VISTEC

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INSTITUTE OF SCIENCE AND TECHNOLOGY

VISTEC THESIS TEMPLATE:
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Author Name
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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.

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

Contents

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

Brain-Computer Interfaces (BCIs) have emerged as a transformative technology enabling direct communication between the human brain and external devices. This field holds immense potential for applications in assistive technologies, neurorehabilitation, and human-computer interaction, offering new hope for individuals with motor disabilities. However, designing effective BCIs remains challenging due to the inherent variability in brain signals, the presence of noise, and the limited availability of high-quality datasets.

Despite significant advancements in machine learning and signal processing, many current BCI systems struggle with generalization across users, sessions, and tasks. Addressing these challenges requires innovative approaches to improve robustness, adaptability, and scalability. This thesis is motivated by the need to develop methodologies that not only enhance the performance of EEG-based BCIs but also make them more reliable and practical for real-world deployment.

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 Introduces the research motivation, key contributions, and provides an overview of the thesis structure.

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

Chapter 3 Illustrates standardized formatting examples for a VISTEC thesis, covering headings, equations, algorithms, tables, figures, citations, and footnotes to ensure consistency throughout the document.

Chapter 4 Offers Investigations into the proposed experimental paradigm and algorithm, detailing the methodology, results, and analysis.

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

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

Chapter 2

Background

2.1 Overview

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.

2.2 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

VISTEC Thesis Formatting

3.1 Overview

This chapter presents examples of standardized formatting for a VISTEC thesis, including guidelines for headings, equations, algorithms, tables, figures, citations, and footnotes. Each example demonstrates the intended structure and style to ensure consistency throughout the document.

3.2 Headings

This section provides an example of a paragraph placed under a main section heading. It is used to introduce and briefly describe the topic or content area that will be elaborated upon in the following subsections. Use `\autoref{ch3:subheadings}` to refer to Section 3.2.1.

3.2.1 Subheadings

This subsection demonstrates the formatting for subheadings. Text under a subheading serves to further detail specific aspects of the main section, offering a more focused discussion within the broader topic.

3.2.1.1 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.

3.3 Equations

The following is an example of formatting mathematical equations. As illustrated in Equation 3.1, the *Rényi entropy* is defined as:

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

3.4 Figures

Figures can be included easily using the `graphicx` package. Example shown in Figure 3.1 and Figure 3.2.

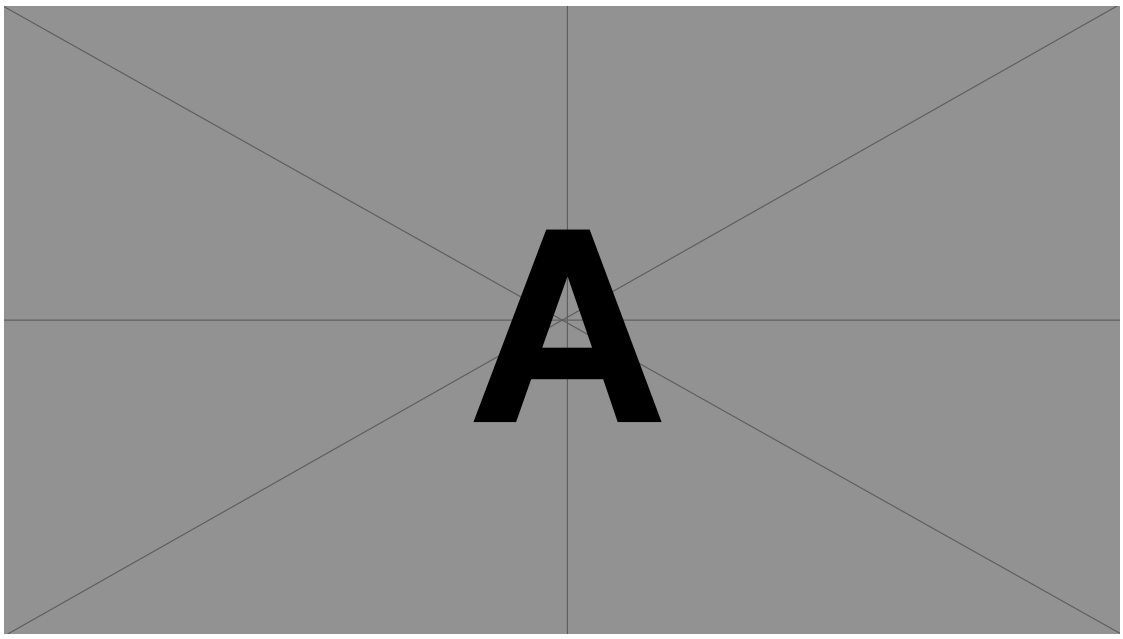

Figure 3.1 Example figure with long caption. This figure demonstrates how to include a standard image (e.g., PDF, PNG, JPG) into your document. Long captions should be aligned properly.

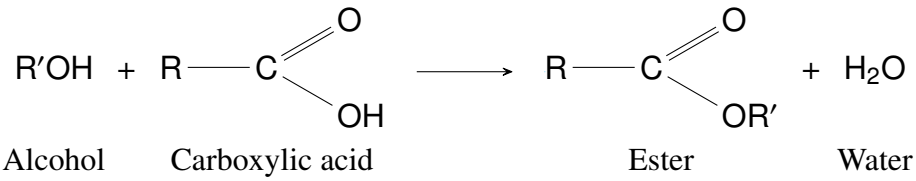

Figure 3.2 An esterification reaction illustrated using the `chemfig` package.

3.5 Tables

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

3.6 Algorithms

Algorithms can be presented using the `algorithmic` package, as shown in Algo-

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***

rithm 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**

3.7 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:

File: `contents/chapter4.tex`

```
1    To cite references, use \cite{}, such as \cite{id1}, or multiple
     ↪  sources like \cite{id2, id3, id4}. Ensure that the corresponding
     ↪  BibTeX entries are added to the \texttt{bibliography.bib} file
     ↪  before citing. Below is an example BibTeX entry:
```

File: `bibliography.bib`

```
@ARTICLE{id1,
  author  = {Author, One and Author, Two and Author, Four},
  journal = {Journal of Placeholder Research},
  title   = {A Placeholder Title for Demonstration Purposes},
  year    = {2022},
  volume  = {99},
  number  = {9},
  pages   = {100--110},
}
```

3.8 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 Introduction

This chapter presents the investigations into the proposed experimental paradigm and algorithm. It details the methodology, results, and analysis, providing a comprehensive understanding of the research conducted. The findings are discussed in the context of their implications for the field of Brain-Computer Interfaces (BCIs) and their potential applications.

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.

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4. Author O, Author B, and Author G. Sample Article on Deep Learning for EEG. **Journal of Artificial Neuroscience**. 2017;12(4):321–340.

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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	Author X and Author Y. An Example Article on Conceptual Theories. **Imaginary Journal of Computation**. 1959;5(3):45–60.
	Author R, Author O, and Author B. **A Sample Conference Paper on Face Recognition**. Proceedings of the International Conference on Vision Research; 2015. p. 101–110.