VISTEC
VIDYASIRIMEDHI
INSTITUTE OF SCIENCE AND TECHNOLOGY

LaTeX THESIS TEMPLATE: AN UNOFFICIAL VERSION

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A THESIS SUBMITTED TO
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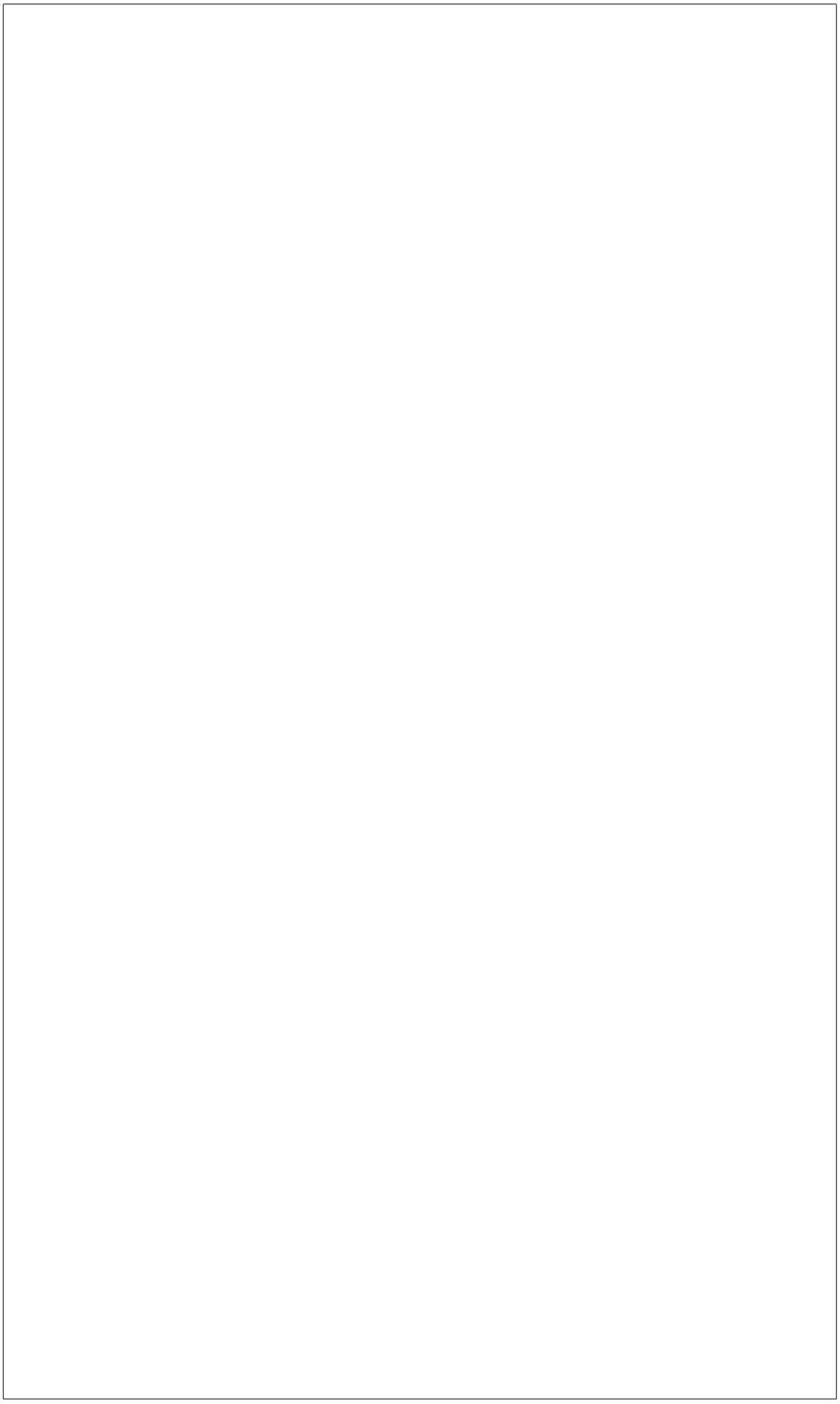

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Vidyasirimedhi Institute of Science and Technology approved this thesis as a partial fulfillment of the requirements for the degree of Doctor of Philosophy in Information Science and Technology.

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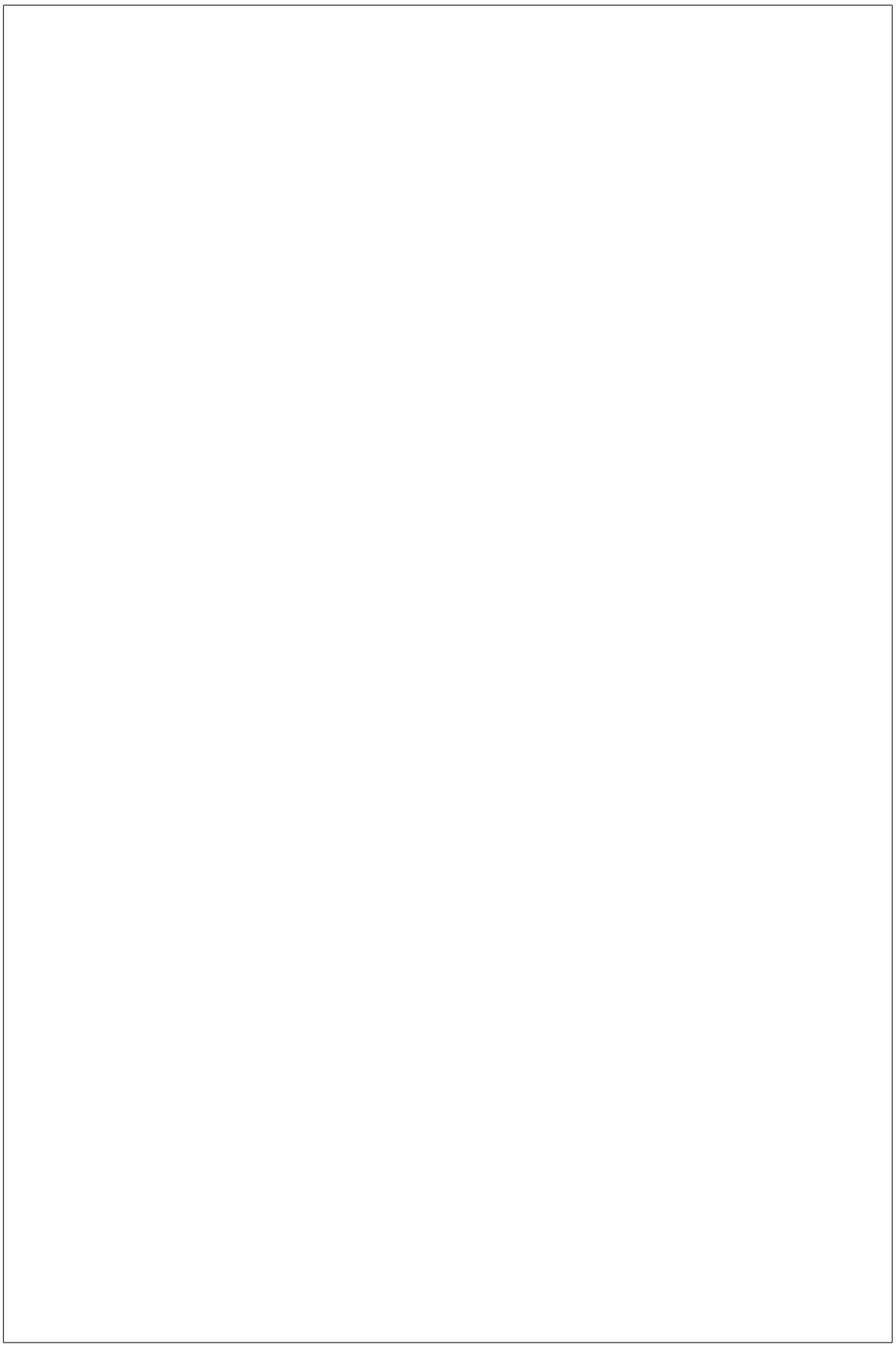

Acknowledgment

I would like to express my sincere gratitude to everyone who has supported me throughout this journey. Completing this thesis has been a long and challenging endeavor, and it would not have been possible without the contributions, encouragement, and belief of many individuals around me.

First and foremost, I am deeply thankful to my advisor, Dr. Jane Smith, for her invaluable guidance, constructive feedback, and constant encouragement throughout the course of my studies. Her mentorship has been instrumental not only in shaping the direction of this research but also in refining my academic thinking, research methodology, and personal growth as a researcher. Her patience, insightful critiques, and continuous motivation have been pivotal in helping me navigate obstacles and stay focused on my goals. I am fortunate to have had the opportunity to learn from her example of academic excellence, integrity, and dedication.

I am also profoundly grateful to the members of the Computational Intelligence Laboratory. The stimulating discussions, technical support, and spirit of collaboration fostered an environment that was both intellectually rigorous and welcoming. Countless brainstorming sessions, coding marathons, and shared frustrations over experimental hurdles made the journey all the more memorable. Their friendship and camaraderie turned the daily grind into a shared adventure, and I feel privileged to have worked alongside such talented individuals.

This thesis was made possible through the generous support of a full scholarship provided by the Vidyasirimedhi Institute of Science and Technology, in collaboration with the PTT Group. Additional support from Siam Commercial Bank and Kasikornbank is also gratefully acknowledged. I would like to express my sincere appreciation for their contributions, which have been instrumental in enabling the completion of this work.

Special thanks are extended to my friends and colleagues, who provided not only technical advice and critical reading of drafts but also much-needed humor, encouragement, and moral support throughout the highs and lows of graduate school. Their constant presence, whether through late-night conversations, spontaneous breaks, or simply shared moments of laughter, was essential in maintaining balance and perspective during the most demanding times.

Most importantly, I owe my deepest appreciation to my family. Their unwavering love, patience, and belief in me have been the bedrock upon which I have built my

academic career. Their sacrifices, understanding, and constant encouragement have been my greatest sources of strength, particularly during moments of doubt and exhaustion. This achievement is as much theirs as it is mine.

In closing, I am profoundly aware that this thesis represents not only my individual efforts but also the collective support, mentorship, and friendship of so many wonderful people. To each of you — thank you from the bottom of my heart. This accomplishment belongs to all of us.

Author Name
10 October 2023

LaTeX Thesis Template: An Unofficial Version

Abstract

Author Name

This abstract presents a dummy content block intended to simulate a real thesis abstract. It spans multiple paragraphs and includes enough text to overflow onto the second page. The purpose of this demonstration is to observe how LaTeX handles hanging indents and vertical spacing, especially in custom environments such as keywords. By designing an extended abstract, it becomes possible to test page layout, margin consistency, and typographic behavior across different environments.

Brain-computer interfaces (BCIs) have emerged as a promising field of research, bridging the gap between neural activity and external device control. In particular, EEG-based BCIs offer a non-invasive and accessible means of communication for individuals with motor impairments. Recent advancements in machine learning and signal processing have significantly improved the performance of BCI systems, yet several challenges remain unresolved, including variability across subjects, limited sample sizes, and signal nonstationarity. Addressing these challenges is essential for developing robust, real-world BCI applications.

This thesis explores a range of approaches for improving EEG-based BCI performance, with a particular emphasis on adaptive learning techniques and multi-task learning frameworks. The investigation begins with a comprehensive review of existing methodologies, identifying key limitations and opportunities for improvement. Following this, a novel experimental design is proposed to systematically evaluate different signal processing pipelines and classification algorithms. Particular attention is given to methods that enhance model generalization across diverse user populations.

Experimental results demonstrate the efficacy of the proposed approaches, revealing notable improvements in classification accuracy and stability across multiple datasets. Statistical analyses validate the significance of these findings, highlighting the potential for adaptive techniques to mitigate inter-subject variability. Furthermore, the implementation of a multi-task learning framework enables the simultaneous optimization of related objectives, further enhancing system performance without substantially increasing computational cost.

In addition to methodological contributions, this thesis also presents a series of

practical guidelines for deploying EEG-based BCI systems in real-world environments. Issues such as user training time, hardware setup, and online adaptation are discussed in detail. Finally, the thesis outlines future research directions, emphasizing the need for interdisciplinary collaboration, the exploration of novel neural decoding strategies, and the ethical considerations inherent to human-computer interaction at the neural level.

In summary, this abstract serves both as a functional test case for LaTeX formatting and as a realistic simulation of a research thesis abstract. It highlights the importance of thorough design, robust experimentation, and careful analysis in the development of next-generation brain-computer interface technologies.

Keywords: No more than 5 words, LaTeX formatting, Thesis template, Abstract layout, Hanging indent.

Contents

Contents (Cont.)

List of Tables

List of Figures

List of Abbreviations

EEG	Electroencephalogram
MI	Motor Imagery
CNN	Convolutional Neural Network
H_2O	Water
DBU	1,8-Diazabicyclo [5.4.0]-7-Undecene

Chapter 1

Introduction

1.1 Motivation

This section describes the research motivation that forms the foundation of the thesis.

1.2 Contributions

This thesis makes the following key contributions:

- We introduce a novel experimental paradigm that addresses key limitations in the current research.
- We propose a novel algorithm that enhances learning performance across multiple tasks.

1.3 Outline

This thesis is organized into the following chapters:

Chapter 1 Introduction: Introduces the research motivation, key contributions, and provides an overview of the thesis structure.

Chapter 2 Background: Provides a comprehensive overview of the fundamental concepts, theoretical foundations, and prior research that form the basis of this thesis.

Chapter 3 How to Use This Template: Offers practical guidance on using the VISTEC LaTeX thesis template, along with examples demonstrating how to format and organize paragraphs, sections, equations, algorithms, tables, figures, citations, and footnotes.

Chapter 4 Investigation: Describes the investigation, expanding upon the results and analysis from the previous study to validate the proposed approaches.

Chapter 5 Conclusion: Summarizes the major findings, discusses their implications, and suggests future research directions.

Appendix A Proofs Supporting Investigation: Presents supplementary materials, including detailed proofs, additional results, and extended discussions that support the main chapters.

Chapter 2

Background

This chapter provides a comprehensive overview of the fundamental concepts, theoretical foundations, and related work that underpin the research presented in this thesis. It serves to establish the necessary background and contextual framework for the subsequent chapters.

2.1 Fundamental Concepts

This section introduces the key concepts relevant to this study. It covers the principles, terminologies, and foundational ideas required to understand the technical contributions of the thesis.

Chapter 3

How to Use This Template

3.1 Overview

This chapter provides guidance on how to effectively use and customize the VISTEC LaTeX thesis template. It explains the general structure, key files, recommended practices, and demonstrates common LaTeX formatting examples such as inserting figures, tables, equations, algorithms, and citations.

3.2 Directory Structure

The template is organized into clearly separated folders and files to simplify management:

- `main.tex` — The main file to compile your thesis.
- `thesisinfo.tex` — Define your title, author information, advisor, and committee.
- `contents/` — Contains all chapter, appendix, and special section files.
- `figures/` — Store all figures, images, and plots used in the thesis.
- `tables/` — Store external table files if needed.
- `bibliography.bib` — Your BibTeX bibliography database.

3.3 Setting Up Document Class Options

The `VISTEC` document class supports several options to customize the thesis according to the degree type, school, and program. Proper configuration of these options ensures that the generated thesis document meets the official formatting standards.

The document class options must be specified in the `main.tex` file.

3.3.1 Required Options

Two required options must be specified when declaring the document class in `main.tex`:

- **Degree Type:**
  - `phd` — for `\degreefield{Doctor of Philosophy}`
  - `master` — for `\degreefield{Master of Engineering}`
- **School and Program:**
  - `ist` — School of Information Science and Technology (Program: Information Science and Technology)
  - `mse` — School of Molecular Science and Engineering (Program: Materials Science and Engineering)
  - `ese` — School of Energy Science and Engineering (Program: Chemical Engineering)
  - `bse` — School of Biomolecular Science and Engineering (Program: Biomolecular Science and Engineering)

If your program is not among the predefined options, you must manually specify the `\degreefield`, `\school`, and `\program` fields in `thesisinfo.tex`.

3.3.2 Optional Options

The document class also provides optional settings that control additional layout features:

- `final` — (default) Compiles the document in its final version.
- `showframe` — Displays page layout frames (e.g., margins, headers, text block areas).
- `showgrid` — Displays a background grid to help visualize element positioning.

These options are useful during the drafting and formatting stages but should be disabled for the final submission. They are set in the document class declaration line in `main.tex`.

3.3.3 Example Usage

The document class options are configured in the preamble of the `main.tex` file. Example configurations include:

- `\documentclass[phd, ist]{VISTEC}`
  Ph.D. thesis, IST School (Information Science and Technology Program)
- `\documentclass[master, mse]{VISTEC}`
  Master's thesis, MSE School (Materials Science and Engineering Program)
- `\documentclass[phd, ese, showframe]{VISTEC}`
  Ph.D. thesis, ESE School (Chemical Engineering Program) with layout frames displayed

3.4 Editing Thesis Metadata

Edit `thesisinfo.tex` to set your thesis title, author name, student ID, academic year, advisor, committee members, and program information. These metadata fields automatically populate the title page, approval page, and other formal sections.

3.5 Adding Content to Chapters

Each main chapter (e.g., Introduction, Background, Investigation, Conclusion) should be placed under `contents/` and included using `\include{}` in `main.tex`. You can create additional chapter files following the provided structure, and organize sections, figures, tables, algorithms, and citations inside them.

3.6 How to Use LaTeX

If you are new to LaTeX, it is recommended to start with basic tutorials to understand fundamental concepts such as document structure, commands, environments, and referencing. A good starting point is the Overleaf online guide available at:

`https://www.overleaf.com/learn`

The Overleaf Learn platform provides comprehensive, beginner-friendly resources

covering topics from basic document setup to advanced formatting and bibliography management. Familiarity with these concepts will significantly improve your ability to customize and work efficiently with this thesis template.

3.7 Compiling the Thesis

Use `pdfLaTeX` as the compiler. A typical compilation sequence includes:

- First, run `pdflatex main.tex` to generate auxiliary files.
- Then, run `bibtex main` to generate the bibliography.
- Finally, run `pdflatex main.tex` twice to resolve cross-references.

Alternatively, tools like `latexmk` or IDEs such as Overleaf, TeXShop, and VS Code with LaTeX Workshop can automate this process.

3.8 Basic Formatting Examples

This section illustrates basic LaTeX formatting examples for headings, equations, algorithms, tables, figures, citations, and footnotes.

3.8.1 Subheadings

This subparagraph provides an example of text placed under a subsection heading. It serves to introduce and briefly describe the specific content or focus of the subsection.

3.8.1.1 Second-Level Subheading

This is a subsubparagraph under the second-level subheading. It is typically used for listing or elaborating fine-grained points.

1) This is the first item in the enumerated list.
2) This is the second item in the enumerated list.
3) This is the third item in the enumerated list.

3.8.2 Equations

The following is an example of formatting mathematical equations. As

illustrated in Equation 3.1, the *Rényi entropy* is defined as:

$$H_\alpha(X) = \frac{1}{1-\alpha} \log \left(\sum_{x \in \mathcal{X}} P[X = x]^\alpha \right). \tag{3.1}$$

3.8.3 Algorithms

Algorithms can be presented using the `algorithmic` package, as shown in Algorithm 3.1.

Algorithm 3.1 An example algorithm with a caption.

Require: $n \geq 0$
Ensure: $y = x^n$
1: $y \leftarrow 1$
2: $X \leftarrow x$
3: $N \leftarrow n$
4: **while** $N \neq 0$ **do**
5: $\quad X \leftarrow X \times X$
6: $\quad N \leftarrow \frac{N}{2}$ ▷ example comment
7: **end while**

3.8.4 Tables

LaTeX table generators, such as TablesGenerator.com, can help you easily create well-formatted tables. See Table 3.1 for an example.

Table 3.1 Classification performance. An asterisk (*) indicates statistically significant results ($p < 0.05$).

Comparison Model	**Subject-independent**	
	Accuracy ± SD	**F1-score ± SD**
FBCSP-SVM	64.96 ± 12.70	65.25 ± 15.14
Deep Convnet	68.33 ± 15.33	70.20 ± 15.18
EEGNet-8,2	68.84 ± 13.87	70.39 ± 14.30
Spectral-Spatial CNN	68.27 ± 13.56	65.86 ± 17.37
MIN2Net	**72.03 ± 14.04***	**72.62 ± 14.14***

3.8.5 Figures

Figures can be included using the `graphicx` package. Example shown in

Figure 3.1 and Figure 3.2.

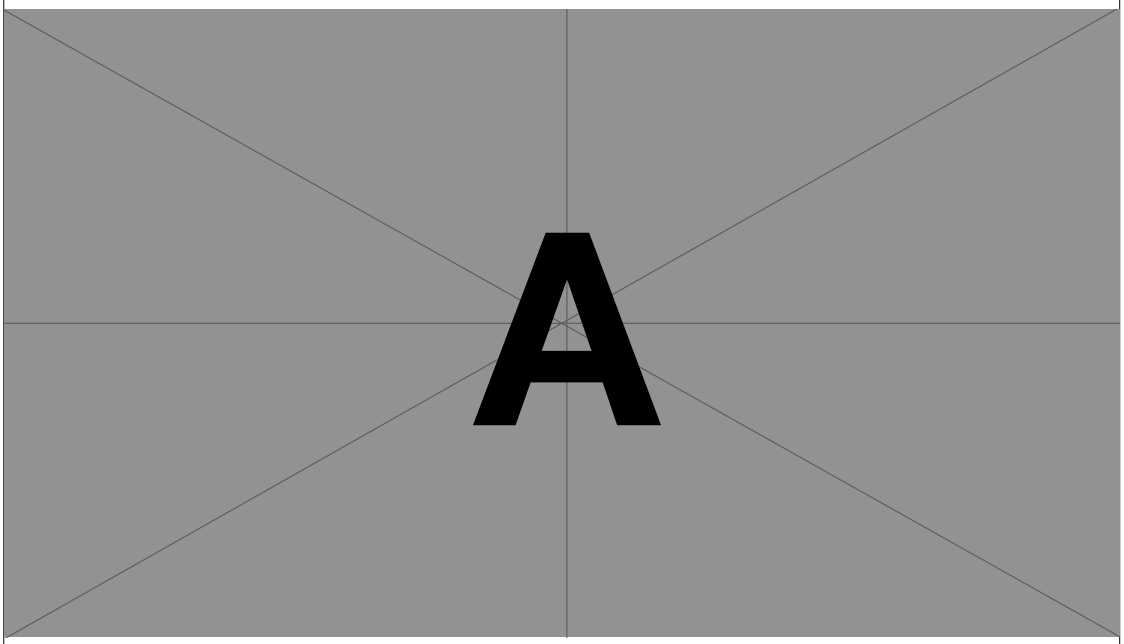

Figure 3.1 Example figure with long caption. This figure demonstrates how to include a standard image (e.g., PDF, PNG, JPG) into your document. Long captions should be aligned properly.

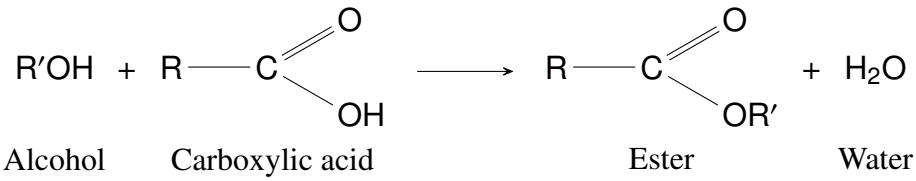

Figure 3.2 An esterification reaction illustrated using the `chemfig` package.

3.8.6 Citations

To cite references, use `\cite{}`, such as [1], or multiple sources like [2–4]. Ensure that the corresponding BibTeX entries are added to the `bibliography.bib` file before citing. Below is an example BibTeX entry:

```
@ARTICLE{dummy2022example,
  author  = {Doe, John and Smith, Jane and Roe, Richard},
  journal = {Journal of Example Studies},
  title   = {A Dummy Title for Demonstration Purposes},
  year    = {2022},
```

```
  volume  = {42},
  number  = {1},
  pages   = {1--10}
}
```

3.8.7 Footnotes

You can insert a footnote marker using `\footnotemark`[1] and define the text later with `\footnotetext{Example footnote.}`

[1] Example footnote.

Chapter 4

Investigation

4.1 Overview of the Investigation

This section provides an overview of the investigation conducted in this study, including the research methodology, experimental setup, and analysis approach used to validate the proposed methods.

Chapter 5

Conclusion

This chapter concludes the thesis by summarizing the key findings, discussing their implications, and outlining potential future directions for research in the field.

References

1. Author O, Author T, and Author F. A Placeholder Title for Demonstration Purposes. **Journal of Placeholder Research** 2022;99(9):100–10.
2. Author A and Author B. **A Dummy Book Title for Example Use**. Fictional Press, 1979.
3. Author F, Author B, and Baz A. Simulated Study on EEG Activity in Hypothetical Conditions. **Journal of Experimental Interfaces** 2020;55(8):8888–99.
4. Author O, Author B, and Author G. Sample Article on Deep Learning for EEG. **Journal of Artificial Neuroscience** 2017;12(4):321–40.

Appendix A

Proofs Supporting Investigation

A.1 Proof of Lemma

This section presents the detailed proof of the lemma introduced in Chapter 4. The proof follows standard mathematical derivation steps and verifies the correctness of the stated result.

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Academic Publication:	Author O, Author T, and Author F. A Placeholder Title for Demonstration Purposes. **Journal of Placeholder Research** 2022;99(9):100–10.
	Author O, Author B, and Author G. Sample Article on Deep Learning for EEG. **Journal of Artificial Neuroscience** 2017;12(4):321–40.
	Author R, Author O, and Author B. **A Sample Conference Paper on Face Recognition**. In: Proceedings of the International Conference on Vision Research. 2015:101–10.