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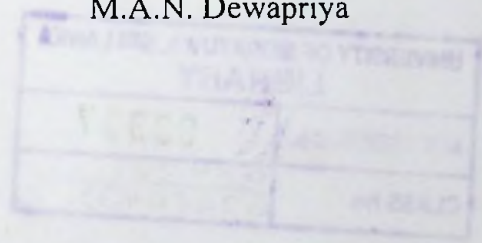
# Exploring Patterns in Historic Earthquake and Tsunami Data

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This thesis was submitted to the Department of Civil Engineering of the University of Moratuwa in partial fulfillment of the requirements for the Degree of Master of Science



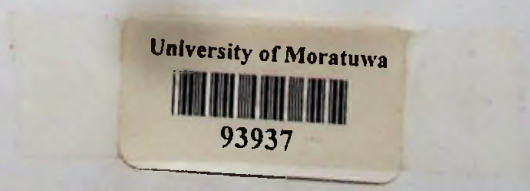
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# DECLARATION

The work included in this thesis in part or whole has not been submitted to any other academic qualification at any institute.

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## **ABSTRACT**

Gusiakov has compiled a comprehensive database compiled that gives data such as earthquake intensity, geographical location, resulting tsunami intensity etc. There have been various relationships proposed between earthquake and tsunami intensities, including by Gusiakov, who also proposes that regional effects may affect this relationship. Meanwhile, artificial neural networks (ANNs) have become a very powerful way of establishing input-output relationships, though lacking the formality of multiple regression (MR) techniques. Various approaches have been used to minimize the “black box” nature of ANNs, including the use of sensitivity analysis. Adaptive network based fuzzy inference systems (ANFIS) are a newly emerging alternative to ANNs. In this work, Artificial Intelligence (AI) methods (ANN and ANFIS) along with MR analysis were used as tools to explore the patterns in historic earthquake and tsunami data. The accuracy of the three modeling schemes were compared and sensitivity analyses performed.

Vulnerability curves have been developed using Monte Carlo simulation that reasonably match survey based curves for the vulnerability of coastal houses to tsunami wave height. This Monte Carlo simulation was used in this work to establish the resulting reduction of vulnerability if proposed strengthening techniques are adopted.



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# CONTENTS

Abstract	i
Acknowledgements	ii
Contents	iii
List of Figures	vi
List of Tables	ix
Abbreviations	x
<b>Chapter 1: Introduction</b>	
1.1 Background	1
1.2 Approach and Scope	2
1.3 Objectives	3
<b>Chapter 2: Review of Existing Knowledge</b>	
2.1 Tsunami Quantification	4
2.2 Earthquake Quantification	5
2.2.1 Surface Wave Magnitude	5
2.2.2 Moment Magnitude	5
2.3 Parametric Data Manager	6
2.3.1 Geographical and Temporal Distribution of Tsunamis in the Historical Records	8
2.4 Relationships between Earthquake and Tsunami	10
2.4.1 Tsunami Generation Potential of Different Tsunamigenic Regions in the Pacific	14
<b>Chapter 3: Data Modeling Approaches</b>	
3.1 Regression Models	16
3.1.1 Linear Regression Models	16
3.1.2 Non-Linear Regression Models	16
3.2 Artificial Neural Networks	17
3.2.1 Human Brain and Neuron	18
3.2.2 Model of a Neuron	19

3.2.3 Backpropagation Neural Network	20
3.2.3.1 Architecture	21
3.2.3.2 Activation Function	21
3.2.3.3 Learning Algorithm	22
3.2.4 Radial Basis Function Neural Network	25
3.2.4.1 Radial Basis Function	26
3.2.4.2 Learning	26
3.3 Adaptive Network Based Fuzzy Inference System	27
3.3.1 Fuzzy Logic	27
3.3.1.1 Fuzzy Set	27
3.3.1.2 Membership Functions	28
3.3.1.3 Logical Operations	29
3.3.1.4 If-then Rule	29
3.3.2 Fuzzy Inference System	29
3.3.3 ANFIS Architecture	31
3.3.4 ANFIS Learning	32

## **Chapter 4: Predicting Tsunami Intensities from Earthquake Events**

4.1 Artificial Neural Network (ANN) Approach	34
4.1.1 $M_w$ _I Model	35
4.1.2 $M_w$ , $R_n$ _I Model	37
4.1.3 $M_w$ , $R_n$ _I Model for Data with Validity Index of 4	38
4.1.4 $M_w$ , $R_n$ _I for Two I Ranges	38
4.1.5 $M_w$ , $R_n$ _2 <sup>1</sup>	39
4.1.6 $M_w$ , TE_2 <sup>1</sup> Model	40
4.1.7 $M_w$ , TE, Depth_2 <sup>1</sup> Model	41
4.1.8 $M_w$ , TE, Depth, Dist_2 <sup>1</sup>	42
4.1.9 $M_w$ , Depth, Dist_2 <sup>1</sup>	43
4.1.10 $M_w$ , Depth_2 <sup>1</sup> Model	44
4.1.11 Further Neural Network Models	46
4.2 Adaptive Network based Fuzzy Inference System (ANFIS) Approach	48
4.3 Regression Analyses	51
4.4 Comparison of Modeling Schemes	53
4.5 Sensitivity Analyses	55



4.5.1 Effect of Moment Magnitude	55
4.5.2 Effect of Focal Depth	57
4.6 Upper and Lower Bounds of I Values	58

## **Chapter 5: Vulnerability of Coastal Housing**

5.1 Review of Existing Work	60
5.2 Monte Carlo Simulation for Typical Building	62
5.3 Monte Carlo Simulation for Strengthened Building	66
5.4 Monte Carlo Simulation to Reproduce Partial Damage Curves	69

## **Chapter 6: Conclusions and Recommendations**

## **Chapter 7: References**

## **Annexe 1**



**LIST OF FIGURES**

Figure 1.1: Graphical view of the approach	2
Figure 2.1: Main menu of PDM	7
Figure 2.2: Event Card of 2004 Indian Ocean tsunami	7
Figure 2.3: Geographical distribution of tsunamigenic sources (Gusiakov, 2007)	8
Figure 2.4: Geographical distribution of tsunamigenic sources (Gusiakov, 2007)	9
Figure 2.5: Temporal distribution of tsunamis (Gusiakov, 2007)	10
Figure 2.6: Tsunami intensity and earthquake magnitude in Sumatra and Pacific regions (Puspito and Gunawan, 2005)	11
Figure 2.7: Tsunami intensity and earthquake magnitude in Pacific regions (Gusiakov, 2007)	13
Figure 2.8: Red, Green and Blue tsunamigenic regions in the pacific (Gusiakov, 2007)	15
Figure 2.9: I vs $M_w$ diagram for “Red”, “Green” and “Blue” tsunamigenic earthquakes occurred in the Pacific in 1900-1998 (Gusiakov, 2007)	15
Figure 3.1: A biological neuron	18
Figure 3.2: A model of a neuron (Neural network tool box™ 6 user’s guide, 2008)	19
Figure 3.3: Backpropagation neural network architecture (Laurene F, 1994)	21
Figure 3.4: Bipolar sigmoid function	22
Figure 3.5: Radial basis function neural network	25
Figure 3.6: Gaussian function	28
Figure 3.7: Sugeno rule operation (Fuzzy logic tool box™ 2 user’s guide, 2008)	31
Figure 3.8: ANFIS architecture (Jang, 1995)	31
Figure 4.1: Distribution of $M_w$ and I	35
Figure 4.2: Variation of MSE with epoch	35
Figure 4.3: ANN response to all inputs	36
Figure 4.4: Output versus target for the 3 data sets	36
Figure 4.5: Schematic diagram of ANN	37
Figure 4.6: Output versus target of $M_w$ , $Rn\_I$ model	37



Figure 4.7: Output versus target of $M_w$ , $Rn\_I$ model with $v = 4$ data	38
Figure 4.8: Output versus target of $M_w$ , $Rn\_I$ models, (a) with $I \leq 0$ data	39
(b) $I > 0$ data	
Figure 4.9: Plot of $2^I$ versus $M_w$	40
Figure 4.10: Output versus target of $M_w$ , $Rn\_2^I$ model	40
Figure 4.11: Output versus target of $M_w$ , $TE\_2^I$ model	41
Figure 4.12: Output versus target of $M_w$ , $TE$ , $Depth\_2^I$	42
Figure 4.13: Output versus target of $M_w$ , $TE$ , $Depth$ , $Dist\_2^I$	43
Figure 4.14: $I$ versus $M_w$ , (a) Gusiakov's model results (b) Actual data in PDM	43
Figure 4.15: Output versus target of $M_w$ , $Depth$ , $Dist\_2^I$ model	44
Figure 4.16: Output versus target of $M_w$ , $Depth\_2^I$ model	45
Figure 4.17: $2^{I-avg}$ versus $M_w$	46
Figure 4.18: Output versus target of $M_w\_2^{I-avg}$ model	46
Figure 4.19: Response of $M_w\_2^{I-avg}$ model to all inputs	47
Figure 4.20: Output versus target of $M_w\_2^{I-avg}$ RBFNN model	48
Figure 4.21: ANFIS model for $M_w$ , $Depth\_2^I$	48
Figure 4.22: Input membership functions for $M_w$ and depth before training	49
Figure 4.23: Changes in MFs (a) $M_w$ (b) Depth (After training MFs are at right)	49
Figure 4.24: Rule view of the ANFIS	50
Figure 4.25: Variation of $2^I$ with $M_w$ and depth	50
Figure 4.26: Output versus target of ANFIS	51
Figure 4.27: Output versus target of MLR model	52
Figure 4.28: Output versus target of MNLR model	53
Figure 4.29: Output versus target of three models (a) ANN (b) ANFIS	54
(c) MLR	
Figure 4.30: Plot of modified $M_w - I$ relationship	55
Figure 4.31: Sensitivity of $2^I$ for $M_w$ (a) At $D = 25$ km (b) At $D = 50$ km	56
Figure 4.32: Variation of $2^I$ with focal depth	57
Figure 4.33: Sensitivity of $2^I$ for Depth (a) At $M_w = 6$ (b) At $M_w = 7.5$	58
(c) At $M_w = 9$	
Figure 4.34: Upper and lower limits of $I$ values	59
Figure 4.35: Variation of the range $I$ values	59
Figure 5.1: Comparison of vulnerability curves (Peiris, 2006)	60
Figure 5.2: Vulnerability curves for various categories (Dias et al., 2009)	61

Figure 5.2: Vulnerability curves for various categories (Dias et al., 2009)	61
Figure 5.3: Comparison of Monte Carlo simulation results and field data (Dias et al., 2009)	61
Figure 5.4: Plan view of the building used for the Monte Carlo simulation (not to scale)	62
Figure 5.5: Force on a house building when the tsunami wave height equals the wall height $H$ (Dias et al., 2009)	64
Figure 5.6: Comparison of Monte Carlo simulation results and field data	65
Figure 5.7: (a) Plan view of the building with columns (b) Column footing (Not to scale)	66
Figure 5.8: Elevation of the strengthened building	67
Figure 5.9: (a) Foundation for 200 mm walls (b) Foundation for 100 mm walls (Not to scale)	67
Figure 5.10: Comparison of Monte Carlo simulation results for typical and strengthened houses	68
Figure 5.11: Vulnerability reduction due to strengthening	69
Figure 5.12: Yield line pattern of the wall	70
Figure 5.13: Partial damage results from Monte Carlo simulation	72
Figure 5.14: Comparison of vulnerability curves	72

**LIST OF TABLES**

Table 2.1: Coefficients of the relationship $\log H = -a + bM_w$ (Blackford)	12
Table 2.2: Wave height variation with Focal depth (Liu et al, 2007)	13
Table 2.3: TE values of Pacific regions (Gusiakov, 2005)	14
Table 3.1: Learning procedure of ANFIS	33
Table 4.1: Summary of ANN model details and performance	45
Table 4.2: Analysis of variance table	51
Table 4.3: Analysis of predictor variables	52
Table 4.4: Summary of performance of the best 3 modeling schemes	55
Table 5.1: Parameters for Monte Carlo simulation	63
Table 5.2: Results of Monte Carlo simulation	65
Table 5.3: Results of Monte Carlo simulation on strengthened building	68
Table 5.4: Characteristic strength of walling materials (BS5628:Part1: 1992)	70
Table 5.5: Results of Monte Carlo simulation considering partial collapse	71





## **ABBREVIATIONS**

ANN – Artificial neural network

AI – Artificial intelligence

ANFIS – Adaptive network based fuzzy inference system

MR – Multiple regression

MLR – Multiple linear regression

PDM – Parametric data manager

$M_w$  – Moment magnitude

I – Tsunami intensity in Soloviev- Imamura intensity scale