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Book Catalogue
Series in Signal, Image and Speech Processing

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Machine Intelligence (MI) is the motor that drives the modern information-rich society. Supercomputing and parallel coding have made MI programs feasible and the theoretical base of MI has matured. Graphical Processors (GPs) have found new life as carrier for low-cost supercomputing. The road towards lower cost & size leads to embedding systems, such as self-driving cars and intelligent houses.

Machine intelligence has not only opened many disruptive venues but given simultaneously a lot of anxiety. Compared to the many accidents in the early days of automotive traffic, the few problems with the TESLA cars are already sufficient for major concern. Evidently, still research is required to bring MI on the appropriate safety levels that rule the type tests for acceptance on the European automotive market.

In the ACM Turing Award 2018, Hennessy and Patterson prophesize the breakthrough of Domain-Specific Processor. A typical example is the modern vision hardware in the automotive domain. Such applications bring collectively self-driving in reach for safety concerns. It features a domain-specific mix of hardware and software. Hardware can be correctly designed & manufactured and will not change afterwards. Software can be formally proven but efficiency requires to keep it close to the platform.

Robust Embedded Intelligence on Cellular Neural Networks makes the reader familiar with the mathematical and electronic techniques to turn a data-driven problem into a safe embedded solution. In particular, it treats aspects on Cellular Neural Networks (CNN) for reliable visual recognition in a wide range of practical applications, highlighting vein feature extraction and license plate recognition.
Description:
The subject of Signals and Systems is enormously complex, involving many concepts such as signals, mathematics and filter design that are woven together in an intricate manner. To cope with this scope and complexity, many Signals and Systems texts are often organized around the "numerical examples" of a system. With such organization, students can see through the complexity of Signals and Systems, they can learn about the distinct concepts and protocols in one part of the communication system while seeing the big picture of how all parts fit together. From a pedagogical perspective, our personal experience has been that such approach indeed works well. Based on the Authors extensive experience of teaching and research, the book is written with such a reader in mind. The Book is intended for a course on signals & systems at the senior undergraduate level and above. The authors consider all the requirements and tools used in analysis and design of discrete time systems for filter design and signal processing.

Key features of the International Edition:

- The extensive use of MATLAB based examples to illustrate how to solve the signals & systems problems. The textbook includes a wealth of problems with solutions.
- Worked-out examples have been included to explain new and difficult concepts and to expose the reader to real-life signal processing problems.

The inclusion of FIR and IIR filter design further enriches the contents of the book.
Description:
The emergence of huge amounts of data which require analysis and in some cases real-time processing has forced exploration into fast algorithms for handling very large data sizes. Analysis of x-ray images in medical applications, cyber security data, crime data, telecommunications and stock market data, health records and business analytics data are but a few areas of interest. Applications and platforms including R, RapidMiner and Weka provide the basis for analysis, often used by practitioners who pay little to no attention to the underlying mathematics and processes impacting the data. This often leads to an inability to explain results or correct mistakes, or to spot errors.

*Applied Data Analytics - Principles and Applications* seeks to bridge this missing gap by providing some of the most sought after techniques in big data analytics. Establishing strong foundations in these topics provides practical ease when big data analyses are undertaken using the widely available open source and commercially orientated computation platforms, languages and visualisation systems. The book, when combined with such platforms, provides a complete set of tools required to handle big data and can lead to fast implementations and applications.

The book contains a mixture of machine learning foundations, deep learning, artificial intelligence, statistics and evolutionary learning mathematics written from the usage point of view with rich explanations on what the concepts mean. The author has thus avoided the complexities often associated with these concepts when found in research papers. The tutorial nature of the book and the applications provided are some of the reasons why the book is suitable for undergraduate, postgraduate and big data analytics enthusiasts.

This text should ease the fear of mathematics often associated with practical data analytics and support rapid applications in artificial intelligence, environmental sensor data modelling and analysis, health informatics, business data analytics, data from Internet of Things and deep learning applications.
Description:
The book presents the fundamentals of music science, followed by a discussion on the historical evolution of music. An introduction to the analysis of signals in time and frequency is presented, which includes sound and noise. Features and mathematical aspects of the sound are discussed, including vibration and timbre.

The book presents a review of existing voice models and discusses the voice production, sound perception, music characteristics and acoustics, tempo, rhythm and harmony. Musical theory is presented, including staff, notes, alterations, keys and intervals, tones and associated frequencies and wavelengths.

The creation of major and minor scales is emphasized, along with a study on consonance and dissonance, measure, metric, tempo markings, dynamics, modulation. The book also explains the chord formation, and discusses melody and composition.

The book has four appendices, including an appendix on the basic differentiation and integration theorems, another with useful Fourier tables, and an appendix featuring the notes, their frequencies and wavelengths. The book also has a glossary of music terms.
Description:
Video is the main driver of bandwidth use, accounting for over 80 per cent of consumer Internet traffic. Video compression is a critical component of many of the available multimedia applications, it is necessary for storage or transmission of digital video over today’s band-limited networks. The majority of this video is coded using international standards developed in collaboration with ITU-T Study Group and MPEG.

The MPEG family of video coding standards begun on the early 1990s with MPEG-1, developed for video and audio storage on CD-ROMs, with support for progressive video. MPEG-2 was standardized in 1995 for applications of video on DVD, standard and high definition television, with support for interlaced and progressive video. MPEG-4 part 2, also known as MPEG-2 video, was standardized in 1999 for applications of low-bit rate multimedia on mobile platforms and the Internet, with the support of object-based or content based coding by modeling the scene as background and foreground. Since MPEG-1, the main video coding standards were based on the so-called macroblocks. However, research groups continued the work beyond the traditional video coding architectures and found that macroblocks could limit the performance of the compression when using high-resolution video. Therefore, in 2013 the high efficiency video coding (HEVC) also known and H.265, was released, with a structure similar to H.264/AVC but using coding units with more flexible partitions than the traditional macroblocks. HEVC has greater flexibility in prediction modes and transform block sizes, also it has a more sophisticated interpolation and de blocking filters.

In 2006 the VC-1 was released. VC-1 is a video codec implemented by Microsoft and the Microsoft Windows Media Video (WMV) 9 and standardized by the Society of Motion Picture and Television Engineers (SMPTE). In 2017 the Joint Video Experts Team (JVET) released a call for proposals for a new video coding standard initially called Beyond the HEVC, Future Video Coding (FVC) or known as Versatile Video Coding (VVC). VVC is being built on top of HEVC for application on Standard Dynamic Range (SDR), High Dynamic Range (HDR) and 360° Video. The VVC is planned to be finalized by 2020.

This book presents the new VVC, and updates on the HEVC. The book discusses the advances in lossless coding and covers the topic of screen content coding. Technical topics discussed include:

- Beyond the High Efficiency Video Coding
- High Efficiency Video Coding encoder
- Screen content
- Lossless and visually lossless coding algorithms
- Fast coding algorithms
- Visual quality assessment
- Other screen content coding algorithms
- Overview of JPEG Series
Description:
Research in information, communications and signal processing has brought about new services, applications and functions in a large number of fields which include consumer electronics, biomedical devices and defence. These applications play an important role in advancing technologies to enhance human life in general.

Recent Advances in Information, Communications and Signal Processing aims to give students, researchers, and engineers information pertaining to recent advances in these fields. In terms of research in signal processing topics, the two chapters included in this book have a strong emphasis on advances in algorithmic development in the biomedical, and human-computer interfaces domain areas. More specifically, the use of deep learning for placental maturity staging is discussed as well as the use of vibration analysis for localising impacts on surfaces for human-computer applications. In terms of communications signal processing, advances in new wireless communication such as NOMA (non-orthogonal multiple access) and millimetre-wave antenna design for 5G cellular mobile radio, as well as innovations in LDPC (low density parity check code) decoding and networking coding, are featured.
High Efficiency Video Coding and Other Emerging Standards

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Description:
High Efficiency Video Coding and Other Emerging Standards provides an overview of high efficiency video coding (HEVC) and all its extensions and profiles. There are nearly 300 projects and problems included, and about 400 references related to HEVC alone. Next generation video coding (NGVC) beyond HEVC is also described. Other video coding standards such as AVS2, DAALA, THOR, VP9 (Google), DIRAC, VC1, and AV1 are addressed, and image coding standards such as JPEG, JPEG-LS, JPEG2000, JPEG XR, JPEG XS, JPEG XT and JPEG-Pleno are also listed. Understanding of these standards and their implementation is facilitated by overview papers, standards documents, reference software, software manuals, test sequences, source codes, tutorials, keynote speakers, panel discussions, reflector and ftp/web sites – all in the public domain. Access to these categories is also provided.
Description:
Analysis, design, and realization of digital filters have experienced major developments since the 1970s, and have now become an integral part of the theory and practice in the field of contemporary digital signal processing.

Digital Filter Design and Realization is written to present an up-to-date and comprehensive account of the analysis, design, and realization of digital filters. It is intended to be used as a text for graduate students as well as a reference book for practitioners in the field. Prerequisites for this book include basic knowledge of calculus, linear algebra, signal analysis, and linear system theory.

Technical topics discussed in the book include:

- Discrete-Time Systems and z-Transformation
- Stability and Coefficient Sensitivity
- State-Space Models
- FIR Digital Filter Design
- Frequency-Domain Digital Filter Design
- Time-Domain Digital Filter Design
- Interpolated and Frequency-Response-Masking FIR Digital Filter Design
- Composite Digital Filter Design
- Finite Word Length Effects
- Coefficient Sensitivity Analysis and Minimization
- Error Spectrum Shaping
- Roundoff Noise Analysis and Minimization
- Generalized Transposed Direct-Form II
- Block-State Realization
The subject of Digital Signal Processing (DSP) is enormously complex, involving many concepts, probabilities, and signal processing that are woven together in an intricate manner. To cope with this scope and complexity, many DSP texts are often organized around the “numerical examples” of a communication system. With such organization, readers can see through the complexity of DSP, they learn about the distinct concepts and protocols in one part of the communication system while seeing the big picture of how all parts fit together. From a pedagogical perspective, our personal experience has been that such approach indeed works well.

Based on the authors’ extensive experience in teaching and research, Digital Signal Processing: a breadth-first approach is written with the reader in mind. The book is intended for a course on digital signal processing, for seniors and undergraduate students. The subject has high popularity in the field of electrical and computer engineering, and the authors consider all the needs and tools used in analysis and design of discrete time systems for signal processing.

Key features of the book include:

- The extensive use of MATLAB based examples to illustrate how to solve signal processing problems. The textbook includes a wealth of problems, with solutions
- Worked-out examples have been included to explain new and difficult concepts, which help to expose the reader to real-life signal processing problems
- The inclusion of FIR and IIR filter design further enrich the contents