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by

Your Full Name

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

Major: Your Major

Academic Plan Committee:
John Doe, Co-Major Professor
Jane Doe, Co-major Professor
Arthur Conan Doyle
Leslie Lamport
Dalai Lama

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Iowa State University
Ames, Iowa
2026

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DEDICATION

I would like to dedicate this thesis to my wife Glenda and to my daughter Alice without whose support I would not have been able to complete this work.

TABLE OF CONTENTS

LIST OF TABLES v

LIST OF FIGURES vi

NOMENCLATURE vii

ACKNOWLEDGMENTS viii

ABSTRACT ix

CHAPTER 1. GENERAL INTRODUCTION 1
1.1 Overview 1
1.1.1 Hypothesis 1
1.1.2 Second Hypothesis 1
1.2 Criteria Review 2
1.3 References 2

CHAPTER 2. PAPER 1 TITLE 3
2.1 Abstract 3
2.2 Overview 3
2.3 Introduction 3
2.3.1 Hypothesis 4
2.3.2 Second Hypothesis 4
2.4 Criteria Review 4
2.5 Conclusion 4
2.6 References 5
2.7 Appendix A: Appendix A Title Goes Here After The Colon 5
2.7.1 Procedure details 5
2.8 Appendix B: Appendix B Title Goes Here After The Colon 5
2.8.1 Procedure details 6

CHAPTER 3. PAPER 2 TITLE 7
3.1 Abstract 7
3.2 Overview 7
3.3 Introduction 7
3.3.1 Hypothesis 8
3.3.2 Second Hypothesis 8
3.4 Criteria Review 8

3.5 Conclusion . . . 8
3.6 References . . . 9
3.7 Appendix: Appendix Title Goes Here . . . 9
3.7.1 Procedure details . . . 9

CHAPTER 4. PAPER 3 TITLE . . . 10
4.1 Abstract . . . 10
4.2 Methods and procedures . . . 10
4.3 Introduction . . . 10
4.3.1 Hypothesis . . . 11
4.3.2 Second Hypothesis . . . 12
4.4 Criteria Review . . . 12
4.5 Results . . . 13
4.6 Conclusion . . . 13
4.7 References . . . 13
4.8 Appendix: Appendix Title Goes Here . . . 13
4.8.1 Procedure details . . . 13

CHAPTER 5. PAPER 4 TITLE . . . 14
5.1 Abstract . . . 14
5.2 Overview . . . 14
5.3 Introduction . . . 14
5.3.1 Hypothesis . . . 15
5.3.2 Second Hypothesis . . . 16
5.4 Criteria Review . . . 16
5.5 Results . . . 16
5.6 Conclusion . . . 16
5.6.1 Procedure details . . . 16
5.7 References . . . 16
5.8 Appendix: Appendix title goes here . . . 17
5.8.1 Procedure details . . . 17

CHAPTER 6. GENERAL CONCLUSION . . . 18
6.1 Summary And Discussion . . . 18
6.1.1 Hypothesis . . . 18
6.2 References . . . 20

LIST OF TABLES

Table 4.1 Simple table. 11
Table 4.2 Table with internal notes. 12

Table 5.1 Table with irregular header rows. 15

Table 6.1 Wide table example. 19

LIST OF FIGURES

Figure 4.1 This figure shows a standard sample image. 11

Figure 5.1 An example of the use of subfigures. 15

NOMENCLATURE

The nomenclature for your dissertation or thesis is optional. This list may be placed in the following places: as the last preliminary page, before the Reference section, or as an Appendix. The heading is bold if other major headings are bold, and the list is in the same font size and style as text. Nomenclature should follow a two-column format with the term in the left column and its definition or description within the right column.

Number Sets

$\mathbb{C}$ Complex Numbers

$\mathbb{H}$ Quaternions

$\mathbb{R}$ Real Numbers

Other Symbols

ρ Friction Index

V Constant Volume

Physics Constants

c Speed of light in a vacuum inertial system

g Gravitational Constant

h Plank Constant

ACKNOWLEDGMENTS

I would like to take this opportunity to express my thanks to those who helped me with various aspects of conducting research and the writing of this thesis. First and foremost, Dr. Susan D. Ross for her guidance, patience and support throughout this research and the writing of this thesis. Her insights and words of encouragement have often inspired me and renewed my hopes for completing my graduate education. I would also like to thank my committee members for their efforts and contributions to this work: Dr. August Tanner and Dr. Lewis Hargrave. I would additionally like to thank Dr. Tanner for his guidance throughout the initial stages of my graduate career and Dr. Hargrave for his inspirational teaching style.

ABSTRACT

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in general and the heading and style match the rest of the document.

CHAPTER 1. GENERAL INTRODUCTION

This chapter will have the introduction to your thesis as a whole. This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis. With more general information given here than really necessary.

1.1 Overview

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

1.1.1 Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

1.1.1.1 Parts of the hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

1.1.2 Second Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

1.1.2.1 Parts of the second hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny Allen 1984, Bruner 1960, Vallée Poussin 1900.

1.2 Criteria Review

Here certain criteria are explained thus eventually leading to a foregone conclusion.

1.3 References

Allen, B. S. (1984). "System-assigned learning strategies and CBI." In: *Journal of Instructional Computing Research* 1.1, pp. 3–18.

Bruner, J. (1960). *The process of education*. New York: Random House.

Vallée Poussin, Charles Louis Xavier Joseph de la (1900). A strong form of the prime number theorem, 19th century.

CHAPTER 2. PAPER 1 TITLE

Authors and Affiliations

Modified from a manuscript to be submitted to/ under review/ published in *Name of the Journal*

2.1 Abstract

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in the first paper in general terms. You can use the same abstract as your paper here.

The inclusion of an abstract for these papers is a recommended convention, but is not a strict requirement.

2.2 Overview

The construct of this section or any further section is same as the authors paper. This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis. With more general information given here than really necessary.

2.3 Introduction

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

Allen 1984, Bruner 1960 and Cox 1974 did the initial work in this area. But in Struss' work [Struss 1996] the definitive model is seen.

2.3.1 Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

2.3.1.1 Parts of the hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

2.3.2 Second Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

2.3.2.1 Parts of the second hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

2.4 Criteria Review

Here certain criteria are explained thus eventually leading to a foregone conclusion.

2.5 Conclusion

The conclusion of the paper goes here. Cox 1974, Ancey et al. 1996, Radjavi and Rosenthal 1973, Aupetit 1991, Douglas 1972

2.6 References

Allen, B. S. (1984). "System-assigned learning strategies and CBI." In: *Journal of Instructional Computing Research* 1.1, pp. 3–18.

Bruner, J. (1960). *The process of education*. New York: Random House.

Cox, S. R. (1974). "Computer-assisted instruction and student performance in macroeconomic principles." In: *The Journal of Economic Education* 6.1, pp. 29–37.

Struss, Joseph A. (1996). "An investigation of the sequence of utilizing a simulation in an introductory programming course." Master's thesis. Iowa State University.

Ancey, Christophe, Philippe Coussot, and Pierre Evesque (1996). "Examination of the possibility of a fluid-mechanics treatment of dense granular flows." In: *Mechanics of Cohesive-frictional Materials* 1.4, pp. 385–403. URL: http://doi.wiley.com/10.1002/(SICI)1099-1484(199610)1:4%3C385::AID-CFM20%3E3.0.CO;2-0.

Radjavi, H. and P. Rosenthal (1973). *Invariant Subspaces*. New York: Springer-Verlag.

Aupetit, B. (1991). *A Primer on Spectral Theory*. New York: Springer-Verlag.

Douglas, R. G. (1972). *Banach Algebra Techniques in Operator Theory*. New York: Academic Press.

2.7 Appendix A: Appendix A Title Goes Here After The Colon

If there is an appendix that needs to go with the paper it can be as a section Aupetit 1991

2.7.1 Procedure details

Details of the paper specific appendix procedures

2.8 Appendix B: Appendix B Title Goes Here After The Colon

If there is an appendix that needs to go with the paper it can be as a section Aupetit 1991

2.8.1 Procedure details

Details of the paper specific appendix procedures

CHAPTER 3. PAPER 2 TITLE

Authors and Affiliations

Modified from a manuscript to be submitted to/ under review/ published in *Name of the Journal*

3.1 Abstract

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in the second paper in general terms. You can use the same abstract as your paper here.

The inclusion of an abstract for these papers is a recommended convention, but is not a strict requirement.

3.2 Overview

The construct of this section or any further section is same as the authors paper. This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis. With more general information given here than really necessary.

3.3 Introduction

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

Allen 1984, Bruner 1960 and Cox 1974 did the initial work in this area. But in Struss' work [Struss 1996] the definitive model is seen.

3.3.1 Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

3.3.1.1 Parts of the hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

3.3.2 Second Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

3.3.2.1 Parts of the second hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

3.4 Criteria Review

Here certain criteria are explained thus eventually leading to a foregone conclusion.

3.5 Conclusion

The conclusion of the paper goes here.

Allen 1984, Bruner 1960, Halmos 1982, Rudin 1973, Conway 1990, Conway 1978, Kadison and Ringrose 1983, Kadison and Ringrose 1986

3.6 References

Allen, B. S. (1984). "System-assigned learning strategies and CBI." In: *Journal of Instructional Computing Research* 1.1, pp. 3–18.

Bruner, J. (1960). *The process of education*. New York: Random House.

Cox, S. R. (1974). "Computer-assisted instruction and student performance in macroeconomic principles." In: *The Journal of Economic Education* 6.1, pp. 29–37.

Struss, Joseph A. (1996). "An investigation of the sequence of utilizing a simulation in an introductory programming course." Master's thesis. Iowa State University.

Halmos, P. R. (1982). *A Hilbert Space Problem Book*. Second. New York: Springer-Verlag.

Rudin, W. (1973). *Functional Analysis*. New York: McGraw-Hill.

Conway, J. B. (1990). *A Course in Functional Analysis*. Second. New York: Springer-Verlag.

— (1978). *Functions of One Complex Variable*. New York: Springer-Verlag.

Kadison, R. V. and J. R. Ringrose (1983). *Fundamentals of the Theory of Operator Algebras, Part I*. New York: Academic Press.

— (1986). *Fundamentals of the Theory of Operator Algebras, Part II*. New York: Academic Press.

Aupetit, B. (1991). *A Primer on Spectral Theory*. New York: Springer-Verlag.

3.7 Appendix: Appendix Title Goes Here

If there is an appendix that needs to go with the paper it can be as a section Aupetit 1991

3.7.1 Procedure details

Details of the paper specific appendix procedures

CHAPTER 4. PAPER 3 TITLE

Authors and Affiliations

Modified from a manuscript to be submitted to/ under review/ published in *Name of the Journal*

4.1 Abstract

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in the third paper in general terms. You can use the same abstract as your paper here.

The inclusion of an abstract for these papers is a recommended convention, but is not a strict requirement.

4.2 Methods and procedures

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis. With more general information given here than really necessary.

4.3 Introduction

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

As can be seen in Table 4.1 it is truly obvious what I am saying is true.

Table 4.1: This table shows a standard sample. Additionally, we can set a shortened form of the caption by providing it inside square brakets before this caption in the code. The shortened form is displayed in the List of Tables, which can save some space there.

Material	**Temperature (°C)**	**Pressure (MPa)**	**Yield (%)**	**Purity (%)**
Steel A	850	1.2	94.5	99.1
Steel B	900	1.5	96.2	99.3
Aluminum	650	0.8	89.7	98.5
Titanium	1200	2.1	97.8	99.8

4.3.1 Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

This can also be seen in Figure 4.1 that the rest is obvious.



Figure 4.1: This figure shows a standard sample image.

4.3.1.1 Parts of the hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

4.3.2 Second Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

4.3.2.1 Parts of the second hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

4.4 Criteria Review

Here certain criteria are explained thus eventually leading to a foregone conclusion as can be seen in Table 4.2.

Table 4.2: Due to compatibility issues with the accessibility tagging system, the threeparttable package that creates tables with internal footnotes is not recommended. This table is an example of one method of recreating the look of a threeparttable using a minipage.

Material	**Temperature (°C)**	**Pressure (MPa)**	**Yield (%)**	**Purity[a] (%)**
Steel A[b]	850	1.2	94.5	99.1
Steel B	900	1.5	96.2	99.3
Aluminum	650	0.8	89.7	98.5
Titanium	1200	2.1	97.8	99.8

[a] Purity was measured after final cooling.
[b] Steel A and Steel B were processed under identical atmospheric conditions.

4.5 Results

Include any results

4.6 Conclusion

The conclusion of the paper goes here.

Read 1985 Enflo 1987, Daughtry 1975 Kim et al. 1975

4.7 References

Read, C. J. (1985). "A solution to the invariant subspace problem on the space l_1." In: *Bull. London Math. Soc.* 17, pp. 305–317.

Enflo, P. (1987). "On the invariant subspaces problem for Banach spaces." In: *Acta. Math.* 158. Seminare Maurey-Schwartz (1975-1976), pp. 213–313.

Daughtry, J. (1975). "An invariant subspace theorem." In: *Proc. Amer. Math. Soc.* 49, pp. 267–268.

Kim, H. W., C. Pearcy, and A. L. Shields (1975). "Rank-One Commutators and Hyperinvariant Subspaces." In: *Michigan Math. J.* 22.3, pp. 193–194.

Aupetit, B. (1991). *A Primer on Spectral Theory*. New York: Springer-Verlag.

4.8 Appendix: Appendix Title Goes Here

If there is an appendix that needs to go with the paper it can be as a section Aupetit 1991

4.8.1 Procedure details

Details of the paper specific appendix procedures

CHAPTER 5. PAPER 4 TITLE

Authors and Affiliations

Modified from a manuscript to be submitted to/ under review/ published in *Name of the Journal*

5.1 Abstract

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in the fourth paper in general terms. You can use the same abstract as your paper here.

The inclusion of an abstract for these papers is a recommended convention, but is not a strict requirement.

5.2 Overview

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis. With more general information given here than really necessary.

5.3 Introduction

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

Of course, data on this as seen in Table 5.1 is few and far between.

Table 5.1: An example of a table whose headers rows don't match our DocumentMetadata setting and so requires a separate command for accurate accessibility tagging.

	Validation Set			Test Set		
Model	Accuracy	Precision	Recall	Accuracy	Precision	Recall
Random Forest	0.89	0.87	0.86	0.88	0.86	0.85
Gradient Boosting	0.91	0.90	0.89	0.90	0.89	0.88
XGBoost	0.93	0.92	0.91	0.92	0.91	0.90

5.3.1 Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

Or graphically as seen in Figure 5.1 it is certain that my hypothesis is true.



(a) Original Cy costume from 1954. Photo Credit: Iowa State University Library Special Collections and University Archives https://historicexhibits.lib.iastate.edu/Cy/home.html



(b) Modern Cy costume. Photo-credit: Bobak Ha'Eri CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=71488404

Figure 5.1: An example of the use of subfigures.

5.3.1.1 Parts of the hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

5.3.2 Second Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

5.3.2.1 Parts of the second hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

5.4 Criteria Review

Here certain criteria are explained thus eventually leading to a foregone conclusion.

5.5 Results

5.6 Conclusion

The conclusion of the paper goes here.

5.6.1 Procedure details

Details of the paper specific appendix procedures

5.7 References

Aupetit, B. (1991). *A Primer on Spectral Theory*. New York: Springer-Verlag.

Radjavi, H. (1987). “The Engel-Jacobson Theorem Revisited.” In: *J. Alg.* 111, pp. 427–430.

Mathes, B., M. Omladič, and H. Radjavi (1991). “Linear Spaces of Nilpotent Operators.” In: *Linear Algebra Appl.* 149, pp. 215–225.

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Branges, L. de (1959). “The Stone-Weierstrass Theorem.” In: *Proc. Amer. Math. Soc.* 10, pp. 822–824.

5.8 Appendix: Appendix title goes here

If there is an appendix that needs to go with the paper it can be as a section Aupetit 1991

5.8.1 Procedure details

Details of the paper specific appendix procedures

Radjavi 1987 Mathes et al. 1991, Lomonosov 1973 Lomonosov 1991, Lomonosov 1992 Branges 1959

CHAPTER 6. GENERAL CONCLUSION

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

6.1 Summary And Discussion

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

6.1.1 Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

As can be seen in Table 6.1 it is truly obvious what I am saying is true.

6.1.1.1 Parts of the hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny. Allen 1984, Bruner 1960, Struss 1996

Table 6.1: This table is an example of what you can do in cases where your table is too wide to fit on the page normally. It uses the sidewaystable environment to rotate the whole table to make use of the long dimention of the page, reduces the size of the text, and specifies widths of some of the columns so that the cell contents can line-wrap automatically. Note that the table does not overlap with the page number.

Model	Training Time (min)	Validation Accuracy	Test Accuracy	Precision	Recall	F1-Score	ROC-AUC	Inference Time (ms)	Memory Usage (MB)
Random Forest	15.2	0.894	0.881	0.873	0.867	0.870	0.921	4.8	245
Gradient Boosting	42.7	0.912	0.905	0.901	0.896	0.898	0.944	7.1	318
XGBoost	38.4	0.924	0.917	0.913	0.909	0.911	0.956	5.6	356
LightGBM	24.9	0.928	0.919	0.916	0.912	0.914	0.959	3.9	290
Support Vector Machine	61.5	0.901	0.892	0.887	0.881	0.884	0.933	11.4	410
Neural Network	77.2	0.935	0.927	0.924	0.920	0.922	0.968	2.5	865

6.2 References

Allen, B. S. (1984). “System-assigned learning strategies and CBI.” In: *Journal of Instructional Computing Research* 1.1, pp. 3–18.

Bruner, J. (1960). *The process of education*. New York: Random House.

Struss, Joseph A. (1996). “An investigation of the sequence of utilizing a simulation in an introductory programming course.” Master’s thesis. Iowa State University.