

**PREDICTIVE MODELS FOR PROTEIN  
CLASSIFICATION**

**WATSHARA SHOOMBUEATONG**

**DOCTOR OF PHILOSOPHY  
IN COMPUTER SCIENCE**

**THE GRADUATE SCHOOL  
CHIANG MAI UNIVERSITY  
AUGUST 2013**

**PREDICTIVE MODELS FOR PROTEIN  
CLASSIFICATION**

**WATSHARA SHOOMBUEATONG**

**A THESIS SUBMITTED TO THE GRADUATE SCHOOL IN  
PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF  
DOCTOR OF PHILOSOPHY  
IN COMPUTER SCIENCE**

**THE GRADUATE SCHOOL  
CHIANG MAI UNIVERSITY  
AUGUST 2013**



# PREDICTIVE MODELS FOR PROTEIN CLASSIFICATION

WATSHARA SHOOMBUTONG

THIS THESIS HAS BEEN APPROVED  
TO BE A PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY  
IN COMPUTER SCIENCE

## EXAMINING COMMITTEE

*Shinn-Ying Ho* ..... CHAIRPERSON

Prof. Dr. Shinn-Ying Ho

*Hui-Ling Huang* ..... MEMBER

Assoc. Prof. Dr. Hui-Ling Huang

*Jeerayut Chaijaruwanich* ..... MEMBER

Assoc. Prof. Dr. Jeerayut Chaijaruwanich

*Thanasak Mouktonglang* ..... MEMBER

Asst. Prof. Dr. Thanasak Mouktonglang

*Supapon Cheevadhanarak* ..... MEMBER

Assoc. Prof. Dr. Supapon Cheevadhanarak

*Kitsana Waiyamai* ..... MEMBER

Assoc. Prof. Dr. Kitsana Waiyamai

## THESIS ADVISORY COMMITTEE

*Jeerayut Chaijaruwanich* ..... ADVISOR

Assoc. Prof. Dr. Jeerayut Chaijaruwanich

*Thanasak Mouktonglang* ..... CO-ADVISOR

Asst. Prof. Dr. Thanasak Mouktonglang

*Supapon Cheevadhanarak* ..... CO-ADVISOR

Assoc. Prof. Dr. Supapon Cheevadhanarak

*Kitsana Waiyamai* ..... CO-ADVISOR

Assoc. Prof. Dr. Kitsana Waiyamai

11 August 2013

© Copyright by Chiang Mai University

ลิขสิทธิ์โดยมหาวิทยาลัยเชียงใหม่  
Copyright © by Chiang Mai University  
All rights reserved

## ACKNOWLEDGEMENTS

I would like to express my deep thankfulness and gratitude to my thesis advisor, Assoc. Prof. Dr. Jeerayut Chaijaruwanich at Chiang Mai University, for his moral support, advice, excellent guidance, valuable suggestions and encouragement throughout this study. This thesis would not be possible without the help of so many people. I would like to take this opportunity to express my deep appreciation to all those who help and encourage me.

I would also like to thank my co-advisors Dr. Thanasak Mouktonglang, Assoc. Prof. Dr. Supapon Cheevadhanarak, and Assoc. Prof. Dr. Kitsana Waiyamai for all their advice, inspiration, guidance, and patience.

I wish to express my sincere thank to Dr. Tanawan Samleerat and Sayamon Hongjaisee, for all their advice, inspiration, guidance. They provided valuable comments to the manuscript.

I am truly grateful to Prof. Dr. Shinn-Ying Ho and his team from Exchange student at IC Lab.-Intelligent Computing Laboratory (National Chiao Tung University), Hsinchu, Taiwan. Additionally, I wish to express my sincere thank to Assoc. Prof. Dr. Hui-Ling Huang, for all her advice, guidance, and patience.

I wish to extend my special thanks to Dr. Robert Cutler. He advises, teaches, guides, and suggests me knowledge every time when I work with him. I am very grateful to him. Dr. Robert Cutler always spends his time to check through my manuscripts. Without him these manuscripts could not be finished. Therefore, I would like to express my deep thankfulness and gratitude to him.



My thanks is extended to the Bioinformatics Research Lab, Department of Bioinformatics, Faculty of Science, Chiang Mai University for kindly providing me with the computer system and place which made this study possible. I also wish to thank my friends in the Bioinformatics Lab. The most importance I would like to thank The Royal Golden Jubilee Ph.D. Program (RGJ) for the financial support for this project.

Also I have a good support from my family, who always stands behind me with great patience, love and inspiration. I am so grateful to have my parents' constant support and motivation. Many words of thanks are not enough to express my deep gratitude to them. The last one is my God, he makes me feel that I am not alone, and always blesses me.

Watshara Shoombuatong