# Foreword

Olfaction is one of the main five senses that convey perception of the external world to the brain. The Chemical Senses (Olfaction and Taste) have often been considered as second class senses when compared to vision or hearing. However, advances in olfaction research in the last two decades have greatly increased our level of scientific understanding. In particular, the discovery of the olfactory receptors and the description of the organization of the olfactory system by Buck and Axel (Nobel Laureates in Medicine and Physiology in 2004), was a breakthrough and opened new research paths. In this new light, olfaction appears as a very intriguing and sophisticated chemical information processing system. The presence of hundreds of different receptors with overlapped specificities but also diverse molecular receptive fields, together with a high degree of redundancy provides an information rich set of neural signals that are very efficiently processed by the neural circuitry, both in vertebrates and insects.

*Machine Olfaction* tries to mimic the sense of smell in electronic instrumentation, and uses biology as a model system. Commencing with the pioneering work of Moncrieff in the early sixties (*Journal of Applied Physiology, 16,* 742-749, 1961), this has been a dream of many scientists and engineers. Persaud and Dodd's seminal 1982 paper (*Nature, 299,* 352–355) established the basis of what today is considered the field of *Artificial Olfaction* or *Machine Olfaction*. Since those early works, the field of Machine Olfaction has generated much interest for its ability to approach a diverse set of problems in areas as food production, environmental monitoring, and lately medical diagnosis. Today, a consolidated research community supports advances in this field, and a number of companies offer the technology in a commercial basis.

In this book, a number of papers survey the latest advances in Machine Olfaction, with emphasis in the signal and data processing component of the systems. Individual chapters have been written by recognized researchers in the field. They cover not

only fundamental methodological issues such as optimum feature selection, data fusion using evolutionary algorithms, incremental learning and noise in chemical sensors but also applications such as odor reproduction for movies, modeling gas distributions for odor robot navigation, application of colorimetric arrays, disease identification in plants and the detection of bacteria.

Researchers in the Machine Olfaction community, as well as users wishing to know more about the underpinning technologies, will find this book to provide a useful update in the latest state of the art.

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***Santiago Marco*** *completed his university degree in Applied Physics in 1988 and received a PhD in Microsystem Technology from the University of Barcelona in 1993. He held a Human Capital Mobility grant for a postdoctoral position in 1994 at the Department of Electronic Engineering at the University of Rome "Tor Vergata". Since 1995, he has been an Associate Professor in the Department of Electronics at the University of Barcelona. In 2004 he spent a period of sabbatical leave at EADS-Corporate Research, Munich, working on Ion Mobility Spectrometry. He has recently been appointed leader of the Artificial Olfaction Lab at the Institute of Bioengineering of Catalonia (http://www.ibecbarcelona.eu/artificial_olfaction). His research concerns the development of signal and data processing algorithmic solutions for smart chemical sensing based in sensor arrays or microspectrometers typically integrated using Microsystem Technologies.*