INFORMATION THEORY AND THE BRAIN

Information Theory and the Brain deals with a new and expanding area of neuroscience which provides a framework for understanding neuronal processing. It is derived from a conference held in Newquay, UK, where a handful of scientists from around the world met to discuss the topic. This book begins with an introduction to the basic concepts of information theory and then illustrates these concepts with examples from research over the last 40 years. Throughout the book, the contributors highlight current research from four different areas: (1) biological networks, including a review of information theory based on models of the retina, understanding the operation of the insect retina in terms of energy efficiency, and the relationship of image statistics and image coding; (2) information theory and artificial networks, including independent component-based networks and models of the emergence of orientation and ocular dominance maps; (3) information theory and psychology, including clarity of speech models, information theory and connectionist models, and models of information theory and resource allocation; (4) formal analysis, including chapters on modelling the hippocampus, stochastic resonance, and measuring information density. Each part includes an introduction and glossary covering basic concepts.

This book will appeal to graduate students and researchers in neuroscience as well as computer scientists and cognitive scientists. Neuroscientists interested in any aspect of neural networks or information processing will find this a very useful addition to the current literature in this rapidly growing field.

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INFORMATION THEORY
AND THE BRAIN

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Preface

This book is the result of a dilemma I had in 1996: I wanted to attend a conference on information theory, I fancied learning to surf, and my position meant that it was very difficult to obtain travel funds. To solve all of these problems in one fell swoop, I decided to organise a cheap conference, in a place anyone who was interested could surf, and to use as a justification a conference on information theory. All I can say is that I thoroughly recommend doing this. Organising the conference was a doddle (a couple of web pages, and a couple of phone calls to the hotel in Newquay). The location was superb. A grand hotel perched on a headland looking out to sea (and the film location of that well-known film *Witches*). All that and not 100 yards from the most famous surfing beach in Britain. The conference was friendly, and the talks were really very good. The whole experience was only marred by the fact that Jack Scannell was out skilfully surfing the offshore breakers, whilst I was still wobbling on the inshore surf.

Before the conference I had absolutely no intention of producing a book, but after going to the conference, getting assurances from the other editors that they would help, and realising that in fact the talks would make a book that I would quite like to read, I plunged into it. Unlike the actual conference organisation, preparing the book has been a lot of work, but I hope the result is of interest to at least a few people, and that the people who submitted their chapter promptly are not too annoyed at the length of time the whole thing took to produce.

Roland Baddeley

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