



VISTEC THESIS TEMPLATE:  
A COMPLETE LATEX THESIS PREPARATION VERSION 1

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A THESIS SUBMITTED TO  
VIDYASIRIMEDHI INSTITUTE OF SCIENCE AND TECHNOLOGY  
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR  
THE DEGREE OF DOCTOR OF PHILOSOPHY  
IN INFORMATION SCIENCE AND TECHNOLOGY

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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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VISTEC Thesis Template:  
A Complete LaTeX Thesis Preparation Version 1

**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  $\text{\LaTeX}$  handles hanging indents and vertical spacing, especially in custom environments such as keywords.

Keywords: No more than 5 words,  $\text{\LaTeX}$  formatting, Thesis template, Abstract layout,  
Hanging indent.

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## Acknowledgment

I would like to express my sincere gratitude to everyone who has supported me throughout this journey.

First and foremost, I am deeply thankful to my advisor, Dr. Jane Smith, for her invaluable guidance, constructive feedback, and constant encouragement. Her mentorship has been instrumental in shaping both the direction of this research and my development as a researcher.

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Special thanks to my friends and colleagues, whose humor, advice, and moral support helped me maintain perspective during stressful times.

Lastly, I owe my deepest appreciation to my family for their unwavering belief in me. Their love and patience provided the foundation that carried me through the ups and downs of graduate life.

This work would not have been possible without all of you.

Author Name  
30 April 2025

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## Contents

|  | Page |
|--|------|
| Abstract .....                                   | ii   |
| Acknowledgment .....                             | iii  |
| List of Tables .....                             | v    |
| List of Figures .....                            | vi   |
| List of Abbreviations .....                      | vii  |
| Chapter 1 Introduction .....                     | 1    |
| 1.1 Motivation .....                             | 1    |
| 1.2 Contributions .....                          | 1    |
| 1.3 Outline .....                                | 1    |
| Chapter 2 Background.....                        | 3    |
| 2.1 Overview .....                               | 3    |
| 2.2 Fundamental Concepts .....                   | 3    |
| Chapter 3 VISTEC Thesis Formatting .....         | 4    |
| 3.1 Overview .....                               | 4    |
| 3.2 Headings.....                                | 4    |
| 3.2.1 Subheadings .....                          | 4    |
| 3.3 Equations .....                              | 4    |
| 3.4 Figures .....                                | 5    |
| 3.5 Tables.....                                  | 5    |
| 3.6 Algorithms .....                             | 6    |
| 3.7 Citations.....                               | 6    |
| 3.8 Footnotes .....                              | 7    |
| Chapter 4 Investigation.....                     | 8    |
| 4.1 Introduction .....                           | 8    |
| Chapter 5 Conclusion .....                       | 9    |
| References .....                                 | 10   |
| Appendix A Proofs Supporting Investigation ..... | 11   |
| A.1 Proof of Lemma.....                          | 11   |
| A.2 Proof of Lemma.....                          | 11   |
| A.2.1 Proof of Lemma .....                       | 11   |
| Author's Biography.....                          | 12   |

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## List of Tables

| Table |   | Page |
|-------|---|------|
| 3.1   | Classification performance. An asterisk (*) indicates statistically significant results ( $p < 0.05$ ). | 6    |

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## List of Figures

| Figure |  | Page |
|--------|--|------|
| 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. | 5    |
| 3.2    | An esterification reaction illustrated using the <code>chemfig</code> package.   | 5    |

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## List of Abbreviations

|                  |                                    |
|------------------|------------------------------------|
| EEG              | Electroencephalogram               |
| MI               | Motor Imagery                      |
| CNN              | Convolutional Neural Network       |
| H <sub>2</sub> O | Water                              |
| DBU              | 1,8-Diazabicyclo[5.4.0]-7-undecene |



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# 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.

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**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.

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## 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.

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## 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.

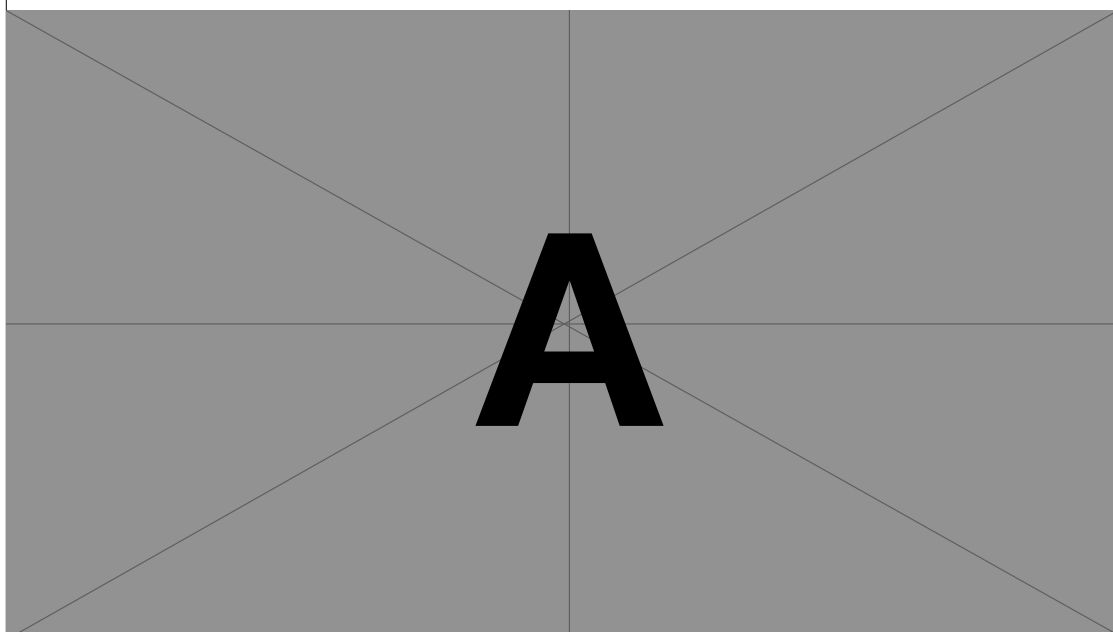
#### 3.3 Equations

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

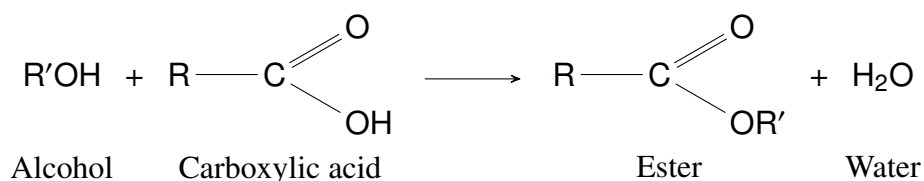
$$H_{\alpha}(X) = \frac{1}{1-\alpha} \log \left( \sum_{x \in \mathcal{X}} P[X=x]^{\alpha} \right). \quad (3.1)$$

### 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

$\text{\LaTeX}$  table generators, such as [TablesGenerator.com](http://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 $\pm$ SD                    | F1-score $\pm$ SD                    |
| FBCSP-SVM            | 64.96 $\pm$ 12.70                    | 65.25 $\pm$ 15.14                    |
| Deep Convnet         | 68.33 $\pm$ 15.33                    | 70.20 $\pm$ 15.18                    |
| EEGNet-8,2           | 68.84 $\pm$ 13.87                    | 70.39 $\pm$ 14.30                    |
| Spectral-Spatial CNN | 68.27 $\pm$ 13.56                    | 65.86 $\pm$ 17.37                    |
| MIN2Net              | <b>72.03 <math>\pm</math> 14.04*</b> | <b>72.62 <math>\pm</math> 14.14*</b> |

### 3.6 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:      $X \leftarrow X \times X$   
6:      $N \leftarrow \frac{N}{2}$  ▷ 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:

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**File:** bibliography.bib

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

### 3.8 Footnotes

You can insert a footnote marker using `\footnotemark1` and define the text later with `\footnotetext{Example footnote.}`

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<sup>1</sup>Example footnote.

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## **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.



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## 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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## References

1. Author O, Author T, and Author F. A Placeholder Title for Demonstration Purposes. **Journal of Placeholder Research**. 2022;99(9):100–110.
2. Author A and Author B. **A Dummy Book Title for Example Use**. Fictional Press, 1979.
3. Author X and Author Y. An Example Article on Conceptual Theories. **Imaginary Journal of Computation**. 1959;5(3):45–60.
4. Author O, Author B, and Author G. Sample Article on Deep Learning for EEG. **Journal of Artificial Neuroscience**. 2017;12(4):321–340.

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## **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.

#### **A.2 Proof of Lemma**

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##### **A.2.1.1 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's Biography

|                              |  |
|------------------------------|--|
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| <b>Academic Publication:</b> | <p>Author O, Author T, and Author F. A Placeholder Title for Demonstration Purposes. <b>Journal of Placeholder Research</b>. 2022;99(9):100–110.</p> <p>Author X and Author Y. An Example Article on Conceptual Theories. <b>Imaginary Journal of Computation</b>. 1959;5(3):45–60.</p> <p>Author R, Author O, and Author B. <b>A Sample Conference Paper on Face Recognition</b>. Proceedings of the International Conference on Vision Research; 2015. p. 101–110.</p> |

