Multi Sensor Data Fusion With Matlab

Sensor and Data FusionData Fusion: Concepts and IdeasTracking and Sensor Data FusionSensor and Data Fusion Concepts and ApplicationsMulti-Sensor Data FusionMulti-Sensor Data Fusion with MATLABMultisensor Data FusionMulti-Sensor Data Fusion with MATLAB®Resource-Aware Data Fusion Algorithms for Wireless Sensor NetworksMathematical Techniques in Multisensor Data FusionHandbook of Multisensor Data FusionMultisensor Data Fusion2017 Symposium on Sensor Data Fusion: Trends, Solutions, Applications (SDF)Multisensor FusionData Fusion in Wireless Sensor NetworksSensor and Data Fusion for Intelligent Transportation SystemsSensor Data Fusion Analysis for Broad ApplicationsAdvances and Challenges in Multisensor Data and Information ProcessingSensor Data FusionData Fusion in Robotics & Machine Intelligence Lawrence A. Klein H B Mitchell Wolfgang Koch Lawrence A. Klein H.B. Mitchell Jitendra R. Raol Hassen Fourati Jitendra R. Raol Ahmed Abdelgawad David Lee Hall Martin Liggins II David Hall Anthony K. Hyder Domenico Ciuonzo Lawrence A. Klein Natividad Duro Carralero Eric Lefebvre S.C. Horenberg Bozzano G Luisa

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

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there are approximately 30 new sections 50 new examples and 100 new references at the same time material which is out of date has been eliminated and the remaining text has been rewritten for added clarity altogether the new book is nearly 70 pages longer than the original book matlab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 nowappear 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 statisticalframework 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

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

first published in 1993 this tutorial text has been revised and updated to provide explanations and examples of data fusion algorithms in areas not covered in the first edition these include bayesian inference artificial neural networks and fuzzy logic all of the chapters in the first edition have been revised and updated and new material is included on the fascode and modtran atmospheric models and eosael which analyzes physical processes that affect the performance of millimeter wave and ir sensors

the purpose of this book is to provide an introduction to the theories and techniques of multi sensor data fusion the book has been designed as a text for a one semester graduate course in multi sensor data fusion it should also be useful to advanced undergraduates in electrical engineering or computer science who are studying data fusion for the rst time and to practising en neers who wish to apply the concepts of data fusion to practical applications the book is intended to be largely self contained in so far as the subject of multi sensor data fusion is concerned although some prior exposure to the subject may be helpful to the reader a clear understanding of multi sensor data fusion can only be achieved with the use of a certain minimum level of mathematics itisthereforeassumedthatthereaderhasareasonableworking knowledge of the basic tools of linear algebra calculus and simple probability theory more speci c results and techniques which are required are explained in the body of the book or in appendices which are appended to the end of the book

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

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

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 crcpress com

this book introduces resource aware data fusion algorithms to gather and combine data from multiple sources e g sensors in order to achieve inferences these techniques can be used in centralized and distributed systems to overcome sensor failure technological limitation and spatial and temporal coverage problems the algorithms described in this book are evaluated with simulation and experimental results to show they will maintain data integrity and make data useful and informative describes techniques to overcome real problems posed by wireless sensor networks deployed in circumstances that might interfere with measurements provided such as strong variations of pressure temperature radiation and electromagnetic noise uses simulation and experimental results to evaluate algorithms presented and includes real test bed includes case study implementing data fusion algorithms on a remote monitoring framework for sand production in oil pipelines

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

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

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

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

the role of data fusion has been expanding in recent years through the incorporation of pervasive applications where the physical infrastructure is coupled with information and communication technologies such as wireless sensor networks for the internet of things iot e health and industry 4 0 in this edited reference the authors provide advanced tools for the design analysis and implementation of inference algorithms in wireless sensor networks

sensor and data fusion for intelligent transportation 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

nowadays there are many fields of application where different sensors are used to collect sensitive data a good analysis of this data allows for improving the performance of a system as well as making it more efficient and secure new technologies have made it increasingly possible to analyze larger amounts of data which has allowing for the area of sensor data fusion analysis to undergo exponential growth the objective of this reprint is to immerse the reader in the latest

advances in this area showing applications in very different fields that demonstrate its relevance

information fusion resulting from multi source processing often called multisensor data fusion when sensors are the main sources of information is a relatively young less than 20 years technology domain it provides techniques and methods for integrating data from multiple sources and using the complementarity of this data to derive maximum information about the phenomenon being observed analyzing and deriving the meaning of these observations selecting the best course of action and controlling the actions various sensors have been designed to detect some specific phenomena but not others data fusion applications can combine synergically information from many sensors including data provided by satellites and contextual and encyclopedic knowledge to provide enhanced ability to detect and recognize anomalies in the environment compared with conventional means data fusion is an integral part of multisensor processing but it can also be applied to fuse non sensor information geopolitical intelligence etc to provide decision support for a timely and effective situation and threat assessment one special field of application for data fusion is satellite imagery which can provide extensive information over a wide area of the electromagnetic spectrum using several types of sensors visible infra red ir thermal ir radar synthetic aperture radar sar polarimetric sar polsar hyperspectral satellite imagery provides the coverage rate needed to identify and monitor human activities from agricultural practices land use crop types identification to defence related surveillance land sea target detection and classification by acquiring remotely sensed imagery over earth regions that land sensors cannot access valuable information can be gathered for the defence against terrorism this books deals with the following research areas target recognition classification and tracking sensor systems image processing remote sensing and remote control belief functions theory and situation assessment

this book addresses the techniques for modeling and integration of data provided by different sensors within robotics and knowledge sources within machine intelligence leaders in robotics and machine intelligence capture state of the art technology in data sensor fusion and give a unified vision of the future of the field presented from both the theoretical and practical angles

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