Sensorimotor Control And Learning An Introduction To The Behavioral Neuroscience Of Action By Tresilian James 2012 Hardcover

The report is the first of a two-part presentation which deals with certain computer controlled manipulator problems. This first part discusses a model which is designed to address problems of motor control, motor learning, adaptation, and sensorimotor integration. The problems are outlined and a solution is given which makes use of a state space memory and a piece-wise linearization of the equations of motion. A forthcoming companion article will present the results of tests performed on an implementation of the model.

Motor control has established itself as an area of scientific research characterized by a multi-disciplinary approach. The book offers a collection of chapters written by the most prominent researchers in the field.


Close your eyes and ask yourself, 'what do I feel?' You might feel thirsty or tired. You might feel healthy and well or perhaps a little under the weather. Maybe you can feel that you are standing or that you are leaning over. You may also feel the world around you - the shape and texture of an apple in your hand, the feel of a chair you’re sitting on. All these feelings have something in common, say psychologists and neuroscientists. They are all mental events, things that happen in the mind. But what if this is all wrong? What if it’s not just the mind, but also the body itself that feels? And not merely physical sensations, but other feelings that seem to have nothing to do with bodies. Things like 'emotions' and 'intuitions' - joy or rage, anxiety or optimism, or the feeling of being hard done by or misunderstood? Drawing on the latest research and a range of classic and contemporary thought, How You Feel shows you that your brain and your body are two parts of a single system that creates your mind and mental life. You will discover that you don’t have feelings, thoughts and emotions inside your body, you have them with your body. There can be no mind without the body. Psychology is no longer about the brain, or about 'mind and body', it is about the whole that is you.

The human hand can take on a huge variety of shapes and functions, providing its owner with a powerful hammer at one time or a delicate pair of forceps at another. The universal utility of the hand is even more enhanced by the ability to amplify the function of the hand by using tools. To understand and appreciate how the human brain controls movements of the hand, it is important to investigate both the healthy motor behaviour and dysfunction during everyday manipulative tasks. This book provides a
contemporary summary of the physiology and pathophysiology of the manipulative and exploratory functions of the human hand. With contributions from scientists and clinical researchers of biomechanics, kinesiology, neurophysiology, psychology, physical medicine and rehabilitation, it covers the development of healthy human grasping over the lifespan, the wide spectrum of disability in the pathological state and links basic motor research with modern brain sciences.

Humanoid robots are highly sophisticated machines equipped with human-like sensory and motor capabilities. Today we are on the verge of a new era of rapid transformations in both science and engineering—one that brings together technological advancements in a way that will accelerate both neuroscience and robotics. Humanoid Robotics and Neuroscience: Science, Engineering and Society presents the contributions of prominent scientists who explore key aspects of the further potential of these systems. Topics include: Neurorscientific research findings on dexterous robotic hand control Humanoid vision and how understanding the structure of the human eye can lead to improvements in artificial vision Humanoid locomotion, motor control, and the learning of motor skills Cognitive elements of humanoid robots, including the neurrorscientific aspects of imitation and development The impact of robots on society and the potential for developing new systems and devices to benefit humans The use of humanoid robotics can help us develop a greater scientific understanding of humans, leading to the design of better engineered systems and machines for society. This book assembles the work of scientists on the cutting edge of robotic research who demonstrate the vast possibilities in this field of research.

This volume presents the proceedings of the Brazilian Congress on Biomedical Engineering (CBEB 2018). The conference was organised by the Brazilian Society on Biomedical Engineering (SBEB) and held in Armação de Buzios, Rio de Janeiro, Brazil from 21-25 October, 2018. Topics of the proceedings include these 11 tracks: • Bioengineering • Biomaterials, Tissue Engineering and Artificial Organs • Biomechanics and Rehabilitation • Biomedical Devices and Instrumentation • Biomedical Robotics, Assistive Technologies and Health Informatics • Clinical Engineering and Health Technology Assessment • Metrology, Standardization, Testing and Quality in Health • Biomedical Signal and Image Processing • Neural Engineering • Special Topics • Systems and Technologies for Therapy and Diagnosis

The Springer Handbook for Computational Intelligence is the first book covering the basics, the state-of-the-art and important applications of the dynamic and rapidly expanding discipline of computational intelligence. This comprehensive handbook makes readers familiar with a broad spectrum of approaches to solve various problems in science and technology. Possible approaches include, for example, those being inspired by biology, living organisms and animate systems. Content is organized in seven parts: foundations; fuzzy logic; rough sets; evolutionary computation; neural networks; swarm intelligence and hybrid computational intelligence systems. Each Part is supervised by its own Part Editor(s) so that high-quality content as well as completeness are assured.

Bringing together the expertise of leading research practitioners in the field, the second edition of Clinical Management of Sensorimotor Speech Disorders is an up-to-date reference for the underlying theory and the basic principles of assessment and
treatment. This book provides a solid foundation in the conceptual framework essential for classifying and differentiating disorders according to clinical categories. It covers the theory underlying measurement strategies including acoustic, kinematic, aerodynamic, and electromyographic techniques, and guides the reader through treatments for each disorder. New in this edition is a comprehensive section with in-depth coverage of the diseases, syndromes, and pathologic conditions which are accompanied by sensorimotor speech disorders. These chapters provide concise descriptions of the disease and its signs and symptoms, neuropathology, epidemiology, and etiology. Each chapter goes on to present the speech impairment associated with the disorder and its signs and symptoms, etiology, neuropathology, associated cognitive, linguistic, and communicative signs and symptoms, special diagnostic considerations, treatment, and key references. Features: Clear articulation of theoretical issues provides a strong foundation for the clinical management of the dysarthrias, apraxia, and speech problems secondary to hearing loss. New chapter on neurogenic fluency disorders. Extensive discussion of neuropathologic conditions that cause sensorimotor speech disorders. Authoritative and comprehensive, this expanded edition will prove to be the reference of choice for students in speech-language pathology programs as well as clinicians and researchers.

This book constitutes the refereed proceedings of the 13th International Symposium on Visual Computing, ISVC 2018, held in Las Vegas, NV, USA in November 2018. The total of 66 papers presented in this volume was carefully reviewed and selected from 91 submissions. The papers are organized in topical sections named: ST: computational bioimaging; computer graphics; visual surveillance; pattern recognition; virtual reality; deep learning; motion and tracking; visualization; object detection and recognition; applications; segmentation; and ST: intelligent transportation systems.

The general idea that brains anticipate the future, that they engage in prediction, and that one means of doing this is through some sort of inner model that can be run of?ine,hasalonghistory. SomeversionoftheideawascommontoAristotle,aswell as to many medieval scholastics, to Leibniz and Hume, and in more recent times, to Kenneth Craik and Philip Johnson-Laird. One reason that this general idea recurs continually is that this is the kind of picture that introspection paints. When we are engaged in tasks it seems that we form images that are predictions, or anticipations, and that these images are isomorphic to what they represent. But as much as the general idea recurs, opposition to it also recurs. The idea has never been widely accepted, or uncontroversial among psychologists, cognitive scientists and neuroscientists. The main reason has been that science cannot be s- is?ed with metaphors and introspection. In order to gain acceptance, an idea needs to be formulated clearly enough so that it can be used to construct testable hypot- ses whose results will clearly supportor cast doubtupon the hypothesis. Next, those ideasthatare formulablein one oranthersortof symbolismonotionare capable of being modeled, and modeling is a huge part of cognitive neuroscience. If an idea cannot be clearly modeled, then there are limits to how widely it can be tested and accepted by a cognitive neuroscience community.

Medical and Health Sciences is a component of Encyclopedia of Biological, Physiological and Health Sciences in the global Encyclopedia of Life Support Systems (EOLSS), which is an integrated compendium of twenty one Encyclopedias. These volume
set contains several chapters, each of size 5000-30000 words, with perspectives, applications and extensive illustrations. It carries state-of-the-art knowledge in the fields of Medical and Health Sciences and is aimed, by virtue of the several applications, at the following five major target audiences: University and College Students, Educators, Professional Practitioners, Research Personnel and Policy Analysts, Managers, and Decision Makers and NGOs.

This book focuses on a critical issue in the study of physical agents, whether natural or artificial: the quantitative modelling of sensory–motor coordination. Adopting a novel approach, it defines a common scientific framework for both the intelligent systems designed by engineers and those that have evolved naturally. As such it contributes to the widespread adoption of a rigorous quantitative and refutable approach in the scientific study of ‘embodied’ intelligence and cognition. More than 70 years after Norbert Wiener’s famous book Cybernetics: or Control and Communication in the Animal and the Machine (1948), robotics, AI and life sciences seem to be converging towards a common model of what we can call the ‘science of embodied intelligent/cognitive agents’. This book is interesting for an interdisciplinary community of researchers, technologists and entrepreneurs working at the frontiers of robotics and AI, neuroscience and general life and brain sciences.

Reinforcement learning (RL) and adaptive dynamic programming (ADP) has been one of the most critical research fields in science and engineering for modern complex systems. This book describes the latest RL and ADP techniques for decision and control in human engineered systems, covering both single player decision and control and multi-player games. Edited by the pioneers of RL and ADP research, the book brings together ideas and methods from many fields and provides an important and timely guidance on controlling a wide variety of systems, such as robots, industrial processes, and economic decision-making.

An introduction to the computational biology of reaching and pointing, with an emphasis on motor learning. Neuroscience involves the study of the nervous system, and its topics range from genetics to inferential reasoning. At its heart, however, lies a search for understanding how the environment affects the nervous system and how the nervous system, in turn, empowers us to interact with and alter our environment. This empowerment requires motor learning. The Computational Neurobiology of Reaching and Pointing addresses the neural mechanisms of one important form of motor learning. The authors integrate material from the computational, behavioral, and neural sciences of motor control that is not available in any other single source. The result is a unified, comprehensive model of reaching and pointing. The book is intended to be used as a text by graduate students in both neuroscience and bioengineering and as a reference source by experts in neuroscience, robotics, and other disciplines. The book begins with an overview of the evolution, anatomy, and physiology of the motor system, including the mechanisms for generating force and maintaining limb stability. The sections that follow, "Computing Locations and Displacements", "Skills, Adaptations, and Trajectories", and "Predictions, Decisions, and Flexibility", present a theory of sensorially guided reaching and pointing that evolves organically based on computational principles rather than a traditional structure-by-structure approach. The book also includes five appendixes that provide brief refreshers on fundamentals of biology, mathematics, physics, and neurophysiology, as well as a glossary of relevant terms. The authors have also made supplemental materials available on the Internet. These web
documents provide source code for simulations, step-by-step derivations of certain mathematical formulations, and expanded explanations of some concepts.


Mastering a rich repertoire of motor behaviors, as humans and other animals do, is a surprising and still poorly understood outcome of evolution, development, and learning. Many degrees-of-freedom, non-linear dynamics, and sensory delays provide formidable challenges for controlling even simple actions. Modularity as a functional element, both structural and computational, of a control architecture might be the key organizational principle that the central nervous system employs for achieving versatility and adaptability in motor control. Recent investigations of muscle synergies, motor primitives, compositionality, basic action concepts, and related work in machine learning have contributed to advance, at different levels, our understanding of the modular architecture underlying rich motor behaviors. However, the existence and nature of the modules in the control architecture is far from settled. For instance, regularity and low-dimensionality in the motor output are often taken as an indication of modularity but could they simply be a byproduct of optimization and task constraints? Moreover, what are the relationships between modules at different levels, such as muscle synergies, kinematic invariants, and basic action concepts? One important reason for the new interest in understanding modularity in motor control from different viewpoints is the impressive development in cognitive robotics. In comparison to animals and humans, the motor skills of today’s best robots are limited and inflexible. However, robot technology is maturing to the point at which it can start approximating a reasonable spectrum of isolated perceptual, cognitive, and motor capabilities. These advances allow researchers to explore how these motor, sensory and cognitive functions might be integrated into meaningful architectures and to test their functional limits. Such systems provide a new test bed to explore different concepts of modularity and to address the interaction between motor and cognitive processes experimentally. Thus, the goal of this Research Topic is to review, compare, and debate theoretical and experimental investigations of the modular organization of the motor control system at different levels. By bringing together researchers seeking to understand the building blocks for coordinating many muscles, for planning endpoint and joint trajectories, and for representing motor and behavioral actions in memory we aim at promoting new interactions between often disconnected research areas and approaches and at providing a broad perspective on the idea of modularity in motor control. We welcome original research, methodological, theoretical, review, and perspective contributions from behavioral, system, and computational motor neuroscience research, cognitive psychology, and cognitive robotics.

Setting a common international agenda for physical education, this book asks how physical education and physical education teacher education can be reconfigured together so that they are responsive to changes in today’s fast-paced, diverse and
uncertain global society. It argues that only a revolutionary move away from national policy silos can reinvigorate physical education and lead to improved, equitable outcomes for children and youth, and both novice and veteran teachers. Drawing on developing success stories in diverse places, this book emphasizes three important strategies: international-comparative analyses, which facilitate cross-border knowledge generation, innovation, professional learning and continuous improvement; solid, dynamic partnerships between teacher education programmes and exemplary school physical education programmes; and knowledge-generating teams consisting of exemplary teachers and teacher educators. Each chapter provides viable alternatives and rationales framed by unique national and local contexts. Significantly, these chapters announce that the work that lies ahead – and starts now – is a collective action project. It necessitates collaborative research and development among policy leaders, researchers, teacher education specialists, physical education teachers and, in some cases, school-age students. This is essential reading for all researchers with an interest in physical education or teacher education, and an invaluable source of new perspectives for physical education students, pre-service and in-service teachers, and educational administrators and policymakers.

Though there have been many developments in sensory/motor prosthetics, they have not yet reached the level of standard and worldwide use like pacemakers and cochlear implants. One challenging issue in motor prosthetics is the large variety of patient situations, which depending on the type of neurological disorder. To improve neuroprosthetic performance beyond the current limited use of such systems, robust bio-signal processing and model-based control involving actual sensory motor state (with biosignal feedback) would bring about new modalities and applications, and could be a breakthrough toward adaptive neuroprosthetics. Recent advances of Brain Computer Interfaces (BCI) now enable patients to transmit their intention of movement. However, the functionality and controllability of motor prosthetics itself can be further improved to take advantage of BCI interfaces. In this Research Topic we welcome contribution of original research articles, computational and experimental studies, review articles, and methodological advances related to biosignal processing that may enhance the functionality of sensory motor neuroprosthetics. The scope of this topic includes, but is not limited to, studies aimed at enhancing: 1) computational biosignal processing in EMG (Electromyography), EEG (Electroencephalography), and other modalities of biofeedback information; 2) the computational method in modeling and control of sensory motor neuroprosthetics; 3) the systematic functionality aiming to provide solutions for specific pathological movement disorders; 4) human interfaces such as BCI - but in the case of BCI study, manuscripts should be experimental studies which are applied to sensory/motor neuroprosthetics in patients with motor disabilities.

This book is concerned with Intelligent Control methods and applications. The field of intelligent control has been expanded very much during the recent years and a solid body of theoretical and practical results are now available. These results have been obtained through the synergetic fusion of concepts and techniques from a variety of fields such as automatic control, systems science, computer science, neurophysiology and operational research. Intelligent control systems have to perform
anthropomorphic tasks fully autonomously or interactively with the human under known or unknown and uncertain environmental conditions. Therefore the basic components of any intelligent control system include cognition, perception, learning, sensing, planning, numeric and symbolic processing, fault detection/repair, reaction, and control action. These components must be linked in a systematic, synergetic and efficient way. Predecessors of intelligent control are adaptive control, self-organizing control, and learning control which are well documented in the literature. Typical application examples of intelligent controls are intelligent robotic systems, intelligent manufacturing systems, intelligent medical systems, and intelligent space teleoperators. Intelligent controllers must employ both quantitative and qualitative information and must be able to cope with severe temporal and spatial variations, in addition to the fundamental task of achieving the desired transient and steady-state performance. Of course the level of intelligence required in each particular application is a matter of discussion between the designers and users. The current literature on intelligent control is increasing, but the information is still available in a sparse and disorganized way.
"In the present work, we seek to build on previous studies of speech motor control and learning responses to perturbed auditory feedback by demonstrating associations between sensorimotor speech processes and patterns of brain activity. In particular, we wish to draw attention to speech motor learning in comparison to speech motor control. Contemporary models of speech motor control have been constructed on the basis of feedback perturbation studies, but generally do not include mechanisms for motor learning or the associated neural substrates. In a series of three studies, we investigated the modulation of cortical beta oscillations during unperturbed speech planning and production; in response to perturbed auditory feedback; and as a measure to compare resting brain connectivity before and after a speech motor learning and speech motor control task. The first study revealed a broad role for beta desynchronization during speech planning, beginning in different regions of the left and right hemisphere and then spreading across much of the left hemisphere and a more restricted area of the right. During overt speech production, beta desynchronization was focused around pericentral regions, with additional modulations in auditory and inferior frontal regions at certain points during the utterance, corresponding in time to sensorimotor feedback processing. The patterns of beta oscillations throughout both phases partly corresponded with pathways proposed by a "dual-stream" model of auditory processing. The second study found significant associations between cortical beta power and behavioural compensation to perturbed auditory feedback. The particular regions depended on the learning phase (early/late) and also the utterance phase (planning/production). A number of brain regions outside of those proposed in speech motor control models showed this relationship with behavioural compensation, particularly in prefrontal and inferior parietal regions, including bilateral supramarginal gyrus, a region proposed to play a variety of different sensorimotor functions during speech. The final study found a broad network of brain regions with significant increases in beta band connectivity after a speech motor learning task, particularly including anterior prefrontal and right temporal regions. In comparison, a speech motor control task evoked only two significant increases in connectivity. Connectivity changes across the two tasks showed some potential functional overlap, but also point to a network for feedback processing outside of core speech motor control regions. This network would include a module for phonological working memory, as well as a link between speech motor learning and lexical-semantic processes. Our results suggest the need for expanded models of speech production. These expanded models could then serve as a basis for examining the interactions between lower-level sensorimotor control and learning processes and behavioural processes such as second-language learning and recovery of speech capacities after injury." --

This up-to-date handbook focuses on the study of action, or"motor control,"which examines movement and skill and the internal processes that lead to them. As action is interrelated with cognition, this is a vigorous field of investigation.
by international experts, Motor Skills provides current reviews on general processes important to motor control--learning, coordination, timing, planning, and control--and on the individual skills of throwing, catching, reaching, and typing. The text describes important conceptual and methodological advances regarding control theory and timing, and is divided into two sections which analyze skill from the perspectives of general processes and individual skills. Sensorimotor Control and Learning is a groundbreaking text that provides a uniquely integrated treatment of sensory and motor processes, reflecting the latest research trends in both neuromotor control and the perceptual sciences. Richly illustrated and written in a clear and concise manner, the book emphasizes the intimate links between sensory and motor processes, providing an integrated view of perception and action. 

Features of the book: • Emphasis on the multidisciplinary nature of the subject, which makes the text useful for a wide variety of readers • A rigorous and thorough account of how motor behaviors are controlled, coordinated, and changed • Numerous real-world examples relating to everyday experience • The latest research in the field, including a unique introductory treatment of control theory • Boxes highlighting and explaining more than 100 key terms, definitions and concepts throughout the text • Essential background material on neuroscience, biomechanics and engineering, making it a self-contained book for students • Over 600 high-quality illustrations by the author Sensorimotor Control and Learning is an indispensable resource for students of kinesiology and psychology, as well as students of other disciplines such as human factors, biomedical engineering, physiotherapy, and the neurosciences.

This book brings together some of the latest research in robot applications, control, modeling, sensors and algorithms. Consisting of three main sections, the first section of the book has a focus on robotic surgery, rehabilitation, self-assembly, while the second section offers an insight into the area of control with discussions on exoskeleton control and robot learning among others. The third section is on vision and ultrasonic sensors which is followed by a series of chapters which include a focus on the programming of intelligent service robots and systems adaptations. Despite the intensive experimental and theoretical studies for over a century, the general processes involved in neural control of posture and movement, in learning of motor behaviour in healthy subjects and in adaptation in pathology were and remain a challenging problems for the scientists in the field of sensorimotor control. The book is the outcome of the Advanced Research Workshop Sensorimotor Control, where the focus was on the state and the perspectives of the study in the field.

Die Sportpsychologie ist eine sich dynamisch entwickelnde Disziplin im Schnittbereich von Psychologie und Sportwissenschaft. Sie beschäftigt sich mit menschlichem Erleben und Handeln im komplexen Feld des Sports und der Bewegung. Dabei interessieren zum einen Möglichkeiten, wie sportliche Leistungen optimiert werden können, und zum
We introduce a biomimetic simulation framework for investigating human perception and sensorimotor control. Our framework is unique in that it features a biomechanically simulated musculoskeletal human model actuated by 823 muscles. The anthropomorphic model has two human-like eyes whose retinas contain spatially nonuniform arrangements of photoreceptors. The sensorimotor control system of our human model comprises a set of 15 automatically-trained, fully-connected deep neural networks. Two networks control the saccadic eye movement functionality of its binocular, foveated perception system. The remaining networks achieve neuromuscular control of the skeletal muscles. One network controls the 216 neck muscles that actuate the neck-head biomechanical complex, producing controlled head movements. In our prototype model, 3 networks control each limb; in particular, the 29 muscles in each of the two arms and the 39 muscles in each of the two legs. Thus, the virtual human demonstrates eective sensorimotor control of its eyes, head, and four limbs driven exclusively by visual perception to achieve a nontrivial motor task. We also demonstrate that its foveated perceptual system is capable of appearance-based recognition.

Taken together, the findings from these studies provide novel insights into the sensorimotor integration impairments underlying stuttering. The sensorimotor learning studies demonstrated that sensory prediction errors may not be correctly integrated for subsequent movement planning in both CWS and AWS, and that this limitation reflects less than optimal implicit learning processes. The sensorimotor control study confirmed that AWS are indeed more dependent on online feedback for immediate within-movement corrections. This necessary but inefficient control strategy may ultimately lead to the repetitive corrections or postural fixations that are perceived as stuttering moments during speech production (Max et al., 2004; Max & Daliri, 2019). The book constitutes the proceedings of the 24th International Conference on Artificial Neural Networks, ICANN 2014, held in Hamburg, Germany, in September 2014. The 107 papers included in the proceedings were carefully reviewed and selected from 173 submissions. The focus of the papers is on following topics: recurrent networks; competitive learning and self-organisation; clustering and classification; trees and graphs; human-machine interaction; deep networks; theory; reinforcement learning and action; vision; supervised learning; dynamical models and time series; neuroscience; and applications. Sensorimotor Control and Learning is a groundbreaking text that provides a uniquely integrated treatment of sensory and motor...
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