

# UNCERTAINTY IN RECURRENT NEURAL NETWORKS

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# UNCERTAINTY IN RECURRENT NEURAL NETWORKS

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A thesis submitted in fulfilment of the  
requirements for the award of the degree of  
Doctor of Philosophy

Advanced Informatics School  
Universiti Teknologi Malaysia

APRIL 2017



I declare that this thesis entitled “*Uncertainty in Recurrent Neural Networks*” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature	:	<hr/>
Name	:	<hr/> Alireza Samar
Date	:	<hr/> April 13, 2017



## Dedication



## **ACKNOWLEDGEMENT**

Acknowledgement





**ABSTRACT**

This is the English abstract



## **ABSTRAK**

Ini adalah abstrak Bahasa Melayu



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**LIST OF ABBREVIATIONS**

ANN	-	Artificial Neural Network
PC	-	Personal Computer
SVM	-	Support Vector Machine
XML	-	Extensible Markup Language



**LIST OF SYMBOLS**

$\gamma$	-	Whatever
$\sigma$	-	Whatever
$\varepsilon$	-	Whatever



**LIST OF APPENDICES**

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Problem Background**

Introduction to the thesis [1] to the thesis [2]. This section attempts to give a brief introduction to quantum computing. Before entering the microscopic world of quantum computing, we revisit the present digital system commonly used by the masses. The current digital system is based on binary digits, commonly known as bits. Each bit is represented with a binary value called “logic 0” or “logic 1” and the number of distinct states is  $2^n$ , where  $n$  is the number of bits. Physically, these logic values are typically represented by two different voltage levels. In this thesis, such computers are referred to as a *classical computer*.

#### **1.2 State-of-the-Arts**

#### **1.3 Problem Statement**

#### **1.4 Objective and Scope**

#### **1.5 Organization**



## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 State-of-the-Arts**

#### **2.2 Limitations**

1. Mentor Graphics 2
  - (a) item 3
2. item 4

#### **2.3 Research Gaps**

The processing at layer-5<sup>1</sup> is done ...

---

<sup>1</sup>In this thesis, OSI model is used.



## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

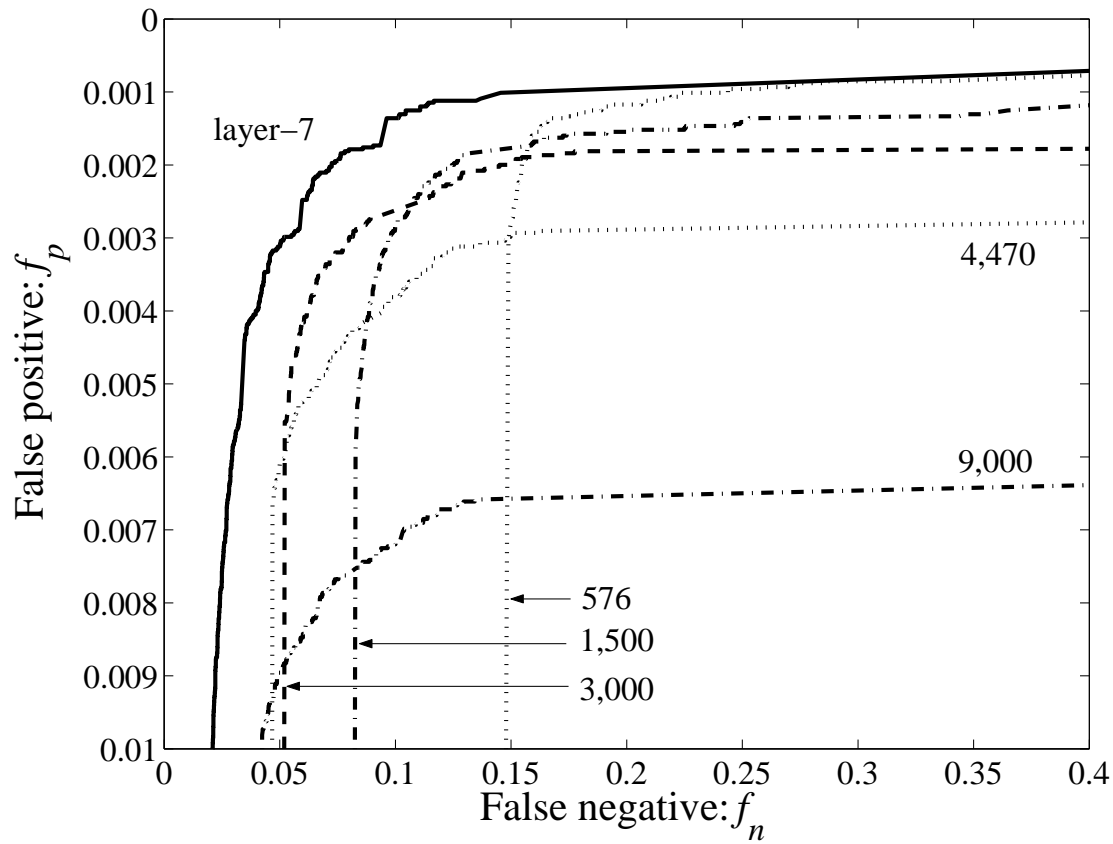
- 3.1 Top-level View**
- 3.2 Research Activities**
- 3.3 Controllables vs. Obseravables**
- 3.4 Techniques**
- 3.5 Tools and Platforms**
- 3.6 Chapter Summary**



## **CHAPTER 4**

### **PROPOSED WORK**

- 4.1 The Big Picture**
- 4.2 Analytical Proofs**
- 4.3 Results and Discussion**
- 4.4 Chapter Summary**



**Figure 4.1:** Example of a figure. This is a long, very long, long long, long caption. You can give a shorter caption for the “list of figures” using the square bracket symbol.

**Table 4.1:** Example of a table. This is a long, very long, long long, long caption. You can give a shorter caption for the “list of table” using the square bracket symbol.

Temperature	Resonant Frequency	Q factor
13 mK $\pm$ 1 mK	16.93	811
40 mK $\pm$ 1 mK	16.93	817
100 mK $\pm$ 1 mK	16.93	815
300 mK $\pm$ 1 mK	16.93	806
500 mK $\pm$ 1 mK	16.93	811
800 mK $\pm$ 5 mK	16.93	814
1000 mK $\pm$ 5 mK	16.93	806



## **CHAPTER 5**

## **CONCLUSION**

### **5.1 Research Outcomes**

### **5.2 Contributions to Knowledge**

### **5.3 Future Works**



## REFERENCES

1. Oetiker, T., Partl, H., Hyna, I. and Schlegl, E. *The Not So Short Introduction to L<sup>A</sup>T<sub>E</sub>X 2 $\epsilon$* . 2013. URL <http://ctan.tug.org/tex-archive/info/lshort/english/lshort.pdf>.
2. Okamoto, Y., Ando, Y., Hataya, K., Nakayama, T., Miyamoto, H., Inoue, T., Senda, M., Hirata, K., Kosaki, M., Shibata, N. *et al.* Improved power performance for a recessed-gate AlGa<sub>N</sub>-Ga<sub>N</sub> heterojunction FET with a field-modulating plate. *Microwave Theory and Techniques, IEEE Transactions on*, 2004. 52(11): 2536–2540.



## **APPENDIX A**

**DO NOT USE LONG TITLES.**



## **APPENDIX B**

### **PSEUDO-CODES**





## **APPENDIX C**

### **TIME-SERIES RESULTS**