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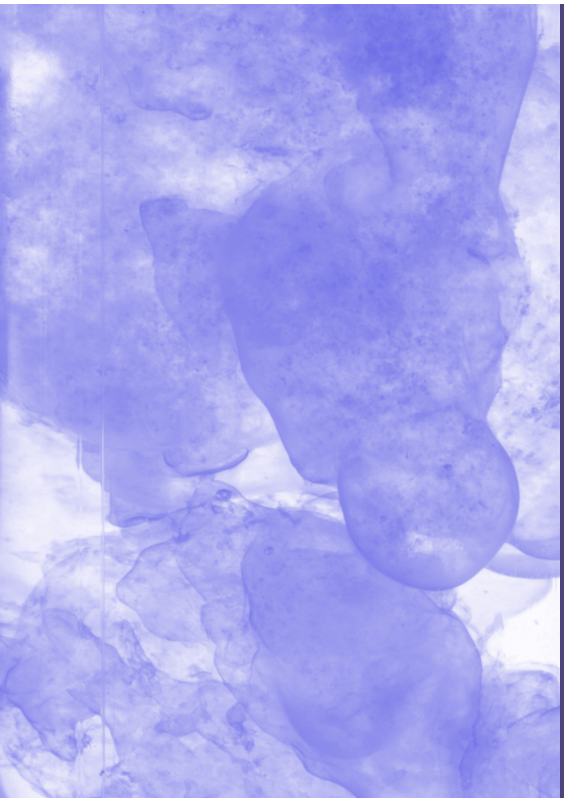

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Message from the Editor-in-Chief

As the world of science becomes ever more specialized, researchers may lose themselves in the deep forest of the ever increasing number of subfields being created. This open access journal Applied Sciences has been started to link these subfields, so researchers can cut through the forest and see the surrounding, or quite distant fields and subfields to help develop his/her own research even further with the aid of this multi-dimensional network.

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Invitation to Submit

New Insights into Intelligent Robotics

Guest Editors: Prof. Dr. Licheng Wu, Dr. Haiming Huang and Prof. Dr. Xiong Luo
Deadline: 20 March 2025

Advances in Automation and Robotics

Collection Editors: Prof. Dr. Manuel Armada and Dr. Roemi Fernandez

Special Issue Reprints

Recent Advances in Robotics and Intelligent Robots Applications

Fault Detection and State Estimation in Automatic Control

Selected Papers

Non-Parametric Calibration of the Inverse Kinematic Matrix of a Three-Wheeled Omnidirectional Mobile Robot based on Genetic Algorithms

Authors: Jordi Palacín, Elena Rubies, Ricard Bitrià and Eduard Clotet

Abstract: Odometry is a computation method that provides a periodic estimation of the relative displacements performed by a mobile robot based on its inverse kinematic matrix, its previous orientation and position, and the estimation of the angular rotational velocity of its driving wheels. Odometry is cumulatively updated from tens to hundreds of times per second, so any inaccuracy in the definition of the inverse kinematic matrix of a robot leads to systematic trajectory errors. This paper proposes a non-parametric calibration of the inverse kinematic (IK) matrix of a three-wheeled omnidirectional mobile robot based on the use of genetic algorithms (GA) to minimize the positioning error registered in a set of calibration trajectories. The application of this non-parametric procedure has provided an average improvement of 82% in the estimation of the final position and orientation of the mobile robot. This is similar to the improvement achieved with analogous parametric methods. The advantage of this non-parametric approach is that it covers a larger search space because it eliminates the need to define feasible physical limits to the search performed to calibrate the inverse kinematic matrix of the mobile robot.

https://doi.org/10.3390/app13021053

ntegrating Virtual, Mixed, and Augmented Reality to Human–Robot Interaction Applications Using Game Engines: A Brief Review of Accessible Software Tools and Frameworks

Authors: Enrique Coronado, Shunki Itadera and Ixchel G. Ramirez-Alpizar

Abstract: This article identifies and summarizes software tools and frameworks proposed in the Human–Robot Interaction (HRI) literature for developing extended reality (XR) experiences using game engines. This review includes primary studies proposing Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) solutions where humans can control or interact with real robotic platforms using devices that extend the user's reality. The objective of this article is not to present an extensive list of applications and tools. Instead, we present recent, relevant, common, and accessible frameworks and software tools implemented in research articles published in high-impact robotics conferences and journals. For this, we searched papers published during a seven-years period between 2015 and 2022 in relevant databases for robotics (Science Direct, IEEE Xplore, ACM digital library, Springer Link, and Web of Science). Additionally, we present and classify the application context of the reviewed articles in four groups: social robotics, programming of industrial robots, teleoperation of industrial robots, and Human–Robot collaboration (HRC).

https://doi.org/10.3390/app13031292

Metamodelling of Manufacturing Processes and Automation Workflows towards Designing and Operating Digital Twins

Authors: Panagiotis Stavropoulos, Alexios Papacharalampopoulos, Kyriakos Sabatakakis and Dimitris Mourtzis

Abstract: The automation of workflows for the optimization of manufacturing processes through digital twins seems to be achievable nowadays. The enabling technologies of Industry 4.0 have matured, while the plethora of available sensors and data processing methods can be used to address functionalities related to manufacturing processes, such as process monitoring and control, quality assessment and process modelling. However, technologies succeeding Computer-Integrated Manufacturing and several promising techniques, such as metamodelling languages, have not been exploited enough. To this end, a framework is presented, utilizing an automation workflow knowledge database, a classification of technologies and a metamodelling language. This approach will be highly useful for creating digital twins for both the design and operation of manufacturing processes, while keeping humans in the loop. Two process control paradigms are used to illustrate the applicability of such an approach, under the framework of certifiable human-in-the-loop process optimization.

https://doi.org/10.3390/app13031945

A Fine-Tuning Based Approach for Daily Activity Recognition between Smart Homes

Authors: Yunqian Yu, Kun Tang and Yaqing Liu

Abstract: Daily activity recognition between different smart home environments faces some challenges, such as an insufficient amount of data and differences in data distribution. However, a deep network requires a large amount of labeled data for training. Additionally, inconsistent data distribution can lead to over-fitting of network learning. Additionally, the time cost of training the network from scratch is too high. In order to solve the above problems, this paper proposes a fine-tuning method suitable for daily activity recognition, which is the first application of this method in our field. Firstly, we unify the sensor space and activity space to reduce the variability in heterogeneous environments. Then, the Word2Vec algorithm is used to transform the activity samples into digital vectors recognizable by the network. Finally, the deep network is fine-tuned to transfer knowledge and complete the recognition task. Additionally, we try to train the network on public datasets. The results show that the network trained on a small dataset also has good transferability. It effectively improves the recognition accuracy and reduces the time cost and heavy data annotation.

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