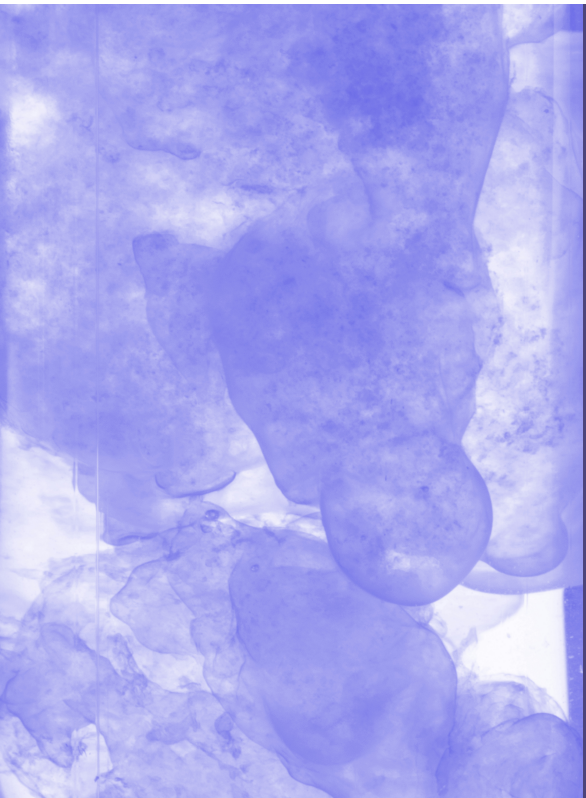
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Selected Papers



Optimizing Coverage in Wireless Sensor Networks: A Binary Ant Colony Algorithm with Hill Climbing

Authors: Alwin M. Kurian, Munachimso J. Onuorah and Habib M. Ammari

Abstract: Wireless sensor networks (WSNs) play a vital role in various fields, but ensuring optimal coverage poses a significant challenge due to the limited energy resources that constrain sensor nodes. To address this issue, this paper presents a novel approach that combines the binary ant colony algorithm (BACA), a variant of ant colony optimization (ACO), with other search optimization algorithms, such as hill climbing (HC) and simulated annealing (SA). The BACA is employed to generate an initial solution by emulating the foraging behavior of ants and the pheromone trails they leave behind in their search for food. However, we acknowledge that the BACA alone may not guarantee the most optimal solution. Subsequently, HC and SA are optimization search algorithms that refine the initial solution obtained by the BACA to find a more enhanced solution. Through extensive simulations and experiments, we demonstrate that our proposed approach results in enhanced coverage and energy-efficient coverage in a two-dimensional (2D) field. Interestingly, our findings reveal that HC consistently outperforms SA, particularly in less complex search spaces, leveraging its robust exploitation approach....

https://doi.org/10.3390/app14030960



UWB-Based Real-Time Indoor Positioning Systems: A Comprehensive Review

Authors: Mohammed Faeik Ruzaij Al-Okby, Steffen Junginger, Thomas Roddelkopf and Kerstin Thurow

Abstract: Currently, the process of tracking moving objects and determining their indoor location is considered to be one of the most attractive applications that have begun to see widespread use, especially after the adoption of this technology in some smartphone applications. The great developments in electronics and communications systems have provided the basis for tracking and location systems inside buildings, so-called indoor positioning systems (IPSs). The ultra-wideband (UWB) technology is one of the important emerging solutions for IPSs. This radio communications technology provides important characteristics that distinguish it from other solutions, such as secure and robust communications, wide bandwidth, high data rate, and low transmission power. In this paper, we review the implementation of the most important real-time indoor positioning and tracking systems that use ultra-wideband technology for tracking and localizing moving objects. This paper reviews the newest in-market UWB modules and solutions, discussing several types of algorithms that are used by the real-time UWB-based systems to determine the location with high accuracy, along with a detailed comparison that saves the reader a lot of time and effort in choosing the appropriate UWB-module/method/algorithm for real-time implementation.

https://doi.org/10.3390/app142311005

Fractal Metasurfaces and Antennas: An Overview for Advanced Applications in Wireless Communications

Authors: Francesca Venneri, Sandra Costanzo and Antonio Borgia

Abstract: This paper provides an overview of fractal antennas and metasurfaces, exploring their design principles, performance, and applications. Fractal antennas, incorporating self-similar geometric shapes, offer several advantages, such as their multiband operation, compact size, and improved performance. Metasurfaces, on the other hand, are two-dimensional structures composed of subwavelength unit cells and are designed to achieve advantageous and unusual electromagnetic properties by enabling precise control over electromagnetic waves. This paper discusses the fundamental concepts of fractal antennas and metasurfaces, compares their characteristics, and presents the latest advances in research. Additionally, it highlights applications in wireless communications, energy harvesting, sensing, and beyond.

https://doi.org/10.3390/app14072843

Digital Twins Generated by Artificial Intelligence in Personalized Healthcare

Authors: Marian Łukaniszyn, Łukasz Majka, Barbara Grochowicz, Dariusz Mikołajewski and Aleksandra Kawala-Sterniuk

Abstract: Digital society strategies in healthcare include the rapid development of digital twins (DTs) for patients and human organs in medical research and the use of artificial intelligence (AI) in clinical practice to develop effective treatments in a cheaper, quicker, and more effective manner. This is facilitated by the availability of large historical datasets from previous clinical trials and other real-world data sources (e.g., patient biometrics collected from wearable devices). DTs can use AI models to create predictions of future health outcomes for an individual patient in the form of an AI-generated digital twin to support the rapid assessment of in silico intervention strategies. DTs are gaining the ability to update in real time in relation to their corresponding physical patients and connect to multiple diagnostic and therapeutic devices. Support for this form of personalized medicine is necessary due to the complex technological challenges, regulatory perspectives, and complex issues of security and trust in this approach. The challenge is also to combine different datasets and omics to quickly interpret large datasets in order to generate health and disease indicators and to improve sampling and longitudinal analysis. It is possible to improve patient care through various means (simulated clinical trials, disease prediction, the remote monitoring of apatient's condition, treatment progress, and adjustments to the treatment plan), especially in the environments of smart cities and smart territories and through the wider use of 6G, blockchain (and soon maybe quantum cryptography), and the Internet of Things (IoT), as well as through medical technologies, such as multiomics....

https://doi.org/10.3390/app14209404

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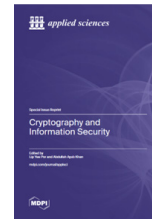
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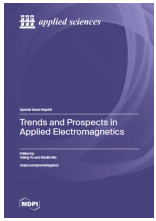
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