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Submitted by

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*B. Eng. (ABC Uni)*

A dissertation submitted in partial fulfilment of the  
requirements for the degree of  
Master of Science in Engineering  
(Electrical and Electronic Engineering)

At the

Department of Electrical and Computer Engineering  
The University of Hong Kong

In

July 2026

## **ABSTRACT**

The abstract should be suitable for direct inclusion in abstracting services as a self-contained article. The length of the abstract should not exceed 1 page. Do not include figure numbers, table numbers, references or displayed mathematical expressions. Provide the abstract word count.

**Abstract Word Count:** XXX

## DECLARATION

I declare that this dissertation represents my own work, except where due acknowledgment is made, and that it has not been previously included in a thesis, dissertation or report submitted to this University or to any other institution for a degree, diploma or other qualifications.

Signature: Signature

CHAN TAI MAN

Date: 6<sup>th</sup> July 2026

## **ACKNOWLEDGEMENT**

I would like to express my sincere gratitude to all those who contributed to the completion of this thesis.

First and foremost, I would like to thank Prof. Supervisor Name for their invaluable guidance, patience, and constant encouragement throughout the course of this research. Their insightful feedback and deep expertise were indispensable in shaping the direction and quality of this work.

Finally, I am deeply grateful to my family for their constant love, patience, and belief in me. This thesis would not have been possible without their unwavering support.

Thank you to everyone who contributed directly or indirectly to this work.

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## LIST OF SYMBOLS

Symbol	Description	Unit
<i>Roman Symbols</i>		
$\mathbf{x}$	Input feature vector	—
$\mathbf{X}$	Input/design matrix	—
$\mathbf{Y}$	Response (label) vector	—
$\mathbf{W}$	Weight matrix	—
$f(\cdot)$	Classifier / mapping function	—
$n$	Number of training samples	—
$p$	Number of features	—
$J(\cdot)$	Loss / objective function	—
<i>Greek Symbols</i>		
$\alpha$	Learning rate	—
$\lambda$	Regularisation parameter	—
$\mu$	Mean value	—
$\sigma$	Standard deviation	—
$\theta$	Model parameter vector	—
$\epsilon$	Error / residual term	—
<i>Special Notation</i>		
$\ \cdot\ _2$	Euclidean ( $l_2$ ) norm	—
$(\cdot)^T$	Matrix / vector transpose	—
$\mathbb{R}$	Set of real numbers	—
$\nabla$	Gradient operator	—

# Chapter 1 Introduction

This is the introduction of the dissertation. Replace this placeholder text with your own content.

This dissertation explores methods in machine learning (ML) with a focus on artificial intelligence (AI), the Internet of Things (IoT), long short-term memory (LSTM), and support vector machine (SVM) architectures. A key challenge is overfitting, addressed via regularisation.

Equations are numbered by chapter:

$$y = \mathbf{w}^\top \mathbf{x} + b, \quad (1.1)$$

where  $\mathbf{w}$  is the weight vector and  $b$  is the bias.

$$\mathbf{W} = \arg \min_{\mathbf{W}} \|\mathbf{Y} - \mathbf{XW}\|_F^2 + \lambda \|\mathbf{W}\|_F^2. \quad (1.2)$$

## 1.1 General Background

Provide broad background on your research area here. The use of AI in engineering has grown significantly, with convolutional neural network (CNN) and LSTM models becoming standard tools.

## 1.2 Motivation and Contribution

Describe your motivation and key contributions here.

- Contribution 1: Description of the first contribution.
- Contribution 2: Description of the second contribution.
- Contribution 3: Description of the third contribution.

### **1.3 Outline**

Chapter 2 reviews related work. Chapter 3 presents the proposed methodology. Chapter 4 reports experimental results. Chapter 5 concludes the dissertation.

## Chapter 2 Literature Review

A classifier  $f(\cdot)$  is a function or mapping which returns for a feature vector  $\mathbf{x}$  the membership function  $y$  that belongs to a given set  $S$ . The membership function can either be a soft decision where  $y \in [0, 1]$ , or a hard decision where  $S$  consists of discrete labels of different classes [4].

Table 2.1 shows an example of a table. Fig. 2.1 shows an example of a figure.

**Table 2.1** Title for Table 2.1

<b>Method</b>	<b>Metric A</b>	<b>Metric B</b>
Method 1	0.85	0.76
Method 2	0.88	0.79
Method 3	<b>0.91</b>	<b>0.83</b>



**Figure 2.1** Title for Figure 2.1

### 2.1 This is Section 2.1

This is an example section. Replace with your own literature review content discussing the relevant works in your research area.

#### 2.1.1 *Naïve Bayes Classifier*

Describe the Naïve Bayes classifier here. Cite relevant works as needed [1].

#### 2.1.2 *Fisher's Linear Discriminant*

Describe Fisher's Linear Discriminant Analysis here [2].

**2.2 This is Section 2.2**

Continue your literature review here.

**2.3 This is Section 2.3**

Continue your literature review here.

## Chapter 3 Proposed Methodology

This chapter describes the proposed methodology. Describe your approach, algorithms, and theoretical framework here.

### 3.1 Pre-processing

Describe how raw data is collected, cleaned, normalised, and prepared before being fed into your model.

### 3.2 Proposed Method

Let  $\mathbf{X} = [\mathbf{x}_1, \dots, \mathbf{x}_n]^\top \in \mathbb{R}^{n \times p}$  denote the data matrix. The objective is to minimise the following regularised loss:

$$\min_{\boldsymbol{\beta}} \frac{1}{n} \sum_{i=1}^n \ell(y_i, \mathbf{x}_i^\top \boldsymbol{\beta}) + \lambda \Omega(\boldsymbol{\beta}), \quad (3.1)$$

where  $\ell(\cdot, \cdot)$  is a loss function and  $\Omega(\boldsymbol{\beta})$  is a regularisation term.

**Initialisation:**

$$\boldsymbol{\beta}^{(0)} = \mathbf{0}, \quad \mathbf{r}^{(0)} = \mathbf{y} - \mathbf{X}\boldsymbol{\beta}^{(0)}. \quad (3.2)$$

**Recursive step:** For  $t = 1, 2, \dots, T$ :

$$\boldsymbol{\beta}^{(t)} = \boldsymbol{\beta}^{(t-1)} - \eta \nabla_{\boldsymbol{\beta}} \mathcal{L}(\boldsymbol{\beta}^{(t-1)}), \quad (3.3)$$

where  $\eta > 0$  is the learning rate.

## Chapter 4 Experimental Results

This chapter presents the experimental evaluation of the proposed approach. Experiments are conducted on publicly available benchmark datasets. Results are reported using standard evaluation metrics.

### 4.1 Experimental Settings

Describe datasets, evaluation metrics, baselines, and implementation details here.

### 4.2 Comparison with State-of-the-Art Algorithms

Table 4.1 summarises the main quantitative results.

**Table 4.1** Title for Table 4.1

<b>Method</b>	<b>Dataset A</b>	<b>Dataset B</b>
Baseline 1	78.3	72.1
Baseline 2	81.5	75.6
Proposed	<b>85.2</b>	<b>80.3</b>

### 4.3 Discussion

Analyse and interpret your results here.

## **Chapter 5 Conclusion**

This is my conclusion. Replace with a summary of the key findings, contributions, limitations, and future directions of your work.

### **5.1 Summary**

Summarise the main contributions of this dissertation.

### **5.2 Future Work**

Describe directions for future research here.

## REFERENCES

- [1] S. Serneels, C. Croux, P. Filzmoser, and P. J. Van Espen, “Partial robust M-regression,” *Chemometrics and Intelligent Laboratory Systems*, vol. 79, no. 1–2, pp. 55–64, 2005.
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- [3] S. C. Chan, “Partial least squares,” *Internal Technical Report*, Dept. of Electrical and Electronics Engineering, University of Hong Kong, 2009.
- [4] R. A. Maronna, R. D. Martin, and V. J. Yohai, *Robust Statistics: Theory and Methods*. Wiley, Chichester, 2006.

## **Appendix A   Supplementary Data**

This appendix contains supplementary data, extended derivations, or additional experimental results that support the main body of the dissertation.

## **Appendix B Implementation Details**

This appendix provides implementation details, pseudocode, or source code listings relevant to the work described in this dissertation.