Artificial Intelligence In Aerospace

This book explores the main concepts, algorithms, and techniques of Machine Learning and data mining for aerospace technology. Satellites are the ‘eagle eyes’ that allow us to view massive areas of the Earth simultaneously, and can gather more data, more quickly, than tools on the ground. Consequently, the development of intelligent health monitoring systems for artificial satellites – which can determine satellites’ current status and predict their failure based on telemetry data – is one of the most important current issues in aerospace engineering. This book is divided into three parts, the first of which discusses central problems in the health monitoring of artificial satellites, including tensor-based anomaly detection for satellite telemetry data and machine learning in satellite monitoring, as well as the design, implementation, and validation of satellite simulators. The second part addresses telemetry data analytics and mining problems, while the last part focuses on security issues in telemetry data.

"A follow-on volume to Advances in Intelligent and Autonomous Aerospace Systems (AIAA, 2012), Advances in Computational Intelligence and Autonomy for Aerospace Systems seeks tp provide both the aerospace researcher and the practicing aerospace engineer with further insight into the latest innovative methods and approaches regarding intelligent and autonomous aerospace systems."--Page [4] of cover.

Space technology has become increasingly important after the great development and rapid progress in information and communication technology as well as the technology of space exploration. This book deals with the latest and most prominent research in space technology. The first part of the book (first six chapters) deals with the algorithms and software used in information processing, communications and control of spacecrafts. The second part (chapters 7 to 10) deals with the latest research on the space structures. The third part (chapters 11 to 14) deals with some of the latest applications in space. The fourth part (chapters 15 and 16) deals with small satellite technologies. The fifth part (chapters 17 to 20) deals with some of the latest applications in the field of aircrafts. The sixth part (chapters 21 to 25) outlines some recent research efforts in different subjects.

The ultimate goal of this report was to integrate the powerful tools of artificial intelligence into the traditional process of software development. To maintain the US aerospace competitive advantage, traditional aerospace and software engineers need to more easily incorporate the technology of artificial intelligence into the advanced aerospace systems being designed today. The future goal was to transition artificial intelligence from an emerging technology to a standard technology that is considered early in the life cycle process to develop state-of-the-art aircraft automation systems. This report addressed the future goal in two ways. First, it provided a matrix that identified typical aircraft automation

applications conducive to various artificial intelligence methods. The purpose of this matrix was to provide top-level guidance to managers contemplating the possible use of artificial intelligence in the development of aircraft automation. Second, the report provided a methodology to formally evaluate neural networks as part of the traditional process of software development. The matrix was developed by organizing the discipline of artificial intelligence into the following six methods: logical, object representation-based, distributed, uncertainty management, temporal and neurocomputing. Next, a study of existing aircraft automation applications that have been conducive to artificial intelligence implementation resulted in the following five categories: pilot-vehicle interface, system status and diagnosis, situation assessment, automatic flight planning, and aircraft flight control. The resulting matrix provided management guidance to understand artificial intelligence as it applied to aircraft automation. The approach taken to develop a methodology to formally evaluate neural networks as part of the software engineering life cycle was to start with the existing software quality assurance standards and to change these standards to include neural network dev...

The development and launch of the first artificial satellite Sputnik more than five decades ago propelled both the scientific and engineering communities to new heights as they worked together to develop novel solutions to the challenges of spacecraft system design. This symbiotic relationship has brought significant technological advances that have enabled the design of systems that can withstand the rigors of space while providing valuable space-based services. With its 26 chapters divided into three sections, this book brings together critical contributions from renowned international researchers to provide an outstanding survey of recent advances in spacecraft technologies. The first section includes nine chapters that focus on innovative hardware technologies while the next section is comprised of seven chapters that center on cutting-edge state estimation techniques. The final section contains eleven chapters that present a series of novel control methods for spacecraft orbit and attitude control.

The resurgence of artificial intelligence has been fueled by the availability of the present generation of high-performance computational tools and techniques. This book is designed to provide introductory guidance to artificial intelligence, particularly from the perspective of digital systems engineering. Artificial Intelligence and Digital Systems Engineering provides a general introduction to the origin of AI and covers the wide application areas and software and hardware interfaces. It will prove to be instrumental in helping new users expand their knowledge horizon to the growing market of AI tools, as well as showing how AI is applicable to the development of games, simulation, and consumer products, particularly using artificial neural networks. This book is for the general reader, university students, and instructors of industrial, production, civil, mechanical, and manufacturing engineering. It will also be of interest to managers of technology, projects, business, plants, and operations.

Biomimetics in Aerospace: Technologies and Applications focuses on five key technology areas for the broad aerospace and related communities, including Education, Systems Engineering and Design, Artificial Intelligence, Big Data, and Machine Learning, Energy Conversion, Power and Propulsion, Communications, Instrumentation, Robotics and Synthetic Biology, Life in Extreme Environments, and Human Persistence in Space. With contributions from all over the world, readers will get a much broader introduction and deeper dive into the utility of biomimetics to solve a number of technical challenges in aeronautics and space exploration. Presents a series of bio-inspired technologies applicable to the field of aerospace engineering Provides an introduction to nature-inspired design and engineering and its relevance to planning and developing the next generation of robotic and human space missions Includes hot topics such as bioinspired flight simulation, modeling and computation, flight control, and future trends in bioinspired flight

Research advances in embedded computational intelligence, communication, control, and new mechanisms for sensing, actuation, and adaptation hold the promise to transform aerospace. The result will be air and space vehicles, propulsion systems, exploration systems, and vehicle management systems that respond more quickly, provide large-scale distributed coordination, work in dangerous or inaccessible environments, and augment human capabilities. Advances in Intelligent and Autonomous Aerospace Systems seeks to provide both the aerospace researcher and the practicing aerospace engineer with an exposition on the latest innovative methods and approaches that focus on intelligent and autonomous aerospace systems. The chapters are written by leading researchers in this field, and include ideas, directions, and recent results on intelligent aerospace research issues with a focus on dynamics and control, systems engineering, and aerospace design. The content on uncertainties, modeling of large and highly non-linear complex systems, robustness, and adaptivity is intended to be useful in both the sub-system and the overall system level design and analysis of various aerospace vehicles.A broad spectrum of methods and approaches are presented, including: * Bio-Inspiration * Fuzzy Logic * Genetic Algorithms * Q-Learning * Markov Decision Processes * Approximate Dynamic Programming * Artificial Neural Networks * Probabilistic Maps * Multi-Agent Systems * Kalman, particle, and confidence filtering

Air traffic controllers need advanced information and automated systems to provide a safe environment for everyone traveling by plane. One of the primary challenges in developing training for automated systems is to determine how much a trainee will need to know about the underlying technologies to use automation safely and efficiently. To ensure safety and success, task analysis techniques should be used as the basis of the design for training in automated systems in the aviation and aerospace industries. Automated Systems in the Aviation and Aerospace Industries is a pivotal reference source that provides vital research on the application of underlying technologies used to enforce automation safety and efficiency. While highlighting topics such as expert systems, text mining, and human-machine interface, this publication explores the concept of constructing navigation algorithms, based on the use of video information and the methods of the estimation of the availability and accuracy parameters of satellite navigation. This book is ideal for aviation professionals, researchers, and managers seeking current research on information technology used to reduce the risk involved in aviation.

Handbook of Research on Artificial Intelligence Applications in the Aviation and Aerospace IndustriesIGI Global

With the emergence of smart technology and automated systems in today’s world, artificial intelligence (AI) is being incorporated into an array of professions. The aviation and aerospace industry, specifically, is a field that has seen the successful implementation of early stages of automation in daily flight operations through flight management systems and autopilot. However,

the effectiveness of aviation systems and the provision of flight safety still depend primarily upon the reliability of aviation specialists and human decision making. The Handbook of Research on Artificial Intelligence Applications in the Aviation and Aerospace Industries is a pivotal reference source that explores best practices for AI implementation in aviation to enhance security and the ability to learn, improve, and predict. While highlighting topics such as computer-aided design, automated systems, and human factors, this publication explores the enhancement of global aviation security as well as the methods of modern information systems in the aeronautics industry. This book is ideally designed for pilots, scientists, engineers, aviation operators, air crash investigators, teachers, academicians, researchers, and students seeking current research on the application of AI in the field of aviation.