Tracking And Data Fusion A Handbook Of Algorithms By

Data Fusion ApplicationsMathematics of Data FusionUncertainty Theories and Multisensor Data FusionData Fusion for Situation Monitoring, Incident Detection, Alert and Response ManagementMultisensor Data FusionSensor and Data Fusion for Intelligent Transportation SystemsTracking and Sensor Data FusionData Fusion for Sensory Information Processing SystemsMultisensor Fusion and Integration for Intelligent SystemsSensor and Data FusionMultisensor Data FusionMulti-sensor Data Fusion with MATLABAdvances in Multi-Sensor Information Fusion: Theory and Applications 2017Random SetsMultisensor Data FusionData Fusion for Situation Monitoring, Incident Detection, Alert and Response ManagementMultisensor Attitude EstimationSensor and Data FusionNon-Cooperative Target Tracking, Fusion and ControlMathematical Techniques in Multisensor Data FusionDesign and Analysis of Modern Tracking SystemsMobile Positioning and TrackingIntegrated Tracking, Classification, and Sensor ManagementDistributed Data Fusion for Network-Centric OperationsData Fusion: Concepts and IdeasData Fusion MathematicsHigh-Level Data FusionMulti-Sensor Data FusionMulti-Sensor Data Fusion with MATLAB®Multitarget-multisensor TrackingEstimation with Applications to Tracking and NavigationMathematics of Data FusionMultisensor FusionTracking and Data FusionDistributed Data Fusion for Network-Centric OperationsHandbook of

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Data Fusion Applications

For some time, all branches of the military have used a wide range of sensors to provide data for many purposes, including surveillance, reconnoitring, target detection and battle damage assessment. Many nations have also attempted to utilise these sensors for civilian applications, such as crop monitoring, agricultural disease tracking, environmental diagnostics, cartography, ocean temperature profiling, urban planning, and the characterisation of the Ozone Hole above Antarctica. The recent convergence of several important technologies has made possible new, advanced, high performance, sensor based applications relying on the near-simultaneous fusion of data from an ensemble of different types of sensors. The book examines the underlying principles of sensor operation and data fusion, the techniques and technologies that enable the process, including the operation of 'fusion engines'. Fundamental theory and the enabling technologies of data fusion are presented in a systematic and accessible manner. Applications are discussed in the areas of medicine, meteorology, BDA and targeting, transportation, cartography, the environment, agriculture, and manufacturing and process control.

Mathematics of Data Fusion

With the recent proliferation of service-oriented architectures (SOA), cloud computing technologies, and distributed-interconnected systems, distributed fusion is taking on a larger role in a variety of applications—from environmental monitoring and crisis management to intelligent buildings and defense. Drawing on the work of leading experts around the world, Distributed Data Fusion for Network-Centric Operations examines the state of the art of data fusion in a distributed sensing, communications, and computing environment. Get Insight into Designing and Implementing Data Fusion in a Distributed Network Addressing the entirety of information fusion, the contributors cover everything from signal and image processing, through estimation, to situation awareness. In particular, the work offers a timely look at the issues and solutions involving fusion within a distributed network enterprise. These include critical design problems, such as how to maintain a pedigree of agents or nodes that receive information, provide their contribution to the dataset, and pass to other network components. The book also tackles dynamic data sharing within a network-centric enterprise, distributed fusion effects on state estimation, graph-theoretic methods to optimize fusion performance, human engineering factors, and computer ontologies for higher levels of situation assessment. A comprehensive introduction to this emerging field and its challenges, the book explores how data fusion can be used within grid, distributed, and cloud computing

architectures. Bringing together both theoretical and applied research perspectives, this is a valuable reference for fusion researchers and practitioners. It offers guidance and insight for those working on the complex issues of designing and implementing distributed, decentralized information fusion.

Uncertainty Theories and Multisensor Data Fusion

Data fusion or information fusion are names which have been primarily assigned to military-oriented problems. In military applications, typical data fusion problems are: multisensor, multitarget detection, object identification, tracking, threat assessment, mission assessment and mission planning, among many others. However, it is clear that the basic underlying concepts underlying such fusion procedures can often be used in nonmilitary applications as well. The purpose of this book is twofold: First, to point out present gaps in the way data fusion problems are conceptually treated. Second, to address this issue by exhibiting mathematical tools which treat combination of evidence in the presence of uncertainty in a more systematic and comprehensive way. These techniques are based essentially on two novel ideas relating to probability theory: the newly developed fields of random set theory and conditional and relational event algebra. This volume is intended to be both an update on research progress on data fusion and an introduction to potentially powerful new techniques: fuzzy logic, random set theory, and

conditional and relational event algebra. Audience: This volume can be used as a reference book for researchers and practitioners in data fusion or expert systems theory, or for graduate students as text for a research seminar or graduate level course.

Data Fusion for Situation Monitoring, Incident Detection, Alert and Response Management

Fills the Existing Gap of Mathematics for Data Fusion Data fusion (DF) combines large amounts of information from a variety of sources and fuses this data algorithmically, logically and, if required intelligently, using artificial intelligence (AI). Also, known as sensor data fusion (SDF), the DF fusion system is an important component for use in various applications that include the monitoring of vehicles, aerospace systems, large-scale structures, and large industrial automation plants. Data Fusion Mathematics: Theory and Practice offers a comprehensive overview of data fusion, and provides a proper and adequate understanding of the basic mathematics directly related to DF. The material covered can be used for evaluation of the performances of any designed and developed DF systems. It tries to answer whether unified data fusion mathematics can evolve from various disparate mathematical concepts, and highlights mathematics that can add credibility to the data fusion process. Focuses on Mathematical Tools That Use Data Fusion This text explores the use of statistical/probabilistic signal/image processing, filtering, component

analysis, image algebra, decision making, and neuro-FL–GA paradigms in studying, developing and validating data fusion processes (DFP). It covers major mathematical expressions, and formulae and equations as well as, where feasible, their derivations. It also discusses SDF concepts, DF models and architectures, aspects and methods of type 1 and 2 fuzzy logics, and related practical applications. In addition, the author covers soft computing paradigms that are finding increasing applications in multisensory DF approaches and applications. This book: Explores the use of interval type 2 fuzzy logic and ANFIS in DF Covers the mathematical treatment of many types of filtering algorithms, target-tracking methods, and kinematic DF methods Presents single and multi-sensor tracking and fusion mathematics Considers specific DF architectures in the context of decentralized systems Discusses information filtering, Bayesian approaches, several DF rules, image algebra and image fusion, decision fusion, and wireless sensor network (WSN) multimodality fusion Data Fusion Mathematics: Theory and Practice incorporates concepts, processes, methods, and approaches in data fusion that can help you with integrating DF mathematics and achieving higher levels of fusion activity, and clarity of performance. This text is geared toward researchers, scientists, teachers and practicing engineers interested and working in the multisensor data fusion area.

Multisensor Data Fusion

"Sensor and Data Fusion for Intelligent Transportation

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Systems introduces readers to the roles of the data fusion processes defined by the Joint Directors of Laboratories (JDL) data fusion model, data fusion algorithms, and noteworthy applications of data fusion to ITS. Additionally, the monograph offers detailed descriptions of three of the widely applied data fusion techniques and their relevance to ITS (namely, Bayesian inference, Dempster-Shafer evidential reasoning, and Kalman filtering), and indicates directions for future research in the area of data fusion. The focus is on data fusion algorithms rather than on sensor and data fusion architectures, although the book does summarize factors that influence the selection of a fusion architecture and several architecture frameworks"--

Sensor and Data Fusion for Intelligent Transportation Systems

Using MATLAB® examples wherever possible, Multi-Sensor Data Fusion with MATLAB explores the three levels of multi-sensor data fusion (MSDF): kinematic-level fusion, including the theory of DF; fuzzy logic and decision fusion; and pixel- and feature-level image fusion. The authors elucidate DF strategies, algorithms, and performance evaluation mainly for aerospace applications, although the methods can also be applied to systems in other areas, such as biomedicine, military defense, and environmental engineering. After presenting several useful strategies and algorithms for DF and tracking performance, the book evaluates DF algorithms, software, and systems. It next covers fuzzy logic, fuzzy sets and their

properties, fuzzy logic operators, fuzzy propositions/rule-based systems, an inference engine, and defuzzification methods. It develops a new MATLAB graphical user interface for evaluating fuzzy implication functions, before using fuzzy logic to estimate the unknown states of a dynamic system by processing sensor data. The book then employs principal component analysis, spatial frequency, and wavelet-based image fusion algorithms for the fusion of image data from sensors. It also presents procedures for combing tracks obtained from imaging sensor and ground-based radar. The final chapters discuss how DF is applied to mobile intelligent autonomous systems and intelligent monitoring systems. Fusing sensors' data can lead to numerous benefits in a system's performance. Through real-world examples and the evaluation of algorithmic results, this detailed book provides an understanding of MSDF concepts and methods from a practical point of view. Select MATLAB programs are available for download on www.crcpress.com

Tracking and Sensor Data Fusion

This book gives a concise and comprehensive overview of non-cooperative target tracking, fusion and control. Focusing on algorithms rather than theories for non-cooperative targets including air and space-borne targets, this work explores a number of advanced techniques, including Gaussian mixture cardinalized probability hypothesis density (CPHD) filter, optimization on manifold, construction of filter banks and tight frames, structured sparse

representation, and others. Containing a variety of illustrative and computational examples, Non-cooperative Target Tracking, Fusion and Control will be useful for students as well as engineers with an interest in information fusion, aerospace applications, radar data processing and remote sensing.

Data Fusion for Sensory Information Processing Systems

There has been an increasing interest in multi-disciplinary research on multisensor attitude estimation technology driven by its versatility and diverse areas of application, such as sensor networks, robotics, navigation, video, biomedicine, etc. Attitude estimation consists of the determination of rigid bodies' orientation in 3D space. This research area is a multilevel, multifaceted process handling the automatic association, correlation, estimation, and combination of data and information from several sources. Data fusion for attitude estimation is motivated by several issues and problems, such as data imperfection, data multi-modality, data dimensionality, processing framework, etc. While many of these problems have been identified and heavily investigated, no single data fusion algorithm is capable of addressing all the aforementioned challenges. The variety of methods in the literature focus on a subset of these issues to solve, which would be determined based on the application in hand. Historically, the problem of attitude estimation has been introduced by Grace Wahba in 1965 within the estimate of satellite attitude and aerospace

applications. This book intends to provide the reader with both a generic and comprehensive view of contemporary data fusion methodologies for attitude estimation, as well as the most recent researches and novel advances on multisensor attitude estimation task. It explores the design of algorithms and architectures, benefits, and challenging aspects, as well as a broad array of disciplines, including: navigation, robotics, biomedicine, motion analysis, etc. A number of issues that make data fusion for attitude estimation a challenging task, and which will be discussed through the different chapters of the book, are related to: 1) The nature of sensors and information sources (accelerometer, gyroscope, magnetometer, GPS, inclinometer, etc.); 2) The computational ability at the sensors; 3) The theoretical developments and convergence proofs; 4) The system architecture, computational resources, fusion level.

Multisensor Fusion and Integration for Intelligent Systems

The adaptive configuration of nodes in a sensor network has the potential to improve sequential estimation performance by intelligently allocating limited sensor network resources. In addition, the use of heterogeneous sensing nodes provides a diversity of information that also enhances estimation performance. This work reviews cognitive systems and presents a cognitive fusion framework for sequential state estimation using adaptive configuration of heterogeneous sensing nodes and

heterogeneous data fusion. This work also provides an application of cognitive fusion to the sequential estimation problem of target tracking using foveal and radar sensors.

Sensor and Data Fusion

The science associated with the development of artificial sen sory systems is occupied primarily with determining how information about the world can be extracted from sensory data. For example, computational vision is, for the most part, concerned with the de velopment of algorithms for distilling information about the world and recognition of various objects in the environ (e. g. localization ment) from visual images (e. g. photographs or video frames). There are often a multitude of ways in which a specific piece of informa tion about the world can be obtained from sensory data. A subarea of research into sensory systems has arisen which is concerned with methods for combining these various information sources. This field is known as data fusion, or sensor fusion. The literature on data fusion is extensive, indicating the intense interest in this topic, but is quite chaotic. There are no accepted approaches, save for a few special cases, and many of the best methods are ad hoc. This book represents our attempt at providing a mathematical foundation upon which data fusion algorithms can be constructed and analyzed. The methodology that we present in this text is mo tivated by a strong belief in the importance of constraints in sensory information processing systems. In our view, data fusion is best un derstood

as the embedding of multiple constraints on the solution to a sensory information processing problem into the solution pro cess.

Multisensor Data Fusion

This IMA Volume in Mathematics and its Applications RANDOM SETS: THEORY AND APPLICATIONS is based on the proceedings of a very successful 1996 three-day Summer Program on "Application and Theory of Random Sets." We would like to thank the scientific organizers: John Goutsias (Johns Hopkins University), Ronald P.S. Mahler (Lockheed Martin), and Hung T. Nguyen (New Mexico State University) for their excellent work as organizers of the meeting and for editing the proceedings. We also take this opportunity to thank the Army Research Office (ARO), the Office ofNaval Research (0NR), and the Eagan, MinnesotaEngineering Center ofLockheed Martin Tactical Defense Systems, whose financial support made the summer program possible. Avner Friedman Robert Gulliver v PREFACE "Later generations will regard set theory as a disease from which one has recovered. " - Henri Poincare Random set theory was independently conceived by D.G. Kendall and G. Matheron in connection with stochastic geometry. It was however G.

Multi-sensor Data Fusion with MATLAB

Since the publication of the first edition of this book, advances in algorithms, logic and software tools have transformed the field of data fusion. The latest edition

covers these areas as well as smart agents, human computer interaction, cognitive aides to analysis and data system fusion control. data fusion system, this book guides you through the process of determining the trade-offs among competing data fusion algorithms, selecting commercial off-the-shelf (COTS) tools, and understanding when data fusion improves systems processing. Completely new chapters in this second edition explain data fusion system control, DARPA's recently developed TRIP model, and the latest applications of data fusion in data warehousing and medical equipment, as well as defence systems.

Advances in Multi-Sensor Information Fusion: Theory and Applications 2017

This book is a printed edition of the Special Issue "Advances in Multi-Sensor Information Fusion: Theory and Applications 2017" that was published in Sensors

Random Sets

Multisensor Data Fusion

Addressing recent challenges and developments in this growing field, Multisensor Data Fusion Uncertainty Theory first discusses basic questions such as: Why and when is multiple sensor fusion necessary? How can the available measurements be characterized in such a case? What is the purpose and the specificity of information fusion processing in multiple sensor systems? Considering the different

uncertainty formalisms, a set of coherent operators corresponding to the different steps of a complete fusion process is then developed, in order to meet the requirements identified in the first part of the book.

Data Fusion for Situation Monitoring, Incident Detection, Alert and Response Management

This book illustrates the benefits of sensor fusion by considering the characteristics of infrared, microwave, and millimeter-wave sensors, including the influence of the atmosphere on their performance. Applications that benefit from this technology include: vehicular traffic management, remote sensing, target classification and tracking- weather forecasting- military and homeland defense. Covering data fusion algorithms in detail, Klein includes a summary of the information required to implement each of the algorithms discussed, and outlines system application scenarios that may limit sensor size but that require high resolution data.

Multisensor Attitude Estimation

12.3 Cooperative Data Fusion and Filtering Techniques -- 12.4 COMET: A Cooperative Mobile Positioning System -- 12.5 Experimental Activity in a Cooperative WLAN Scenario -- 12.6 Conclusions -- References -- Index -- End User License Agreement

Sensor and Data Fusion

Sensor Data Fusion is the process of combining incomplete and imperfect pieces of mutually complementary sensor information in such a way that a better understanding of an underlying real-world phenomenon is achieved. Typically, this insight is either unobtainable otherwise or a fusion result exceeds what can be produced from a single sensor output in accuracy, reliability, or cost. This book provides an introduction Sensor Data Fusion, as an information technology as well as a branch of engineering science and informatics. Part I presents a coherent methodological framework, thus providing the prerequisites for discussing selected applications in Part II of the book. The presentation mirrors the author's views on the subject and emphasizes his own contributions to the development of particular aspects. With some delay, Sensor Data Fusion is likely to develop along lines similar to the evolution of another modern key technology whose origin is in the military domain, the Internet. It is the author's firm conviction that until now, scientists and engineers have only scratched the surface of the vast range of opportunities for research, engineering, and product development that still waits to be explored: the Internet of the Sensors.

Non-Cooperative Target Tracking, Fusion and Control

The book explores object and situation fusion processes with an appropriate handling of uncertainties, and applies cutting-edge artificial intelligence and emerging technologies like particle

filtering, spatiotemporal clustering, net-centricity, agent formalism, and distributed fusion together with essential Level 1 techniques and Level 1/2 interactions.

Mathematical Techniques in Multisensor Data Fusion

Design and Analysis of Modern Tracking Systems

Here's a thorough overview of the state-of-the-art in design and implementation of advanced tracking for single and multiple sensor systems. This practical resource provides modern system designers and analysts with in-depth evaluations of sensor management, kinematic and attribute data processing, data association, situation assessment, and modern tracking and data fusion methods as applied in both military and non-military arenas.

Mobile Positioning and Tracking

An introduction to data fusion which employs both new and traditional communication and information theory, pattern recognition, image understanding, estimation theory, digital signal processing and artificial intelligence.

Integrated Tracking, Classification, and Sensor Management

Distributed Data Fusion for Network-Centric Operations

Expert coverage of the design and implementation of stateestimation algorithms for tracking and navigation Estimation with Applications to Tracking and Navigationtreats the estimation of various quantities from inherentlyinaccurate remote observations. It explains state estimator designusing a balanced combination of linear systems, probability, andstatistics. The authors provide a review of the necessary backgroundmathematical techniques and offer an overview of the basic conceptsin estimation. They then provide detailed treatments of all themajor issues in estimation with a focus on applying thesetechniques to real systems. Other features include: Problems that apply theoretical material to real-worldapplications In-depth coverage of the Interacting Multiple Model (IMM)estimator Companion DynaEst(TM) software for MATLAB(TM) implementation ofKalman filters and IMM estimators Design guidelines for tracking filters Suitable for graduate engineering students and engineers workingin remote sensors and tracking, Estimation with Applications toTracking and Navigation provides expert coverage of thisimportant area.

Data Fusion: Concepts and Ideas

In the years since the bestselling first edition, fusion research and applications have adapted to service-oriented architectures and pushed the boundaries of

situational modeling in human behavior, expanding into fields such as chemical and biological sensing, crisis management, and intelligent buildings. Handbook of Multisensor Data Fusion: Theory and Practice, Second Edition represents the most current concepts and theory as information fusion expands into the realm of network-centric architectures. It reflects new developments in distributed and detection fusion, situation and impact awareness in complex applications, and human cognitive concepts. With contributions from the world's leading fusion experts, this second edition expands to 31 chapters covering the fundamental theory and cutting-edge developments that are driving this field. New to the Second Edition— · Applications in electromagnetic systems and chemical and biological sensors · Army command and combat identification techniques · Techniques for automated reasoning · Advances in Kalman filtering · Fusion in a network centric environment · Service-oriented architecture concepts · Intelligent agents for improved decision making · Commercial off-the-shelf (COTS) software tools From basic information to state-of-the-art theories, this second edition continues to be a unique, comprehensive, and up-to-date resource for data fusion systems designers.

Data Fusion Mathematics

Multisensor Data Fusion: From Algorithms and Architectural Design to Applications covers the contemporary theory and practice of multisensor data fusion, from fundamental concepts to cutting-edge

techniques drawn from a broad array of disciplines. Featuring contributions from the world's leading data fusion researchers and academicians, this authoritative book: Presents state-of-the-art advances in the design of multisensor data fusion algorithms, addressing issues related to the nature, location, and computational ability of the sensors Describes new materials and achievements in optimal fusion and multisensor filters Discusses the advantages and challenges associated with multisensor data fusion, from extended spatial and temporal coverage to imperfection and diversity in sensor technologies Explores the topology, communication structure, computational resources, fusion level, goals, and optimization of multisensor data fusion system architectures Showcases applications of multisensor data fusion in fields such as medicine, transportation's traffic, defense, and navigation Multisensor Data Fusion: From Algorithms and Architectural Design to Applications is a robust collection of modern multisensor data fusion methodologies. The book instills a deeper understanding of the basics of multisensor data fusion as well as a practical knowledge of the problems that can be faced during its execution.

High-Level Data Fusion

With the recent proliferation of service-oriented architectures (SOA), cloud computing technologies, and distributed-interconnected systems, distributed fusion is taking on a larger role in a variety of applications—from environmental monitoring and

crisis management to intelligent buildings and defense. Drawing on the work of leading experts around the world, Distributed Data Fusion for Network-Centric Operations examines the state of the art of data fusion in a distributed sensing, communications, and computing environment. Get Insight into Designing and Implementing Data Fusion in a Distributed Network Addressing the entirety of information fusion, the contributors cover everything from signal and image processing, through estimation, to situation awareness. In particular, the work offers a timely look at the issues and solutions involving fusion within a distributed network enterprise. These include critical design problems, such as how to maintain a pedigree of agents or nodes that receive information, provide their contribution to the dataset, and pass to other network components. The book also tackles dynamic data sharing within a network-centric enterprise, distributed fusion effects on state estimation, graph-theoretic methods to optimize fusion performance, human engineering factors, and computer ontologies for higher levels of situation assessment. A comprehensive introduction to this emerging field and its challenges, the book explores how data fusion can be used within grid, distributed, and cloud computing architectures. Bringing together both theoretical and applied research perspectives, this is a valuable reference for fusion researchers and practitioners. It offers guidance and insight for those working on the complex issues of designing and implementing distributed, decentralized information fusion.

Multi-Sensor Data Fusion

The ?eld of multi-sensor fusion and integration is growing into signi?cance as our societyisintransitionin toubiquitouscomputingenvironmentswithroboticservic es everywhere under ambient intelligence. What surround us are to be the networks of sensors and actuators that monitor our environment, health, security and safety, as well as the service robots, intelligent vehicles, and autonomous systems of ever heightened autonomy and dependability with integrated heterogeneous sensors and actuators. The ?eld of multi-sensor fusion and integration plays key role for m- ing the above transition possible by providing fundamental theories and tools for implementation. This volume is an edition of the papers selected from the 7th IEEE International Conference on Multi-Sensor Integration and Fusion, IEEE MFI'08, held in Seoul, Korea, August 20–22, 2008. Only 32 papers out of the 122 papers accepted for IEEE MFI'08 were chosen and requested for revision and extension to be included in this volume. The 32 contributions to this volume are organized into three parts: Part I is dedicated to the Theories in Data and Information Fusion, Part II to the Multi-Sensor Fusion and Integration in Robotics and Vision, and Part III to the Applications to Sensor Networks and Ubiquitous Computing Environments. To help readers understand better, a part summary is included in each part as an introduction. The summaries of Parts I, II, and III are prepared respectively by Prof. Hanseok Ko, Prof. Sukhan Lee and Prof. Hernsoo Hahn.

Multi-Sensor Data Fusion with MATLAB®

Data fusion, the ability to combine data derived from several sources to provide a coherent, informative, and useful characterization of a situation,is a challenging task. There is no unified and proven solution which is applicable in all circumstances, but there are many plausible and useful approaches which can be and are used to solve particular applications. This volume presents the proceedings of the workshop Data Fusion Applications hosted in Brussels by the 1992 ESPRIT Conference and Exhibition. It contains 22 papers from 69 experts,who present advanced research results on data fusion together with practicalsolutions to multisensor data fusion in a wide variety of applications: real-time expert systems, robotics, medical diagnosis and patient surveillance, monitoring and control, marine protection, surveillance and safety in public transportation systems, image processing and interpretation, and environmental monitoring. The research forms part of the ESPRIT project DIMUS (Data Integration in Multisensor Systems).

Multitarget-multisensor Tracking

Estimation with Applications to Tracking and Navigation

This book illustrates the benefits of sensor fusion by considering the characteristics of infrared, microwave, and millimeter-wave sensors, including the influence

of the atmosphere on their performance. Applications that benefit from this technology include: vehicular traffic management, remote sensing, target classification and tracking- weather forecasting-military and homeland defense. Covering data fusion algorithms in detail, Klein includes a summary of the information required to implement each of the algorithms discussed, and outlines system application scenarios that may limit sensor size but that require high resolution data.

Mathematics of Data Fusion

This volume contains the Proceedings of the 2nd International Workshop on Information Processing in Sensor Networks (IPSN 2003). The workshop was held at the Palo Alto Research Center (PARC), Palo Alto, California, on April 22–23, 2003. Informationprocessin ginsensornetworksisaninterdisciplinaryresearcharea with deep connections to signal processing, networking and protocols, databases and information management, as well as distributed algorithms. Because of - vances in MEMS microsensors, wireless networking, and embedded processing, ad hoc networks of sensors are becoming increasingly available for commercial andmilitaryapplicationssucha senvironmentalmonitoring(e.g.,tra?c,habitat, security), industrial sensing and diagnostics (e.g., factories, appliances), inf- structure maintenance (e.g., power grids, water distribution, waste disposal), and battle?eld awareness (e.g., multitarget tracking). From the engineering and computing point of view, sensor networks have become a rich source of

problems in communication protocols, sensor tasking and control, sensor fusion, distributed databases and algorithms, probabilistic reasoning, system/software architecture, design methodologies, and evaluation metrics. This workshop took a systemic approach to address crosslayer issues, from the physical sensor layer to the sensor signal processing and networking levels and then all the way to the applications. Following the successful 1st Workshop on Collaborative Signal and Inf- mation Processing in Sensor Networks at PARC in 2001, this new workshop brought together researchers from academia, industry, and government to p- sent and discuss recent work concerning various aspects of sensor networks such as information organization, querying, routing, and self-organization, with an emphasis on the high-level information processing tasks that these networks are designed to perform.

Multisensor Fusion

The emerging technology of multisensor data fusion has a wide range of applications, both in Department of Defense (DoD) areas and in the civilian arena. The techniques of multisensor data fusion draw from an equally broad range of disciplines, including artificial intelligence, pattern recognition, and statistical estimation. With the rapid evolut

Tracking and Data Fusion

Data fusion or information fusion are names which have been primarily assigned to military-oriented

problems. In military applications, typical data fusion problems are: multisensor, multitarget detection, object identification, tracking, threat assessment, mission assessment and mission planning, among many others. However, it is clear that the basic underlying concepts underlying such fusion procedures can often be used in nonmilitary applications as well. The purpose of this book is twofold: First, to point out present gaps in the way data fusion problems are conceptually treated. Second, to address this issue by exhibiting mathematical tools which treat combination of evidence in the presence of uncertainty in a more systematic and comprehensive way. These techniques are based essentially on two novel ideas relating to probability theory: the newly developed fields of random set theory and conditional and relational event algebra. This volume is intended to be both an update on research progress on data fusion and an introduction to potentially powerful new techniques: fuzzy logic, random set theory, and conditional and relational event algebra. Audience: This volume can be used as a reference book for researchers and practitioners in data fusion or expert systems theory, or for graduate students as text for a research seminar or graduate level course.

Distributed Data Fusion for Network-Centric Operations

This textbook provides a comprehensive introduction to the theories and techniques of multi-sensor data fusion. It is aimed at advanced undergraduate and

first-year graduate students in electrical engineering and computer science, as well as researchers and professional engineers. The book is intended to be self-contained. No previous knowledge of multi-sensor data fusion is assumed, although some familiarity with the basic tools of linear algebra, calculus and simple probability theory is recommended.

Handbook of Multisensor Data Fusion

This textbook provides a comprehensive introduction to the concepts and idea of multisensor data fusion. It is an extensively revised second edition of the author's successful book: "Multi-Sensor Data Fusion: An Introduction" which was originally published by Springer-Verlag in 2007. The main changes in the new book are: New Material: Apart from one new chapter there are approximately 30 new sections, 50 new examples and 100 new references. At the same time, material which is out-of-date has been eliminated and the remaining text has been rewritten for added clarity. Altogether, the new book is nearly 70 pages longer than the original book. Matlab code: Where appropriate we have given details of Matlab code which may be downloaded from the worldwide web. In a few places, where such code is not readily available, we have included Matlab code in the body of the text. Layout. The layout and typography has been revised. Examples and Matlab code now appear on a gray background for easy identification and advancd material is marked with an asterisk. The book is intended to be self-contained. No previous knowledge of multi-sensor data fusion is assumed, although

some familarity with the basic tools of linear algebra, calculus and simple probability is recommended. Although conceptually simple, the study of mult-sensor data fusion presents challenges that are unique within the education of the electrical engineer or computer scientist. To become competent in the field the student must become familiar with tools taken from a wide range of diverse subjects including: neural networks, signal processing, statistical estimation, tracking algorithms, computer vision and control theory. All too often, the student views multi-sensor data fusion as a miscellaneous assortment of different processes which bear no relationship to each other. In contrast, in this book the processes are unified by using a common statistical framework. As a consequence, the underlying pattern of relationships that exists between the different methodologies is made evident. The book is illustrated with many real-life examples taken from a diverse range of applications and contains an extensive list of modern references.

Cognitive Fusion for Target Tracking

Data Fusion is a very broad interdisciplinary technology domain. It provides techniques and methods for; integrating information from multiple sources and using the complementarities of these detections to derive maximum information about the phenomenon being observed; analyzing and deriving the meaning of these observations and predicting possible consequences of the observed state of the environment; selecting the best course of action; and

controlling the actions. Here, the focus is on the more mature phase of data fusion, namely the detection and identification / classification of phenomena being observed and exploitation of the related methods for Security-Related Civil Science and Technology (SST) applications. It is necessary to; expand on the data fusion methodology pertinent to Situation Monitoring, Incident Detection, Alert and Response Management; discuss some related Cognitive Engineering and visualization issues; provide an insight into the architectures and methodologies for building a data fusion system; discuss fusion approaches to image exploitation with emphasis on security applications; discuss novel distributed tracking approaches as a necessary step of situation monitoring and incident detection; and provide examples of real situations, in which data fusion can enhance incident detection, prevention and response capability. In order to give a logical presentation of the data fusion material, first the general concepts are highlighted (Fusion Methodology, Human Computer Interactions and Systems and Architectures), closing with several applications (Data Fusion for Imagery, Tracking and Sensor Fusion and Applications and Opportunities for Fusion).

Multiple-target Tracking with Radar Applications

Data fusion problems arise frequently in many different fields. This book provides a specific introduction to data fusion problems using support vector machines. In the first part, this book begins

with a brief survey of additive models and Rayleigh quotient objectives in machine learning, and then introduces kernel fusion as the additive expansion of support vector machines in the dual problem. The second part presents several novel kernel fusion algorithms and some real applications in supervised and unsupervised learning. The last part of the book substantiates the value of the proposed theories and algorithms in MerKator, an open software to identify disease relevant genes based on the integration of heterogeneous genomic data sources in multiple species. The topics presented in this book are meant for researchers or students who use support vector machines. Several topics addressed in the book may also be interesting to computational biologists who want to tackle data fusion challenges in real applications. The background required of the reader is a good knowledge of data mining, machine learning and linear algebra.

Information Processing in Sensor Networks

A unique guide to the state of the art of tracking, classification, and sensor management This book addresses the tremendous progress made over the last few decades in algorithm development and mathematical analysis for filtering, multi-target multi-sensor tracking, sensor management and control, and target classification. It provides for the first time an integrated treatment of these advanced topics, complete with careful mathematical formulation, clear description of the theory, and real-world applications.

Written by experts in the field, Integrated Tracking, Classification, and Sensor Management provides readers with easy access to key Bayesian modeling and filtering methods, multi-target tracking approaches, target classification procedures, and large scale sensor management problem-solving techniques. Features include: An accessible coverage of random finite set based multi-target filtering algorithms such as the Probability Hypothesis Density filters and multi-Bernoulli filters with focus on problem solving A succinct overview of the track-oriented MHT that comprehensively collates all significant developments in filtering and tracking A state-of-the-art algorithm for hybrid Bayesian network (BN) inference that is efficient and scalable for complex classification models New structural results in stochastic sensor scheduling and algorithms for dynamic sensor scheduling and management Coverage of the posterior Cramer-Rao lower bound (PCRLB) for target tracking and sensor management Insight into cutting-edge military and civilian applications, including intelligence, surveillance, and reconnaissance (ISR) With its emphasis on the latest research results, Integrated Tracking, Classification, and Sensor Management is an invaluable guide for researchers and practitioners in statistical signal processing, radar systems, operations research, and control theory.

Kernel-based Data Fusion for Machine Learning

Data Fusion is a very broad interdisciplinary

technology domain. It provides techniques and methods for; integrating information from multiple sources and using the complementarities of these detections to derive maximum information about the phenomenon being observed; analyzing and deriving the meaning of these observations and predicting possible consequences of the observed state of the environment; selecting the best course of action; and controlling the actions. Here, the focus is on the more mature phase of data fusion, namely the detection and identification / classification of phenomena being observed and exploitation of the related methods for Security-Related Civil Science and Technology (SST) applications. It is necessary to; expand on the data fusion methodology pertinent to Situation Monitoring, Incident Detection, Alert and Response Management; discuss some related Cognitive Engineering and visualization issues; provide an insight into the architectures and methodologies for building a data fusion system; discuss fusion approaches to image exploitation with emphasis on security applications; discuss novel distributed tracking approaches as a necessary step of situation monitoring and incident detection; and provide examples of real situations, in which data fusion can enhance incident detection, prevention and response capability. In order to give a logical presentation of the data fusion material, first the general concepts are highlighted (Fusion Methodology, Human Computer Interactions and Systems and Architectures), closing with several applications (Data Fusion for Imagery, Tracking and Sensor Fusion and Applications and Opportunities for Fusion).

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