fulfilling process:

This thesis embodies the culmination of years of research that led me on a profound personal and intellectual journey across several countries, connecting me with many remarkable people who have profoundly shaped my path. The constraints of brevity prevent me from fully expressing my gratitude to everyone in this limited space. I invite you to peruse the unabridged acknowledgments, where I more comprehensively extend my heartfelt appreciation to the collective of advisors, mentors, colleagues, friends, and family whose guidance, support, and motivation were integral throughout this arduous yet



Within these pages, I'd like to gratefully acknowledge the Australian Government for funding my research through the Research Training Program (RTP) Scholarship Program and the Data61 detachment of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for contributing supplemental funding.

I'd also like to express my sincere appreciation to my supervisors, Fabio Ramos and Edwin Bonilla. I'm grateful to Fabio for cultivating my taste for high-impact problems and providing the latitude to explore independently while fostering a supportive framework for productivity and excellence. Working with Edwin has been a privilege, not only for his immense scientific acumen and deeply knowledgeable supervision but also for his genuine care and support. Over the years of our collaboration, it has been abundantly clear that Edwin always had my best interest at heart and a sincere desire to see me succeed. I'm deeply thankful for his boundless patience and steadfast faith in me during the moments of struggle and self-doubt that marked the "messy middle" of my journey. I can't imagine I was a joy to work with at all times, but in spite of this, I've never felt Edwin waiver in his belief in me, and this has made all the difference.

On a personal note, I'm grateful to my enduring better half, Jem, for her unending patience, sacrifice, and devotion through it all. She has taken on extra responsibilities so I could fully immerse myself in this body of work, all the while providing me care, laughter, comfort, and joy when I needed it most. In her selfless support, she has brought me quiet solace during storms, deep comfort in dark clouds, and abundant joy every step along the way. Any contributions or successes I have achieved through this PhD are as much a testament to her efforts as my own. I also owe immense thanks to our sweet canine girl Penelope, whose gentle companionship, joyful antics, and affectionate cuddles have sustained me throughout this endeavor; I appreciate you more than you'll ever know. I could not have reached this milestone without these two precious souls by my side.

I'm grateful to my father, who instilled in me a passion for science and engineering from an early age. Whether we were tinkering with electronics or building models together, he nourished my curiosity and love of making things. I'll always recall with fondness all the times he took out of his demanding schedule as a clinical radiologist to tutor me in maths and physics, which provided me with a strong foundation for all my subsequent pursuits. His continued support over the years made this milestone possible.

I'm grateful to my mother – raising me alone in a new land must have taken tremendous courage. Watching her build a new life taught me resilience and determination. She faced every obstacle with poise and tenacity, showing me how to turn challenges into opportunities. Her tireless support and buoyant encouragement propelled me through my long education, spurring me onward at every turn. Our bond has blossomed into a cherished friendship where intellectual discussion flows freely alongside heartfelt life advice. I learned extensively from her wisdom, compassion, and incisive intellect. Reaching this milestone would have been inconceivable without her years of selfless sacrifice and visionary guidance that set me firmly on my path.

It is with immeasurable gratitude and love that I dedicate this thesis to my parents.

The greatest enemy of knowledge is not ignorance, it is the illusion of knowledge.

— Daniel J. Boorstin (often misattributed to Stephen Hawking)

To know that we know what we know, and to know that we do not know what we do not know, that is true knowledge.

— Nicolaus Copernicus

Real knowledge is to know the extent of one's ignorance.

— Confucius