

TITLE
TO BE DETERMINED

by

John L Waczak

APPROVED BY SUPERVISORY COMMITTEE:

David Lary, Chair

Person 2

Person 3

Person 4

Copyright © 2012

John L Waczak

All rights reserved

*This thesis class file
is dedicated to my students,
who suffered without a proper one
until the present time.*

TITLE
TO BE DETERMINED

by

JOHN L WACZAK, BS

DISSERTATION

Presented to the Faculty of
The University of Texas at Dallas
in Partial Fulfillment
of the Requirements
for the Degree of

DOCTOR OF PHILOSOPHY IN
PHYSICS

THE UNIVERSITY OF TEXAS AT DALLAS

May 2023

ACKNOWLEDGMENTS

Update required!

December 2022

TITLE
TO BE DETERMINED

John L Waczak, PhD
The University of Texas at Dallas, 2023

Supervising Professor: David Lary, Chair

Update required!

TABLE OF CONTENTS

ACKNOWLEDGMENTS	v
ABSTRACT	vi
LIST OF FIGURES	ix
LIST OF TABLES	x
CHAPTER 1 AUTONOMOUS SENSING	1
1.1 Autonomous Hyperspectral Imaging	1
1.2 Walking Robot and Hovercraft	1
CHAPTER 2 SUPER RESOLUTION	2
2.1 Hyper Spectral Images	2
2.2 Visible Images	2
2.3 Thermal Images	2
2.4 Temporal Super Resolution: Imputation	2
CHAPTER 3 ATMOSPHERIC SENSING	3
3.1 Time Series Analysis for Network Nodes	3
CHAPTER 4 BIOMETRIC ANALYSIS	4
4.1 Pose Analysis	4
4.2 Facial Landmark Analysis	4
CHAPTER 5 AUDIO EVENT ANALYSIS	5
5.1 Gunshot Detection	5
5.2 Species Identification	5
CHAPTER 6 TOPOLOGICAL DATA ANALYSIS IN PHYSICAL MEASUREMENT	6
6.1 Persistent Homology	6
6.2 Time Series Visibility Graphs	6
6.3 Graph Spectrum Analysis	6
6.4 Graph Neural Networks	6
CHAPTER 7 SCIENTIFIC MACHINE LEARNING	7
7.1 Interpretable Machine Learning	7
7.2 Sparse Identification of Nonlinear Dynamics	7

7.3	Physics Informed Neural Networks	7
7.4	SciML Applications	7
CHAPTER 8 CONCLUSION		8
BIOGRAPHICAL SKETCH		9
CURRICULUM VITAE		

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

AUTONOMOUS SENSING

1.1 Autonomous Hyperspectral Imaging

1.2 Walking Robot and Hovercraft

CHAPTER 2

SUPER RESOLUTION

2.1 Hyper Spectral Images

2.2 Visible Images

2.3 Thermal Images

2.4 Temporal Super Resolution: Imputation

CHAPTER 3

ATMOSPHERIC SENSING

3.1 Time Series Analysis for Network Nodes

CHAPTER 4

BIOMETRIC ANALYSIS

4.1 Pose Analysis

4.2 Facial Landmark Analysis

CHAPTER 5

AUDIO EVENT ANALYSIS

5.1 Gunshot Detection

5.2 Species Identification

CHAPTER 6

TOPOLOGICAL DATA ANALYSIS IN PHYSICAL MEASUREMENT

6.1 Persistent Homology

6.2 Time Series Visibility Graphs

6.3 Graph Spectrum Analysis

6.4 Graph Neural Networks

CHAPTER 7

SCIENTIFIC MACHINE LEARNING

- 7.1 Interpretable Machine Learning
- 7.2 Sparse Identification of Nonlinear Dynamics
- 7.3 Physics Informed Neural Networks
- 7.4 SciML Applications

CHAPTER 8
CONCLUSION

BIOGRAPHICAL SKETCH

Kevin W. Hamlen began learning the basics of \LaTeX in the Fall of 2000 in order to publish computer science journal articles as part of his Ph.D. candidacy at Cornell University. By the completion of his degree in 2006, he had written thousands of lines of \TeX code.

After completing his Ph.D., Dr. Hamlen joined the faculty of the Computer Science Department at The University of Texas at Dallas, and graduated his first two Ph.D. students (Micah Jones and Sunitha Ramanujam) in 2011. By the graduation of his third student (Richard Wartell) in 2012, he had concluded that a properly crafted \LaTeX class file for UTD theses was badly needed to streamline future dissertation preparations. He therefore created this one in December 2012.

CURRICULUM VITAE