Special Issue for Terry Caelli

INTRODUCTION

Terry Caelli retired from his position as Director of Australia’s National Information and Communications Technology (NICTA) Research Laboratory of Canberra at the end of 2007. This Special Issue of Spatial Vision was prepared to recognize and honour the numerous contributions he has made in many research areas in general and in Spatial Vision in particular. Terry completed his undergraduate and PhD studies at the University of Newcastle, Australia, between 1972 and 1975 in Mathematics and Mathematical Psychology with specific interests in human and machine vision systems. From 1974 to 1982, he was a Lecturer and Senior Lecturer at the Universities of Melbourne and Newcastle. During this time, he spent one year leave of absence at Bell Laboratories, Murray Hill, NJ, USA. From 1982 to 1988, he was Killam Professor in Science and Director of the Alberta Centre for Machine Intelligence and Robotics at the University of Alberta, Edmonton, Canada. In 1989, Terry returned to Australia, first as a Professor and Director of the Cognitive Science Programme and the Vision Group at the University of Melbourne. From 1994 to 1999, he was Head of the Department of Computer Science at Curtin University of Technology, Perth, Australia. After a leave of absence as Director of the NASA Center for Mapping at the Ohio State University, Columbus, Ohio, he returned to the University of Alberta in 1999, where he took leading roles in psychology, in computing science, and in the management of the Alberta iCore initiative. In July 2004, Terry returned once again to Australia to lead the NICTA Research Laboratory of Canberra. Even in retirement Terry has a kept a keen interest in science.

Over the more than 30 years of his career, Terry Caelli has made numerous contributions in a wide range of fields, including human and artificial vision, machine learning, robotics, remote-sensed image interpretation, understanding of human actions, and a large number of applied projects. His work has been published in eleven books, many book chapters and over 300 journal and conference publications. It is difficult to summarize this work in a brief introduction. Indeed, Terry’s career has been characterized by his ability to change and to move in many
different areas, and in each one of them he has made important contributions. There are, however, some threads that run across Terry’s life-long scientific career. One of them is his interest in a differential-geometric approach to vision and to the problem of invariance in particular. This is already evident in his early papers on edge coding via Lie operators. It continues in his work on invariant representation by integral transforms and Lie group analysis as well as on neural networks, more specifically on one class of artificial networks, namely Model Based Neural Networks.

Another long-term focus of Terry’s interest has been statistical pattern recognition and texture perception in particular, beginning with the famous work on visual texture discrimination in collaboration with Bela Julesz. He further focused on pattern and object recognition, where Terry has explored an incredibly large range of approaches, including, for example, filter-based object recognition, transform-based methods, structural models, and over the past decade, graphical model-based recognition. Finally, Terry has always had a keen interest in vision applications to solve real-world problems, especially in the areas of remote-sensed image interpretation and environmental assessment. In this context, he has emphasized how important it is to keep the human in the loop, i.e., to devise systems to help and support human users rather than replace them by autonomous systems.

Diverse as they might seem to be, all the research activities of Terry Caelli appear to be rooted in his curiosity in what he sees as the ‘Meaning of Life’ — both in the sense of spirituality and of Monty Python. Those who are privileged to be his friends know that there is hardly a day where he fails to appreciate existence as he finds it within the limitations of the human brain and how it fits in this universe of some 150 billions of galaxies. He might well agree, therefore, with the conclusion Charles Darwin (1859) drew from his studies on *The Origin of Species by Means of Natural Selection*: “There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms, or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved”. In accordance with his Italian–Irish cultural background, Terry does not only love solving mathematical equations and drawing graphical models but also hearing Gregorian chant, visiting towering cathedrals, and arguing all night about theology and politics (and the expanding universe).

The papers in this Special Issue of *Spatial Vision* all have their roots in Terry Caelli’s ideas and many were directly inspired by his work or are based on collaborative work with him. The first set of four papers is concerned with visual representation and guidance of action, including eye movements and navigation. Ferraro and Boccignone introduce a framework for defining image content in terms of information theory and thermodynamics of irreversible transformations, and they show how such representations can be used to derive mechanisms for the active exploration of visual space. Rentschler, Osman and Jüttner investigate the invariance of object recognition against contrast reversal and changes in illumination direction. They show that contrast invariance reflects functional characteristics of object