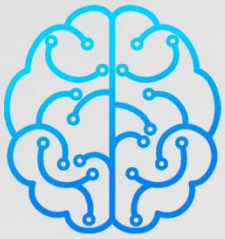

AICCONF2024

Cognitive Models and Artificial Intelligence Conference

Abstracts Book

TOKAT GAZIOSMANPAŞA UNIVERSITY
1992

May 25-26, 2024
İstanbul-Türkiye

2nd Cognitive Models and Artificial Intelligence Conference

May 25-26, 2024, İstanbul-Türkiye

Typesetting

Turgut ÖZSEVEN

Cover Design

Turgut ÖZSEVEN

Editor

Turgut ÖZSEVEN

Published by SETSCI

Publication Date: June 24, 2024

2nd Cognitive Models and Artificial Intelligence Conference

May 25-26, 2024, İstanbul-Türkiye

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AICCONF 2024

2nd Cognitive Models and Artificial Intelligence Conference

May 25-26, 2024, İstanbul-Türkiye
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Aviation & Explainable AI: Making Decision Processes Understandable And Reliable In The Aviation Sector

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Presentation/Paper Type: Oral / Abstract

Abstract – The aviation industry has increasingly adopted artificial intelligence (AI) to bolster safety, streamline operations, and optimize decision-making processes. However, this surge in AI integration has brought forth challenges concerning the comprehensibility and reliability of AI-driven decision-making systems. This article delves into the crucial role of Explainable AI (XAI) within the aviation sector, focusing on its pivotal contribution to enhancing the transparency and trustworthiness of AI applications. It provides a comprehensive examination of how XAI techniques can be effectively employed in several key aspects of aviation, spanning from aircraft operations and air traffic management to pilot training and maintenance procedures. By facilitating a clear understanding of why AI systems make particular decisions, XAI contributes to both safety and efficiency in aviation. This article also underscores the importance of trust and reliability in AI applications within the sector. It acknowledges that gaining the confidence of aviation professionals, regulators, and the public is paramount to ensure the successful implementation of AI technologies. In this context, XAI's potential to offer human-readable explanations for AI-driven actions plays a pivotal role in ensuring a harmonious and secure coexistence of advanced AI solutions with traditional aviation practices. The insights offered in this article contribute to the ongoing dialogue surrounding the assurance of safety and efficiency in AI applications in aviation, further supporting the industry's continued growth and innovation.

Keywords –aviation, explainable ai (xai), decision-making, transparency, safety

AICCONF 2024

2nd Cognitive Models and Artificial Intelligence Conference

May 25-26, 2024, İstanbul-Türkiye
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A Comprehensive Survey of Transfer Learning in Aviation: Methodologies, Applications, and Advancements

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Presentation/Paper Type: Oral / Abstract

Abstract – Transfer learning has emerged as a pivotal approach in aviation, enabling the efficient transfer of knowledge from one task or domain to another. This poster presents a comprehensive survey of transfer learning within the aviation domain, exploring a range of methodologies, applications, and recent advancements. It delves into fundamental principles such as domain adaptation, multi-task learning, and pre-trained models, emphasizing their relevance in scenarios characterized by limited labeled data. Through an investigation of successful applications across various aviation domains including aircraft maintenance, flight operations, and air traffic management, the versatility of transfer learning in aviation is showcased. Despite its promise, challenges such as negative transfer and domain shift persist, addressed alongside recent advancements like meta-learning and few-shot learning. This survey serves as a valuable resource for aviation researchers and practitioners, offering insights into the landscape of transfer learning and its potential to enhance aviation operations by bridging gaps between tasks and domains.

Keywords –Aviation, Transfer Learning, Methodologies, Applications, Advancements

AICCONF 2024

2nd Cognitive Models and Artificial Intelligence Conference

May 25-26, 2024, İstanbul-Türkiye
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Automatic extraction of lighting conditions from a real scene using devices integrated into extended reality viewers and deep learning techniques

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Presentation/Paper Type: Poster

Abstract – Augmented and/or extended reality has been experiencing a significant surge in recent years due to remarkable advancements in virtual object generation and the development of new visualization devices such as Microsoft HoloLens, Meta Quest 3, or Apple Visio Pro. In all cases, the manufacturers' goal has been consistent: to enhance the hardware device to provide the most natural immersive experience possible. This has been achieved by improving the resolution of displays integrated into each viewer, eliminating undesired effects like halos, blurring or aberrations caused by lenses some devices incorporate, and generating virtual objects with the highest possible resolution.

It is necessary to distinguish between two-dimensional virtual objects such as informational panels, pop-up windows, etc., and three-dimensional virtual objects. In the latter case, to achieve a sense of realism and smooth integration between the virtual object and the real world, it is essential to know the lighting conditions of the real scene beforehand. There is no use in generating a 3D object with high resolution and quality textures if they have been generated for specific lighting conditions (e.g., an indoor scene with several cold-high CCT light sources) while the real scene has completely different lighting conditions (e.g., an outdoor scene at sunset with warm-low CCT light).

The objective of this work is to create a real-time analysis system of the lighting conditions surrounding extended reality devices and determine the type of lighting present in the scene. This will enable us to generate virtual objects with appropriate lighting conditions. To achieve this goal, the camera of HoloLens 2 has been controlled, with the automatic white balance option deactivated and set to D65 illuminant, an industry standard for displays. With this configuration, a wide series of image captures have been conducted in a controlled lighting environment consisting of a lighting booth, a ColorChecker calibration chart, and everyday objects of different colors. Based on this set of images, a classification algorithm has been trained using Deep Learning techniques, and subsequently, the information extracted from this algorithm has been integrated into the generation of 3D virtual objects. The results obtained are very promising, although there is still room for improvement in estimating the number of different light sources and their positions.

Funding

This works was supported by the grant IB20094 of the Regional Government of the Junta de Extremadura, and partially financed by the European Regional Development Fund.

Keywords – Extended Reality, Deep Learning techniques, Color Management

AICCONF 2024

2nd Cognitive Models and Artificial Intelligence Conference

May 25-26, 2024, İstanbul-Türkiye
www.ai-conf.com

Real-time SpO2 data capture and integration into a virtual reality environment

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Presentation/Paper Type: Poster

Abstract **–** The concentration of oxygen in the blood can be estimated by calculating SpO2 levels through the comparison between the "pulsating absorbance" values of radiation of 660 (infrared) and 940 (red) nanometers, by application of the Lambert-Beer law, in the Oxyhemoglobin HbO2 and desOxyhemoglobin Hb present in arterial blood, eminently pulsating. Currently, the pulsating component of the "photoplethysmographic" wave, which represents the change in blood flow volume, together with the SpO2 value, is one of the most reliable tests to determine both respiratory failure and certain cardiac pathologies in patients with lung deficiencies.

Recently, a series of sensors have emerged that allow for the acquisition of these physiological measurements and are compatible with IoT devices, such as the MAX32664C chip. The compatibility of this type of sensors with IoT platforms and devices opens up new possibilities for use. The aim of this work is to develop an IoT device that integrates this chip and allows for real-time acquisition of these physiological parameters, processing them, and introducing them into virtual reality environments. Our purpose is, having the SpO2 data and the curve corresponding to the "photoplethysmographic" signal, to integrate them into a virtual representation of the environment of a medical vehicle. Through virtual reality, the aim is to maintain permanent contact that allows interaction with the reference medical center, practically in real time, acquiring relevant information about the patient's clinical situation while it is transported to the facilities. In any case, constituting a source of great value for the immediate or future clinical diagnosis of monitored patients.

To achieve this goal, we have utilized an ESP32 microcontroller, leveraging its two cores; one for data capture and digitization, and the other to act as a server and transmit the data to a virtual reality device. Simultaneously, the data has been stored in a remote database, enabling detailed analysis of the obtained data and their temporal series. The results obtained demonstrate the usefulness of these IoT systems in health-related tasks and their usability in virtual reality environments, both in professional and educational settings.

Funding
This works was supported by the grant IB20094 of the Regional Government of the Junta de Extremadura, and partially financed by the European Regional Development Fund.

Keywords – Biomedical Sensor, IoT, virtual reality, real time communications

AICCONF 2024

2nd Cognitive Models and Artificial Intelligence Conference

May 25-26, 2024, İstanbul-Türkiye
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Edge computing of hyperspectral textures to enhance color fidelity in real-time rendered 3D scenes for virtual reality environments

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Presentation/Paper Type: Poster

Abstract **–** Hyperspectral images have long been providing information about the surrounding world with a greater correspondence to the physical world than the information provided by traditional RGB digital images. Whether in their satellite or near-field version, they represent a rich source of information related to soil properties or digitally captured materials. These improvements come at the expense of processing and transmitting/storing a greater amount of information, resulting in longer computation times. This has so far restricted the use of such images in fields like real-time rendering and virtual reality.

The group of authors has been working on digitally capturing the optical properties of materials using a near-field hyperspectral capture system and applying it in virtual reality environments. It's worth noting that for a virtual reality scenario to function smoothly and provide a sense of immersion, a refresh rate of at least 90 Hz is necessary, with 120 Hz being recommended. This high refresh rate has made it challenging to incorporate hyperspectral information into virtual reality environments.

A data processing model and scripts based on Edge Computing is presented, which allows the use of hyperspectral information obtained from digital capture of materials in real-time rendered scenes. To achieve this, we have placed our hyperspectral texture database on a network drive within our data center and established communication between the virtual reality device used and the computing cluster equipped with 4 Nvidia Ampere A100 GPUs in our data center. This way, the generation of RGB texture images required in virtual reality environments, using Unity as the graphics engine, is performed based on hyperspectral calculations carried out in our graphics computing system. For this purpose, in the communication protocol, it is only necessary to specify the desired material from the database, the spectral range and resolution in nm, and the spectral power distribution of the light source used in the virtual reality environment. As a result of this calculation, the computing system generates and delivers a 4096 x 4096 pixels RGB image that can be used as a texture for any material defined in Unity for that specific light source. The results demonstrate optimal system performance, although we are currently working on improving system latency.

Funding

This works was supported by the grant IB20094 of the Regional Government of the Junta de Extremadura, and partially financed by the European Regional Development Fund.

Keywords – Virtual Reality, Edge Computing, Hyperspectral computation

2nd Cognitive Models and Artificial Intelligence Conference

May 25-26, 2024, İstanbul-Türkiye
www.ai-conf.com

A Defect Detection System Based on Image Processing for Plastic Injection Molding Products

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Presentation/Paper Type: Oral / Abstract

Abstract – In this study, a defect detection system for plastic injection molding products is developed. Front and rear drums of washing machines are chosen as test products. Although there are many types of defects occurring in the production process of these products, our study is conducted on three notable defects of each drum. These defects are burr, shape imperfections and absence/presence of shapes. The defect detection system consists of four parts: a robot arm, a camera module with lighting submodule, a closed cabinet and an image processing software. The system works in the following steps. Initially, the product (front or rear drum) is placed in the closed cabinet. Then, the images of the product are taken by using the camera module which is precisely positioned at all control points by the robot arm. Finally, the images are applied to the image processing software and the software produces decision as OK or Not OK. The defect detection software used in the system is based on the fundamental image processing techniques namely pixel-based and image manipulation techniques. Experimental study shows that the developed defect detection system has successful performance results, and it can be used to detect defects in plastic injection molding products.

Keywords – Image processing, defect detection, plastic injection molding products, quality control, automation

AICCONF 2024

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May 25-26, 2024, İstanbul-Türkiye
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Robotik Süreç Otomasyonunda Sık Karşılaşılan Hata Türleri Ve Hata Yönetimi İçin Çözüm Yaklaşımları

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Türkçe Özet – İş dünyasında kurumlar iş süreçlerindeki ve insan kaynağındaki verimliliklerini arttırmak, maliyetlerini düşürmek ve en önemlisi rekabet avantajı elde etmek için daha etkili teknoloji çözümlerine ilişkin arayış içindedirler ve sürekli olarak yeni teknolojilere yönelmektedirler. Bu bağlamda iş süreçlerini otomatikleştiren, insanların eylemlerini taklit eden bir dizi işlemleri yapan Robotik Süreç Otomasyonu(RSO) önem kazanmaktadır. Aynı zamanda RSO iş dünyasında yenilikçi bir çözüm olarak dönüşümün bir parçası haline gelmektedir. Çünkü RSO ile kurumlar verimliliklerini arttırabilirken maliyetlerini azaltmaktadırlar ve müşteri taleplerini daha hızlı bir şekilde işleyerek işleri tutarlı bir şekilde hata olmadan gerçekleştirebilmektedir. Fakat her teknoloji çözümünde olduğu gibi RSO'nun da potansiyel bazı zorlukları ve hata durumları olabilmektedir. Karşılaşılan bu hatalar iş süreçlerinde verimlilik kaybına ve aksamalara neden olmaktadır. Bu çalışmada RSO'da sık karşılaşılan hata türlerinin tespit edilmesi ve bu hataların etkin bir şekilde yönetilmesi için çözüm yaklaşımlarının incelenmesi amaçlanmaktadır. Çalışmanın amacına uygun olarak Vakıf Katılım Bankası örneği üzerinden RSO projelerinde oluşan hata kayıtları, bu hataların ortaya çıkma nedeni ve hataların nasıl çözüldüğü incelenmiştir. Yapılan inceleme ve tespitler sonucunda hata türleri ve hataların yönetimi için nasıl çözüm yaklaşımları geliştirildiği ele alınmıştır. Çalışmanın bulgularına göre; RSO'da karşılaşılan bu hatalar genellikle yazılımda kod karmaşıklığı ve test yetersizliği, uygulama entegrasyonlarında ortaya çıkan sorunlar, iş analizinin yetersiz olması gibi durumlardan kaynaklandığı belirlenmiştir. Bu çalışmanın sonucunda karşılaşılan hataların RSO'yu başarısız yaptığı anlamına gelmediği ve her bir hatanın bir süreç iyileştirme fırsatı olarak görülerek iyi bir hata yönetimi ile RSO'nun potansiyelinin arttırılıp RSO'dan nasıl maksimum verim elde edilebileceği ortaya konulmuştur..

Anahtar Kelimeler *– Robotik Süreç Otomasyonu, Hata Yönetimi, Hata Türleri, Süreç İyileştirme.*

Common Error Types In Robotıc Process Automatıon And Solutıon Approaches For Error Management

In the business world, organizations are in search of more effective technology solutions to increase their efficiency in business processes and human resources, reduce their costs, most importantly gain competitive advantage, and they are constantly turning to new technologies. In this context, Robotic Process Automation (RSO), which automates business processes, performs a series of operations that mimic human actions gains importance. At the same time, RSO is becoming part of the transformation as an innovative solution in the business world. With RSO, organizations can increase their productivity, reduce their costs process customer requests faster, and perform jobs consistently without errors. However, as with any technology solution, RSO also has some potential difficulties and error situations. These errors cause a loss of efficiency and disruptions in business processes. This study, it is aimed to identify the common error types in RSO and to examine the solution approaches to effectively manage these errors. For the study, the error records that occurred in RSO projects, the reasons for the occurrence of these errors, and how the errors were resolved were examined through the example of Vakıf Participation Bank. As a result of the examination and determinations made, the types of errors and how solution approaches are developed for the management of errors are discussed. According to the findings of the study; it was determined that these errors encountered in RSO are generally caused by situations such as code complexity and insufficient testing in the software, problems arising in application integrations, inadequate business analysis. As a result of this study, it has been revealed that the errors encountered do not mean that RSO fails and each error is seen as a process improvement opportunity and how the potential of RSO can be increased and maximum efficiency can be obtained from RSO with good error management.

Keywords *– Robotic Process Automation, Error Management, Error Types, Process Improvement.*

AICCONF 2024

2nd Cognitive Models and Artificial Intelligence Conference

May 25-26, 2024, İstanbul-Türkiye
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Identity Verification Processes With Voice Biometrics and Artificial Intelligence

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Abstract **–** Biometrics refers to the measurable physical and behavioral characteristics of every living creature. These characteristics represent the unique biological characteristics of individuals. The identities of living things can be determined by analyzing various types of biological data such as fingerprints, faces, eyes, voices, and vascular patterns. Identification from biometric features is used in almost every field today. Voice biometrics performs identity verification by analyzing individuals' speech patterns. Today, voice identification is used as an alternative or verification step in many areas. However, with the spread, the protection of personal data and fraud has gained great importance. In particular, ensuring the confidentiality and security of biometric data is of critical importance for the healthy management of personal data and creating a secure environment. In this context, there are laws and standards determined by the regulatory and supervisory boards of the states. With the development of artificial intelligence technology in recent years, a new threat has emerged regarding the forgery of biometric data. Artificial intelligence algorithms could make it possible to forge biometric data, which could lead to increased fraud. Therefore, the development and implementation of security solutions for the security of biometric data has become an important necessity. In this article, studies on biometric features, especially voice biometrics, and their use with artificial intelligence technology will be discussed.

Keywords *– Biometrics, Voice Biometrics, Identity Verification Process, Artificial Intelligence, Voice Recognition*