A Fuzzy Knowledge Map Framework for Knowledge Representation

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THIS THESIS IS PRESENTED FOR THE DEGREE OF DOCTOR OF PHILOSOPHY OF MURDOCH UNIVERSITY, WESTERN AUSTRALIA

YEAR OF SUBMISSION: 2006
I declare that this thesis is my own account of my research and contains as its main
content work which has not previously been submitted for a degree at any tertiary
education institution.

...............................  
(SEBASTIAN W. KHROR)
Cognitive Maps (CMs) have shown promise as tools for modelling and simulation of knowledge in computers as representation of real objects, concepts, perceptions or events and their relations. This thesis examines the application of fuzzy theory to the expression of these relations, and investigates the development of a framework to better manage the operations of these relations.

The Fuzzy Cognitive Map (FCM) was introduced in 1986 but little progress has been made since. This is because of the difficulty of modifying or extending its reasoning mechanism from causality to relations other than causality, such as associative and deductive reasoning. The ability to express the complex relations between objects and concepts determines the usefulness of the maps. Structuring these concepts and relations in a model so that they can be consistently represented and quickly accessed and manipulated by a computer is the goal of knowledge representation. This forms the main motivation of this research.

In this thesis, a novel framework is proposed whereby single-antecedent fuzzy rules can be applied to a directed graph, and reasoning ability is extended to include non-causality. The framework provides a hierarchical structure where a graph in a higher layer represents knowledge at a high level of abstraction, and graphs in a lower layer represent the knowledge in more detail. The framework allows a modular design of knowledge representation and facilitates the creation of a more complex structure for modelling and reasoning.
The experiments conducted in this thesis show that the proposed framework is effective and useful for deriving inferences from input data, solving certain classification problems, and for prediction and decision-making.
I am deeply indebted to my supervisor Adjunct Associate Professor Dr. M. Shamim Khan for his valuable inputs and tireless encouragement throughout the course of this study.

Associate Professor Lance Chun Che Fung has been a tremendous source of inspiration for professionalism in my research.

My gratitude goes to Dr. Kevin Kok Wai Wong for his insights into and resourcefulness within my field of research.

My thanks and appreciation also goes to Dr. Liana Joy Christensen for her invaluable professional advice on the styles and various aspects of the presentation of this thesis.
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PUBLICATIONS

Some contents of this thesis have been peer-reviewed and published. The chapters with the contents so peer-reviewed and published are listed below:

Chapter 2:

Relevant publications:


Chapter 3:

Relevant publications:


**Chapter 4:**

Relevant publications:


**Chapter 5:**

Relevant publications:


**Chapter 6:**

Relevant publications: