–44, Makassar, 2014.

[11] Ocarina Cloramidina, Salmaa Badriatu Syafaah, Irwan Prasetya Gunawan, Guson Prasamuarso Kuntarto, and Berkah Iman Santoso. High Dynamic Range (HDR) Image Quality Assessment: A Survey. In *2019 International Conference on Information Systems and Technologies (CONRIST 2019)*, Yogyakarta, Indonesia, December 2019.

[12] Irwan Prasetya Gunawan. Digital filters in telecommunications. Undergraduate thesis, Cable and Wireless College, Sekolah Tinggi Teknologi Telkom, Coventry, UK, May 1996.

[13] Irwan Prasetya Gunawan. Very low bit rate video compression system using separable 3-d wavelet transform and generalized optimal bit allocation method,. Master's thesis, Communication Engineering Department, RMIT University, Melbourne, Australia, June 1998.

[14] Irwan Prasetya Gunawan. *Reduced-reference impairment metrics for digitally compressed video*. PhD thesis, University of Essex, Wivenhoe Park, Colchester, UK, June 2006. URL https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.428949,http://catalogue.essex.ac.uk/record=b1627954.

# A Appendix: Additional Data in long table environment

Additional data might be included in the Appendix. For example, we can include a very long table that spans multiple pages in the Appendix. This is given by Table 2 below.

Table 2: Experimental results using QE metrics based on spatial features

| **Quality Model** | **Feature Type** | **Pearson** | **Spearman** | **Outlier** |
|---|---|---|---|---|
| QE1_Sqrt | AccEdgeStrength | 0.167 | 0.251 | 0.000 |
| QE1_1 | AccEdgeStrength | -0.181 | -0.251 | 0.000 |
| QE1_Square | AccEdgeStrength | 0.164 | 0.298 | 0.000 |
| QE1_Cubed | AccEdgeStrength | 0.203 | 0.298 | 0.000 |
| QE2_Sqrt | AccEdgeStrength | 0.135 | 0.301 | 11.570 |
| QE2_1 | AccEdgeStrength | 0.207 | 0.301 | 0.000 |
| QE2_Square | AccEdgeStrength | 0.112 | 0.286 | 34.711 |
| QE2_Cubed | AccEdgeStrength | 0.207 | 0.286 | 0.000 |
| QE3 | AccEdgeStrength | 0.012 | -0.015 | 0.000 |
| QE1_Sqrt | AveEdgeStrength | -0.383 | -0.255 | 0.000 |
| QE1_1 | AveEdgeStrength | -0.044 | -0.124 | 0.000 |
| QE1_Square | AveEdgeStrength | -0.373 | -0.312 | 0.826 |
| QE1_Cubed | AveEdgeStrength | -0.034 | -0.154 | 0.826 |
| QE2_Sqrt | AveEdgeStrength | -0.065 | 0.067 | 12.397 |
| QE2_1 | AveEdgeStrength | 0.027 | -0.067 | 0.000 |
| QE2_Square | AveEdgeStrength | -0.147 | -0.157 | 34.711 |
| QE2_Cubed | AveEdgeStrength | 0.225 | -0.038 | 0.000 |
| QE3 | AveEdgeStrength | 0.429 | 0.376 | 0.000 |
| QE1_Sqrt | AccLuminanceImg | 0.279 | 0.260 | 0.000 |
| QE1_1 | AccLuminanceImg | -0.281 | -0.260 | 0.000 |
| QE1_Square | AccLuminanceImg | 0.267 | 0.246 | 0.000 |
| QE1_Cubed | AccLuminanceImg | 0.276 | 0.246 | 0.000 |
| QE2_Sqrt | AccLuminanceImg | 0.236 | 0.225 | 0.000 |
| QE2_1 | AccLuminanceImg | 0.260 | 0.225 | 0.000 |
| QE2_Square | AccLuminanceImg | 0.204 | 0.207 | 9.091 |
| QE2_Cubed | AccLuminanceImg | 0.245 | 0.207 | 0.000 |
| QE3 | AccLuminanceImg | 0.246 | 0.351 | 0.000 |
| QE1_Sqrt | AveLuminanceImg | -0.115 | -0.130 | 0.000 |
| QE1_1 | AveLuminanceImg | 0.129 | 0.137 | 0.826 |
| QE1_Square | AveLuminanceImg | -0.168 | -0.137 | 21.488 |
| QE1_Cubed | AveLuminanceImg | 0.096 | 0.143 | 0.826 |
| QE2_Sqrt | AveLuminanceImg | -0.315 | -0.187 | 8.264 |
| QE2_1 | AveLuminanceImg | 0.198 | 0.187 | 0.000 |
| QE2_Square | AveLuminanceImg | -0.320 | -0.174 | 25.620 |
| QE2_Cubed | AveLuminanceImg | -0.322 | -0.314 | 0.000 |
| QE3 | AveLuminanceImg | 0.540 | 0.490 | 0.000 |
| QE1_Sqrt | AveLuminanceImg | -0.115 | -0.130 | 0.000 |
| QE1_1 | AveLuminanceImg | 0.129 | 0.137 | 0.826 |
| QE1_Square | AveLuminanceImg | -0.168 | -0.137 | 21.488 |

| Quality Model | Feature Type | Pearson | Spearman | Outlier |
|---|---|---|---|---|
| QE1_Cubed | AveLuminanceImg | 0.096 | 0.143 | 0.826 |
| QE2_Sqrt | AveLuminanceImg | -0.315 | -0.187 | 8.264 |
| QE2_1 | AveLuminanceImg | 0.198 | 0.187 | 0.000 |
| QE2_Square | AveLuminanceImg | -0.320 | -0.174 | 25.620 |
| QE2_Cubed | AveLuminanceImg | -0.322 | -0.314 | 0.000 |
| QE3 | AveLuminanceImg | 0.540 | 0.490 | 0.000 |
| QE1_Sqrt | AveLuminanceImg | -0.115 | -0.130 | 0.000 |
| QE1_1 | AveLuminanceImg | 0.129 | 0.137 | 0.826 |
| QE1_Square | AveLuminanceImg | -0.168 | -0.137 | 21.488 |
| QE1_Cubed | AveLuminanceImg | 0.096 | 0.143 | 0.826 |
| QE2_Sqrt | AveLuminanceImg | -0.315 | -0.187 | 8.264 |
| QE2_1 | AveLuminanceImg | 0.198 | 0.187 | 0.000 |
| QE2_Square | AveLuminanceImg | -0.320 | -0.174 | 25.620 |
| QE2_Cubed | AveLuminanceImg | -0.322 | -0.314 | 0.000 |
| QE3 | AveLuminanceImg | 0.540 | 0.490 | 0.000 |

## B Appendix: Additional codes

We can also include longer code snippets in the Appendix; for example, to include python codes, we can use the LaTeX environment `lstlisting` with an option to use Python language for its writing style.

```
################################################################################
#
# Input the documents
#

# Get all the filenames in the given directory, if the name is valid
if isDir(dirname):
  files_groups = os.listdir(dirname)
  # Get the absolute path of the directory
  abspathdir = os.path.abspath(dirname)
  # Print out the full path of the given directory
  print('Directory name: {}\n'.format(abspathdir))
  if verbose:
    print(”Files found = ”)
    print(files_groups)

# Loopthrough all the files in the specified folder
def read_documents(dirname, file):
  filename = '{}/{}'.format(dirname, file)
  myDocument = pd.DataFrame(columns =['docName','docText','docLen'])
  prefix, extension = os.path.splitext(file)
  if (extension.lower() == '.txt'):
    f = open(filename, 'r', encoding='ISO-8859-1')   # didn't work with utf-8

    # Feed the file text into strings
    docData = f.read()
    f.close()
    if verbose: print(docData)

```

```python
    #Convert to dataframe

    myDocument['docName'] = [file]
    myDocument['docText'] = [docData]
    myDocument['docLen'] = myDocument['docText'].str.len()

    # For checking purposes
    print(myDocument)

  return myDocument

document = pd.concat(all).reset_index(drop = True)

# Construct the corpus from the text in dataframe, treat them as list of strings
corpus = list(document['docText'])
```

Code Listing 2: Python Example

The same environment can also be used with another language; for example, C/C++, such as the followings:

```c
////////////////////////////////////////////////////////////////////////////////
//
// An example using C/C++
//
#include <stdio.h>
#include <string.h>

struct student_college_detail
{
  int college_id;
  char college_name[50];
};

struct student_detail
{
  int id;
  char name[20];
  float percentage;
  // structure within structure
  struct student_college_detail clg_data;
}stu_data;

int main()
{
  struct student_detail stu_data = {1, "Eryz", 90.5, 71145,"Bakrie University"};
  printf(" Id is: %d \n", stu_data.id);
  printf(" Name is: %s \n", stu_data.name);
  printf(" Percentage is: %f \n\n", stu_data.percentage);

  printf(" College Id is: %d \n",
  stu_data.clg_data.college_id);
  printf(" College Name is: %s \n",
  stu_data.clg_data.college_name);
  return 0;
}
```

Code Listing 3: C Example

In particular for python codes, we can also use the LaTeX package `pythonhighlight` such as the followings:

```
########################################################################
#
# Input the documents
#

# Get all the filenames in the given directory, if the name is valid
if isDir(dirname):
  files_groups = os.listdir(dirname)
  # Get the absolute path of the directory
  abspathdir = os.path.abspath(dirname)
  # Print out the full path of the given directory
  print(’Directory name: {}\n’.format(abspathdir))
  if verbose:
    print("Files found = ")
    print(files_groups)

# Loopthrough all the files in the specified folder
def read_documents(dirname,file):
  filename = ’{}/{}’.format(dirname,file)
  myDocument = pd.DataFrame(columns =[’docName’,’docText’,’docLen’])
  prefix, extension = os.path.splitext(file)
  if (extension.lower() == ’.txt’):
    f = open(filename, ’r’, encoding=’ISO-8859-1’)   # didn’t work with utf-8

    # Feed the file text into strings
    docData = f.read()
    f.close()
    if verbose: print(docData)

    #Convert to dataframe

    myDocument[’docName’] = [file]
    myDocument[’docText’] = [docData]
    myDocument[’docLen’] = myDocument[’docText’].str.len()

    # For checking purposes
    print(myDocument)

  return myDocument

document = pd.concat(all).reset_index(drop = True)

# Construct the corpus from the text in dataframe, as list of strings
corpus = list(document[’docText’])

# Stopword removal - using Indonesian from NLTK
listStopword =  set(stopwords.words(’indonesian’))
# TFIDF vectorizer
vect = TfidfVectorizer(min_df=1) #, stop_words=none)
tfidf = vect.fit_transform(corpus)
# Compute pairwise similarities
pairwise_similarity = tfidf * tfidf.T

# Convert the sparse array to numpy array
arr = pairwise_similarity.toarray()
# Masking ’1’ as it represents the similarity of each document to itself
np.fill_diagonal(arr, np.nan)
```

We can certainly use the verbatim environment to include codes written in LaTeXsuch as follows:

```
\begin{figure}[!b]
\centering
\begin{tikzpicture}[node distance=2cm]

% Draw all nodes
\node (start) [startstop] {Start};
\node (in1) [io, below of=start] {Input};
\node (pro1) [process, below of=in1] {Process 1};
\node (dec1) [decision, below of=pro1, yshift=-0.5cm] {Decision 1};
\node (pro2a) [process, below of=dec1, yshift=-0.5cm] {Process 2a};
\node (pro2b) [process, right of=dec1, xshift=2cm] {Process 2b};
\node (out1) [io, below of=pro2a] {Output};
\node (stop) [startstop, below of=out1] {Stop};

% Draw arrows
\draw [arrow] (start) -- (in1);
\draw [arrow] (in1) -- (pro1);
\draw [arrow] (pro1) -- (dec1);
\draw [arrow] (dec1) -- (pro2a);
\draw [arrow] (dec1) -- (pro2b);

% Draw arrows with additional anchor information
% to place the annotation
\draw [arrow] (dec1) -- node[anchor=east] {yes} (pro2a);
\draw [arrow] (dec1) -- node[anchor=south] {no} (pro2b);

\draw [arrow] (pro2b) |- (pro1);
\draw [arrow] (pro2a) -- (out1);
\draw [arrow] (out1) -- (stop);

\end{tikzpicture}
\caption{Another flowchart using \LaTeX\ TikZ package}
\label{fig:chartusingtikz}
\end{figure}
```

Note that the above LaTeX code was used to create the flowchart given in Figure 4 (see page 8).

# C Appendix: Using BPMN Chart

Business Process Model and Notation (BPMN) is a graphical representation for specifying business processes in a business process model. It is based on a flowcharting technique very similar to activity diagrams from Unified Modeling Language (UML).

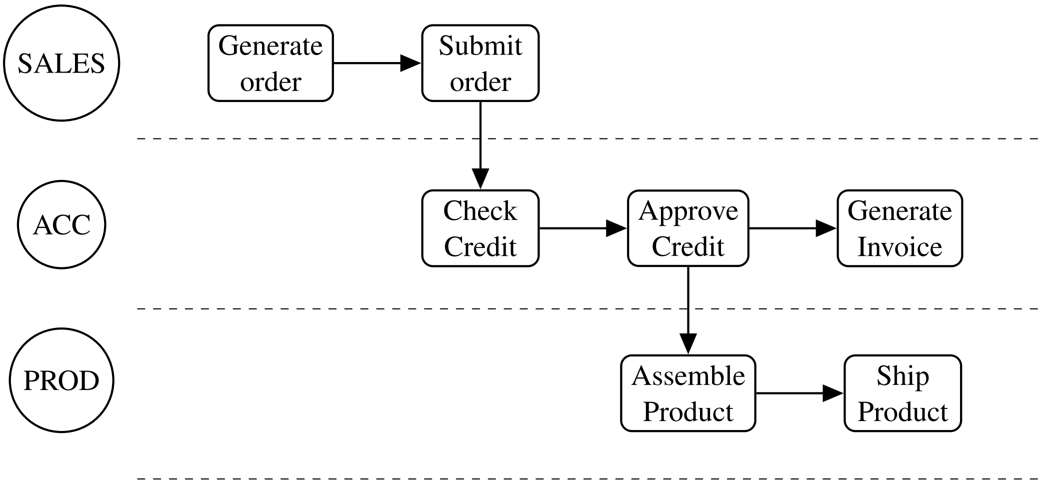

Figure 9: Redrawing of the business process diagram from the MIS textbook

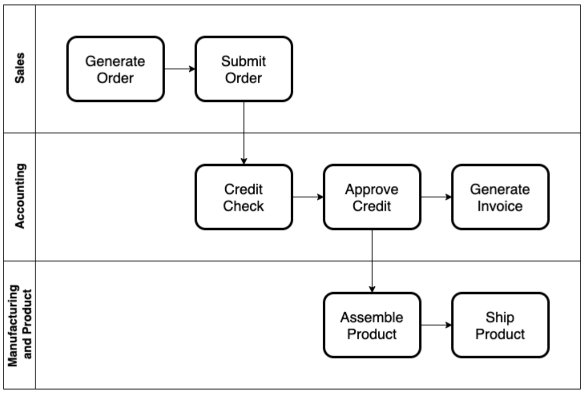

Figure 10: The same business process diagram created using diagrams.net

Natively, in LaTeX we can use a customized `TikZ` style to create such diagram. For example, there are `tikz-bpmn`[10] style or `bpmn-events`[11] style available. An example of simple BPMN diagram created using `tikz-bpmn` is given in Figure 9. By using LaTeX native package such as `TikZ`, we can create diagrams using text and code in an integrated way with the LaTeX editing pipeline, and let the LaTeX backend to handle the rest (ie, produce the actual draw in the document).

Similar approach can also be done using Mermaid Live Editor[12]; it is another tool to create diagrams using text and available online. Further information regarding Mermaid syntax etc can be accessed from https://mermaid-js.github.io/mermaid/

There is also visual-based drawing tool for BPMN; for example, one can use https://www.diagrams.net/ which is also available in various platform in addition to its online version. An example of a BPMN diagram created using the online version of https://www.diagrams.net/ is given in Figure 10. Windows users already familiar with Visio are probably more akin to diagrams.net.

[10] https://github.com/behnaaz/gdeploy/blob/master/francegrilles/tikz-bpmn.sty
[11] https://blog.kubovy.eu/2013/09/30/latex-tikz-bpmn-2-0-events/
[12] https://mermaid-js.github.io/mermaid-live-editor/