

**Approximation theory of multilayer feedforward
artificial neural network**

by

LEONG, Cheok Fan

Master of Science in Mathematics

2002



**Faculty of Science and Technology
University of Macau**

TABLE OF CONTENTS

LIST OF FIGURES	ii
GLOSSARY	iii
LIST OF ABBREVIATIONS	iv
CHAPTER 1: Introduction	1
1.1 Mathematical model of neurons	1
1.2 Multilayer Feedforward networks	5
1.2.1 Single hidden layer feedforward networks	5
1.2.2 Multilayer feedforward networks	13
CHAPTER 2: Locally compact group and Fourier transform	16
2.1 Locally compact groups	16
2.2 Haar and complex measures	19
2.3 Dual groups and Fourier transforms	22
CHAPTER 3: Approximation theory	35
3.1 Justification of the canonical network approximation	36
3.2 Density conditions	38
3.2.1 Density of $\mathcal{H}_R(f)$ in $L^p(\mathbb{R}^R)$ where $1 \leq p < \infty$	42
3.2.2 Density of $\mathcal{H}_R(f)$ in $C(K)$ where K is a compact subset of $\mathbb{R}^R$	44
3.2.3 Discriminatory	46
3.2.4 Result	55
CHAPTER 4: Conclusion	57
APPENDIX A: Appendix	58
A.1 Signed measures	58
A.2 Absolute continuity and Radon-Nikodym theorem	59
A.3 The Riesz representation theorem	60
A.4 Duality	62
BIBLIOGRAPHY	64