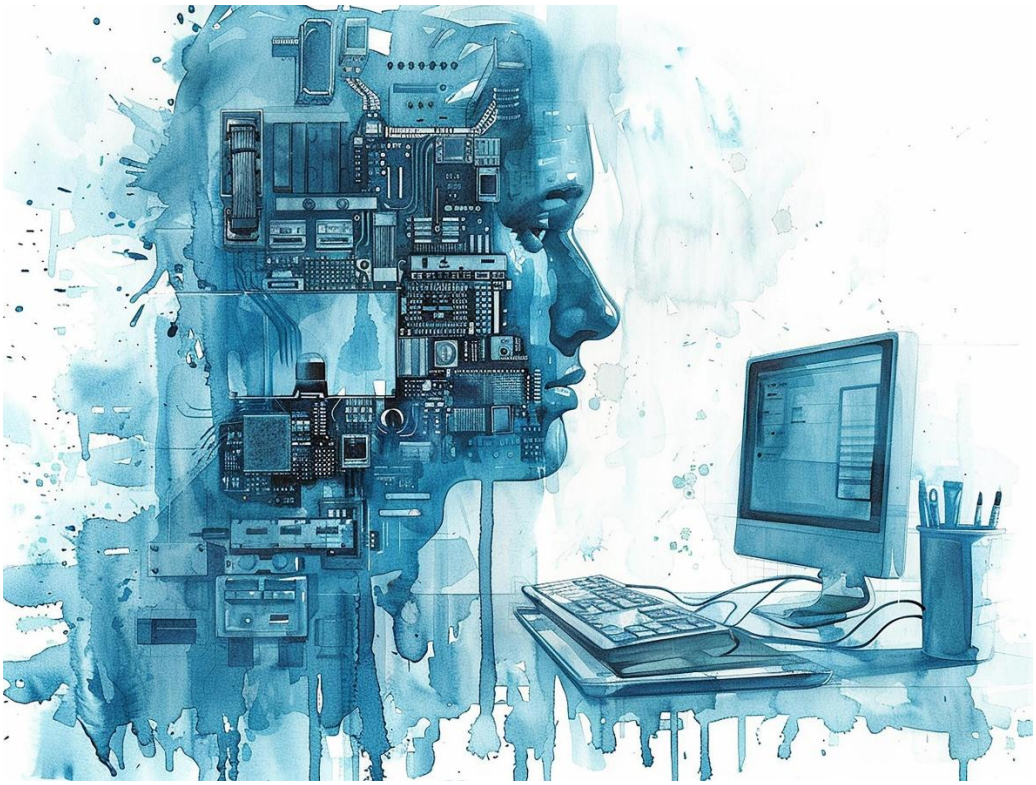
Annual International Congress On
Computer Science

Proceeding of Annual International Congress on

Computer Science

April 17-18, 2025 Oxford, United Kingdom



Computer Science Research Training Center

28 Speedwell St, Oxford, OX1, United Kingdom

WWW.COMRTC.COM

info@comrtc.com

Annual International Congress On
Computer Science

Annual International Congress on

Computer Science

April 17-18, 2025

Oxford, United Kingdom

Annual International Congress on

Computer Science

April 17-18, 2025

Oxford, United Kingdom

© 2025 Published by Computer Science Research Training Center

www.comrtc.com

Peer-review under responsibility of the scientific committee of Annual International Congress on Computer Science

Organizing Committee:

Prof. Henry Ryan *(Conference Chair)*

Prof. Daniel Harris *(Co- Conference Chair)*

Prof. Jiyun Zhai *(Technical Program Chair)*

Dr. Robert Davis *(Workshop Chair)*

Dr. Mila Clark *(Awards and Grants Chair)*

Dr. Deion Anderson *(Publications Chair)*

Eleanor Moore *(Treasurer)*

David Carter *(IT Manager)*

Ava Evans *(Information contact)*

Anna Garcia *(Secretary)*

Daniel Martin *(Secretary)*

Scientific Committee Lead:

Prof. F. Moreira, *University of Aveiro, Portugal*

Prof. Haishan Zeng, *University of British Columbia, Canada*

Prof. S. Papadakis, *University of Crete, Greece*

Prof. G.C.Pastor, *University of Malaga, Spain*

Dr. Mueen Uddin, *University of Doha for Science and Tech., Qatar*

Prof. Mukesh Soni, *Dr. D. Y. Patil University Pune, India*

Dr. Aytaç Altan, *Zonguldak Bulent Ecevit University, Turkey*

Prof. Mansaf Alam, *jamia millia islamia, India*

Dr. Thomas Hanne, *University of Applied Sci. and Arts Switzerland*

Prof. Navjot Singh, *Chandigarh University, India*

Table Content:

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

The Use of Self-Tracking Devices in e-Commerce Management

Juraj Fabus[a], Miriam Garbarova[a], Lukas Vartiak[b,*]

[a]*University of Zilina, Faculty of Operation and Economics of Transport and Communications, Department of Communications, Univerzitna 8251/1, 010 26 Zilina, Slovakia*
[b]*Comenius University, Faculty of Social and Economic Sciences, Institute of Mediamatics, Mlynske luhy 4, 821 05 Bratislava, Slovakia*

* Corresponding author. Tel.: +421-43-2633-474. *E-mail address:* lukas.vartiak@fses.uniba.sk

Abstract

Self-tracking devices are currently increasingly used in various business areas, and they also play a significant role in the management of electronic stores. This paper aims to examine the potential and impacts of self-tracking technologies on the efficiency of e-commerce business management. The research focuses on optimizing employee performance, improving customer experience, and personalizing marketing strategies through data obtained from wearable technologies. The analysis of the results showed that implementing self-tracking can contribute to higher productivity, better management of work tasks, and more efficient use of available resources. However, it also points to challenges associated with protecting personal data, ethical aspects of employee tracking, and return on investment in these technologies. Transparent communication, consistent data security, and appropriate legislative regulation are essential for successfully applying self-tracking systems. The paper points to the growing importance of self-tracking in the e-commerce sector. It identifies areas where it can contribute to better efficiency and competitiveness of businesses in the digital economy.

Keywords: Self-Tracking; e-Commerce; Wearables; Employee Productivity; Customer Experience Personalisation.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Embodied philosophy: Uncertainty reduction principles for assistive augmentations

Susana Sanchez[a,*]

[a]*Independent Researcher, Mexico City, Mexico*

* Corresponding author. Tel.: +421-43-2633-474. *E-mail address:* susana.saps@gmail.com

Abstract

Through a philosophical analysis on the pervasiveness of technology, embodiment is presented as a key principle for reducing uncertainty. This hypothesis is supported by a synthesis of theories, combining the acquisition-learning hypothesis, the information-integration theory, and a neuroscientific account of predictive processing. The Embodied Philosophy is introduced through an exploration of an embodied integration of knowledge and knowing, proposing four core postulates as foundations for designing assistive augmentations: risk, affordance, tenacity, and skill.

Keywords: Embodiment; Uncertainty; Consciousness; Assistive Augmentation; Learning; Embodied Philosophy; Information-Integration; Digital Dementia.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Deep Learning for Emotion Recognition in Image

Fatiha Limami[a,*], Boutaina Hdioud[a], Rachid Oulad Haj Thami Lukas Vartiak[a]

[a]*Advanced Digital Enterprise Modeling and Information Retrieval (ADMIR) Laboratory, Rabat IT Center, Information Retrieval and Data Analytics Team (IRDA), ENSIAS, Mohammed V University in Rabat, Rabat, Morocco*

* Corresponding author. Tel.: +212 661544683. *E-mail address:* Fatiha_limami@um5.ac.ma

Abstract

Artificial intelligence and computer vision are forming the basis of computerized sentiment detection, incorporating social, cultural, and environmental factors in addition to facial emotions. The ConvNet version was enhanced to handle multiple emotional inputs, including body traits and contextual components, by merging ADE20K, MSCOCO, EMODB_SMALL, and FRAMESDB datasets and applying deep learning and data pre-processing methods to enhance sensitivity to emotional cues. Three continuous dimensions and twenty-six discrete variables have been used in our research. With a mAP of 74.84%, our findings demonstrate how much higher this incorporated approach plays than different techniques that use classical models primarily based just on monomodal expressions or deep gaining knowledge of models. Our technique affords a more thorough and precise comprehension of emotional states in images. These developments have giant ramifications that point to broader uses in domain names such as interactive structures, psychological analysis, social robots, and other domains for complicated emotional interpretation.

Keywords: Emotion Recognition; Deep Neural Network; Computer Vision; Contextual Emotions; Body Language; Human-Robot Communication.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Temperature Based Adaptive Genetic Algorithm for 3DOF Robot Inverse Kinematics

Hibatallah Meliani[a,*], Khadija Slimani[b], Samira Khoulji[a]

[a]*Innovate Systems Engineering (ISI) Lab, National School of Applied Sciences (ENSA), Abdelmalek Essaadi University, Tetouan 93000, Morocco*
[b]*Learning, Data and Robotics (LDR) Lab, Graduate School of Information Technology, Electronics, Automation (ESIEA), Paris 75000, France*

* Corresponding author. *E-mail address:* hibatallah.meliani@gmail.com

Abstract

Thermal shock influences Deoxyribonucleic Acid (DNA) structure, where temperature fluctuations can modify the rate of recombination and mutation, affecting genetic stability. Inspired by biological mechanisms, we developed a temperature based adaptive genetic algorithm (TempGA) to solve the inverse kinematics (IK) problem for a 3-degree-of-freedom (DOF) robot arm. Unlike traditional approaches, TempGA incorporates principles from DNA biology, such as the influence of temperature on mutation and crossover type and hot and cold spots in chromosomes, where recombination likelihood varies with temperature. The proposed algorithm adapts mutation and crossover rates using a U-shaped function based on temperature value, enhancing the balance between exploration and exploitation phases. TempGA uses two different types of crossovers and three types of mutations. The Genetic operator choice depends on the population's diversity and the exploration and exploitation state of the algorithm. If we are in exploration phase and the diversity is below threshold, TempGA apply a temperature shock. Temperature shock in our algorithm increases the temperature degree based on a heating schedule, which in return increases the rate of the GA operator and selects operators targeting hot spots, which are the parts of the individual that have higher impact on its value, simulating the effect of high temperature on the DNA. TempGA was compared to other bio-inspired algorithms such as Particle Swarm Optimization, Differential Evolution, Artificial Bee Colony and Simulated Annealing. Experimental results indicate that TempGA significantly improves solution precision and stability for IK challenges.

Keywords: Genetic Algorithm; Inverse Kinematics; Robotics; 3-Degree-of-Freedom Robot.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Approaches used to reduce communication delays in a fleet of connected vehicles: Review

Ahmed ER-Rousse[a,*], Khadija Slimani[b], Najat Rafalia[a]

[a]*LaRI laboratory, Faculty of science, Ibn Tofail University, Kenitra, Morocco.*
[b]*Learning, Data and Robotics (LDR) Lab, Graduate School of Information Technology, Electronics, Automation, (ESIEA), Paris 75000, France*

* Corresponding author. Tel.: +212766633048, *E-mail address:* ahmed.errousse@uit.ac.ma

Abstract

The integration of ICT into vehicles has revolutionized transportation, enabling advancements in safety, autonomy, and traffic management. However, connected vehicles generate vast data (e.g., 4000 GB/day/vehicle), necessitating remote cloud servers with high computational power, which introduce network latency. This latency comprises three components: communication delay to distant servers, queuing delays, and server processing time. While cloud computing addresses resource limitations, its inherent delays prompted exploration of edge computing, which positions servers closer to vehicles to minimize communication times. Task offloading strategies were also analyzed to optimize data processing. Given the stochastic nature of driver behavior, hybrid models combining machine learning and stochastic estimation were proposed to predict vehicle trajectories (using datasets like HighD) and preempt collisions or traffic congestion. A review of existing solutions identified gaps, particularly in real-time data handling and predictive frameworks. This study contributes by preprocessing anticipated vehicle actions (e.g., steering, acceleration) based on driver intent and contextual data, aiming to reduce communication delays in vehicle networks. The approach prioritizes predictive analytics to streamline data transmission and processing, enhancing efficiency in connected vehicle systems.

Keywords: Intelligent Connected Vehicles; Communication Delays; Internet Of Things; Internet of Behaviors.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Machine Learning vs. Traditional Approaches, A Comparative Review of Credit Scoring Models (2018-2024) - Balancing Accuracy, Stability, and Interpretability

Radouane Aboulmaouda[a,*] , Nour El Houda Chaoui[a], Khadija Slimani[b]

[a] *LaRI laboratory, Faculty of science, Ibn Tofail University, Kenitra, Morocco*
[b]*Learning, Data and Robotics (LDR) Lab, Graduate School of Information Technology, Electronics, Automation (ESIEA), Paris, France*

* Corresponding author. Tel.: +33-06-3231-9946. *E-mail address:* aboulmaouda.radouane@uit.ac.ma

Abstract

As machine learning (ML) becomes increasingly integrated into the financial sector, especially in credit risk scoring, it is essential to compare its effectiveness against traditional models. Credit scoring involves estimating the probability of default (PD), a critical factor in financial decision-making. This study conducts a systematic review of 80 selected articles from an initial pool of 210, applying the PRISMA methodology to evaluate accuracy, stability, and interpretability of ML versus standard models. ML algorithms generally outperform traditional ones in terms of accuracy, with advanced ensemble methods achieving particularly strong results. Stability, the ability to deliver consistent performance across varying conditions, is also often higher in ML models due to their adaptability. Techniques like bagging and boosting reduce model variance and enhance reliability. Nonetheless, traditional models such as logistic regression remain competitive, offering stable predictions and strong interpretability. Interpretability, vital for regulatory compliance and stakeholder trust, is where traditional models excel, with 86% of studies highlighting their clarity. ML models, often perceived as black boxes, face limitations in transparency, but tools like SHAP and LIME are increasingly used to explain their predictions. These methods enhance understanding and promote wider adoption of ML in finance. Overall, while ML models lead in accuracy and stability, traditional models retain value in settings where interpretability is crucial. This review provides a structured framework for selecting credit scoring models based on specific performance needs and regulatory demands.

Keywords: Machine Learning; Traditional Models; Credit Scoring, Accuracy; Stability, Interpretability; PRISMA.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

AI-Driven Climate Change Prediction: Harnessing Machine Learning for Environmental Forecasting

Abdel Rahman Alkharabsheh[a], Lina Momani[b*], Abrar Aljabri[a]

[a]*Higher College of Technology, Computer Information System, Abu Dhabi UAE*
[b]*Higher College of Technology, Mechanical Engineering, Dubai, UAE*

* Corresponding author. Tel.: +971544945857. *E-mail address:* akharabsheh@hct.ac.ae

Abstract

Climate change prediction is a complex challenge that requires analysing multiple environmental variables. Machine learning (ML) offers a powerful approach to enhance climate forecasting accuracy by integrating key indicators such as atmospheric carbon dioxide (CO_2) levels, global surface temperatures, sea level rise, ocean temperature and currents, and vegetation and land cover changes. These features serve as critical inputs for ML models, enabling precise predictions of climate patterns and extreme weather events. Advanced algorithms, including regression models, time series analysis, convolutional neural networks (CNNs), and recurrent neural networks (RNNs), facilitate trend detection, anomaly identification, and scenario simulations. Integrating various datasets—ranging from satellite imagery to oceanographic sensors—enhances model robustness, while feature selection techniques such as Principal Component Analysis (PCA) optimize performance. This research highlights the significance of ensemble models, such as Random Forests and Gradient Boosting, in capturing complex interactions among climate variables. Additionally, ML-based climate predictions support critical applications, including disaster preparedness, resource management, and policy development. By leveraging data-driven methodologies, ML enhances climate monitoring and mitigation strategies, providing valuable insights for sustainable environmental decision-making

Keywords: Machine Learning; Climate Change Prediction; Environmental Forecasting; AI-Driven Modeling; Climate Change Mitigation.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

A Multi-Scale Adaptive Convolutional Approach for Crop Disease Detection

Rakshitha A Manoj[a], Mahalakshmi Jeyabalu[a,*], Balakrishnan Chinnayan[a], Vinay M[a], Gayathry S Warrier[a], Gobi Ramasamy[a], Stephen Raju[a]

[a]*Department of Computer Science, Christ University, Bangalore, India*

* Corresponding author. Tel.: +91-8870291059. *E-mail address:* mahalakshmi.j@christunversity.in

Abstract

Crop diseases have a significant effect on global agricultural productivity resulting in resultant huge economical losses. Moreover, this increase causes food insecurity issues. As a result, correct and scalable disease detection methods are crucial to address these effects. This research introduces a Multi-Scale Adaptive Convolutional Network model which integrates multiscale feature extraction and adaptive convolutional layers for robust handling of complex patterns of crop disease. The model was evaluated on a wide collection of over 25,000 images comprising diseases in five major crops, namely rice, wheat, corn, strawberry, and tomato. The proposed MSACN yielded a test accuracy of 98.64%. It showed outstanding performance when assessed based on precision, recall, and F1 scores compared to alternative benchmark models: MLP-ANN, MConvNeXt, MSCPNet, and DMCNN. Furthermore, commonly used deep learning models, such as Xception, ResNet, and InceptionV3, which initially seemed promising, suffered from serious underfitting and overfitting problems because of their complexity. MSACN showed better robustness in handling variability in datasets and complexity of diseases. The results suggest the model's suitability for deployment in precision agriculture to detect diseases on time and thus improve crop management practices for sustainable agricultural productivity.

Keywords: Crop Disease Detection; Deep Learning; Multi-Scale Adaptive Convolutional Network (MSACN); Smart Agriculture; Multi-Scale Feature Learning.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Beyond Silos: How AI and Options Models Enhance Enterprise-Wide Optimization Despite Specialized Software

Thierry Brutman[a,b]

[a]*EDDA Research Laboratory, 21, rue de la Roquette 75011 Paris (France) & 1016 W. Jackson Boulevard*
[b]*Chicago, IL 60607, USA*

* Corresponding author. Tel.: +33-623195320; fax: +33-184106745. *E-mail address:* ceo@edda-researchlaboratory.org

Abstract

For the past three decades, enterprise software has been designed to cater to specific activities within organizations. These solutions are tailored to accounting services, treasury management, control management, supply management, commercial matters, and even business forecasting, among other specialties. However, while platforms like SAP and Oracle aim to integrate these functions and create a more global approach, the question remains: is this truly optimal for companies? Our article argues that this specialized approach is inherently flawed. While individual departments may optimize their specific functions, this does not necessarily lead to optimal performance for the company as a whole. Moreover, this approach can be costly and yield subpar results. In the first part of our article, we will explore various problems and case studies that illustrate why this specialized approach is inefficient and often ineffective. In the second and third part, we will demonstrate how advancements in computer science, particularly through the use of Options models and AI-coordinated Option Matrices, can now analyze and rank the decisions of different specialties within an integrated synergy model. This holistic approach enhances overall company performance and budget allocation, achieving the best Return on Equity (ROE) and future revenue strategies. Additionally, we will discuss how effective AI implementation can enable companies to integrate diverse software systems, achieving efficient outcomes without the drawbacks of specialized software. This integration not only improves inter-departmental communication but also serves as a significant step towards creating a Self-Managed Company, even in the absence of native software solutions

Keywords: Self-Managed Company Hub; Option-Based Forecasting; Strategic Flexibility Index; AI Middleware; Enterprise Optimization.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Practical Aspects of Routing when Building Business Continuity and Disaster Recovery at the Enterprise Level

Andrian Piskozub[a], Mikolaj Karpinski[b,*], Elena Nyemkova[a], Yuriy Lakh[a], Roman Banakh[a], Pawel Sawicki[c]

[a]*Lviv Polytechnic National University, 79013 Lviv, Ukraine*
[b]*University of the National Education Commission, 30-084 Krakow, Poland*
[c]*SunsetPicnic UG Ltd.,13597 Berlin, Germany*

* Corresponding author. Tel.: +48-603-896-982. *E-mail address:* mpkarpinski@gmail.com

Abstract

Disaster recovery and business continuity are critical components of a comprehensive risk management strategy for organizations. Minimizing downtime is one of the key aspects for the company that wants to quickly recover its IT infrastructure, applications, and data after a disaster. The emphasis in this paper is placed on improving network resilience and availability of critical services, possible risks and implementation of several Recovery Time Objective improvements. Practical aspects of routing when building business continuity and disaster recovery at the enterprise level have been discussed. Mitigation steps to minimize the impact of disasters based on improving infrastructure resilience and recovery steps, focused on repairing damaged infrastructure, re-establishing business functions, are considered.

Keywords: BCP; DR; RTO; Routing; Flat Networking; Clustering; MC-LAG; Juniper; VPN

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Protection of Neural Networks from Attacks on Their Structure

Mikolaj Karpinski[a,*], Oleksandr Kushnerov[b], Olena Akhiiezer[c], Vladyslav Sokol[c], Anna Korchenko[a], Valerii Muzh[d]

[a]*University of the National Education Commission, Krakow 30-084, Poland*
[b]*Sumy State University, Sumy, 40007, Ukraine*
[c]*Olena Akhiiezer:National Technical University â€œKharkiv Polytechnic Instituteâ€, Kharkiv 61002 Ukraine*
[d]*Ternopil Ivan Puluj National Technical University, Ternopil 46001, Ukraine*

* Corresponding author. Tel.: +48-603-896-982. *E-mail address:* mpkarpinski@gmail.com

Abstract

Advancements in information technology have integrated neural networks into critical sectors such as healthcare, finance, energy, and national security. While these networks provide enhanced efficiency through data analysis and decision-making capabilities, they are increasingly targeted by sophisticated attacks aimed at their structure. This paper discusses the vulnerabilities associated with neural networks, focusing on backdoor attacks, gradient manipulation, and the challenges of ensuring security in large language models (LLMs). Various methods for detecting and mitigating these attacks, including obfuscation techniques, pruning compromised neurons, and adaptive protection technologies, are explored. Emphasising the importance of robust protection mechanisms, this research highlights approaches like threat modelling, anomaly detection, and structural obfuscation, which are critical to safeguarding neural networks in high-stakes applications. The study concludes with recommendations for future work, particularly on developing adaptive and ethical protection methods for neural networks to ensure stability and reliability across critical systems.

Keywords: neural networks; structural attacks; backdoor attacks; gradient manipulation; obfuscation; adaptive protection

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

The Transformative Impact of AI on GRC: Enhancing Efficiency and Effectiveness

Iman Ahmeid Mohamed[a,*], Amin Buhneik[b]

[a]*Libyan Authority of Scientific Research, Tripoli, Libya*
[b]*Al-Marqab University, Alkhums, Libya*

* Corresponding author. *E-mail address:* eman92ahmeid@gmail.com

Abstract

This research addresses the limitations of traditional Governance, Risk, and Compliance (GRC) frameworks in the face of rapid technological advancements, exploring the transformative potential of Artificial Intelligence (AI). By outlining the definition and core components of GRC, this study examines the tangible benefits of AI integration, including enhanced predictive risk assessment and automated compliance monitoring, illustrated through real-world examples. It further investigates AI's contribution to improved efficiency and effectiveness within GRC processes. Emphasizing critical implementation considerations, such as data governance, ethical implications, and the need for robust security protocols, this paper argues that successful AI adoption is contingent upon addressing these factors. Ultimately, by strategically implementing AI within GRC, organizations can optimize their functions, enabling more effective navigation of complex regulatory environments and the proactive mitigation of evolving cyber risks, thereby enhancing organizational resilience.

Keywords: Artificial Intellegence (AI); GRC (Governance, Risk, Compliance); Risk Assessment; Regulatory Compliance.

Annual International Congress On
Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Adaptive Controller Design for Trajectory Tracking in Second-Order Systems: Application to DC Motor Velocity Control

Efrain Ibarra[a,*], Omar Vargas[a], Ricardo Chapa[b], Romeo Selvas[b]

[a] *Tecnológico Nacional de México, Instituto Tecnológico de Durango, Durango 34080, México*
[b] *Facultad de Ciencias Fisico Matematicas, Av. Universidad s/n. Ciudad Universitaria San Nicolás de los Garza, 66451. Nuevo León, México*

* Corresponding author. Tel.: +52-618-177-7111. *E-mail address:* efrainibarra@itdurango.edu.mx

Abstract

This paper presents the design and implementation of an adaptive controller for trajectory tracking in second-order dynamical systems. A theoretical foundation is established by proving that the tracking error dynamics can be reduced to a first-order equation, significantly simplifying the control design. Based on this theoretical framework, a control law is proposed to ensure that the system follows a desired reference trajectory. The proposed controller is implemented on a DC motor to regulate its angular velocity. Experimental results are provided, demonstrating the effectiveness of the controller in achieving precise trajectory tracking under real operating conditions

Keywords: Adaptive Control; Trajectory Tracking; Second-Order Systems; DC Motor Control; Experimental Implementation.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Artificial Intelligence Technologies and Their Role in Reducing Profit Management in Iraqi Private Banks

Yahia Ali Kadhim[a,*]

[a]*University of baghdad,baghdad,Iraq*

* Corresponding author. Tel.: +7707950309. *E-mail address:* yahia0071985@gmail.com

Abstract

This study aims to demonstrate the role of artificial intelligence technology, especially logistic regression technology, in reducing profit management in Iraqi private banks. Since the Iraqi banking industry has witnessed technological developments in banking, most banking operations have become automated and rely on information technology in their operations. This requires the application of modern technology to help auditors perform auditing work. Therefore, this study proposes the application of one of the data mining techniques, which is the logistic regression technique, to reduce profit management for a sample of private banks in Iraq, which includes (5) banks, where financial ratios were used and then logistic regression some financial factors, i.e. (creditors/total liabilities and cash credit/total deposits), meaning that the logistic regression technique can help reduce profit management by 61.5.

Keywords: Artificial Intelligence; Earnings Management; Logistic Regression.

Annual International Congress On
Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Automated Assessment of Software Product Line Configuration Expressions Through Code Complexity Metrics

Jakub Perdek[a,*], Valentino Vranić[b]

[a]*Institute of Informatics, Information Systems and Software Engineering, Faculty of Informatics and Information Technologies, Slovak University of Technology in Bratislava, 84216 Bratislava, Slovakia*
[b]*Faculty of Informatics, Pan-European University, 820 09 Bratislava, Slovakia*

* Corresponding author. Tel.: +421 950567469; *E-mail address:* jakub.perdek@stuba.sk

Abstract

The variability in the code can be expressed and studied in multiple ways. However, no study has considered the hierarchical representation of configuration expressions as conditional statements and their relationship to code complexity. We continued to analyze the code complexity of variability by designing various JSON hierarchical configuration expressions to be used as conditional statements and placing them from the least complex form (decorators) into the control flow. It brings the possibility of evaluating them under this context with the rest of the code. We ensured that information about rule-guided reasoning regarding variability is captured using the cyclomatic complexity metric, which has been left insensitive to decorators. We statistically determined on our software product line from the graphics domain the less complex type of configuration expression by clarifying that the expression, as the entire JSON, is suitable for expressing hierarchical information.

Keywords: Annotation-Based Software Product Lines; Hierarchical Configuration Expressions; Cyclomatic Complexity; Halstead Measures; Variability Management.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

The Future of Care: How We're Getting Caregivers Excited About AI and Robotics

Werner Beyerle[a,b,*]

[a]*Karat EDV Ltd, 1110 Vienna, Austria*
[b]*Porsche Fachhochsule Wr. Neustadt, 2700 Wr. Neustadt, Austria*

* Corresponding author. Tel.: +43-6643424750. *E-mail address:* wbeyerle@karat.at

Abstract

The care industry is facing significant change, driven by the shortage of skilled workers and the need for high-quality care due to the ever-aging population. Artificial intelligence (AI) and robotics offer promising solutions, but their successful integration depends on acceptance and competent use by nursing staff. This thesis examines how the training of nurses needs to be adapted to promote the uptake of new technologies. An analysis of the current curriculum shows that digital skills are often neglected in education, leading to uncertainty and rejection of new technologies. There are also concerns about data protection and the risk of dehumanizing care. To overcome these challenges, profound changes in training are proposed. These include the early integration of technology content, practical exercises with AI systems and robots, training on ethics and data protection, and interdisciplinary projects. The use of simulations and virtual reality is intended to enable realistic experiences. Further education and training as well as mentoring programs are crucial to keep knowledge up to date. The acceptance of AI and robotics is crucial for the future of care. Only by comprehensively adapting the training can nursing staff be optimally prepared for the new challenges.

Keywords: AI; Robotica; Necessary Changes in Education.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

An Unsupervised Pattern Recognition Model to Localize BSRs on Marine Seismic Reflection Images

Selene Solorza-Calderón[a,*], Antonio González-Fernández[b], Cristian Rodrigo[c], Everardo Gutiérrez-López[a], Emilio Vera[d]

[a]*Facultad de Ciencias, Universidad Autónoma de Baja California, Carretera Transpeninsular Ensenada-Tijuana, No. 3917, Col. Playitas, C.P. 22860, Ensenada, B.C., Mexico*
[b]*Departamento de Geología, CICESE, Carretera Ensenada-Tijuana, No. 3918, Frac..Zona Playitas, C.P. 22860, Ensenada, B.C., Mexico*
[c]*Facultad de Ingeniería-Geología, Universidad Andrés Bello, Quillota 980, Viña del Mar, Chile*
[d]*Departamento de Geofísica, Universidad de Chile, Blanco Encalada 2002, Chile*

* Corresponding author. Tel.: +52-646-152-82-11. *E-mail address:* selene.solorza@uabc.edu.mx

Abstract

Even today, the location of the Bottom-Simulating Reflector (BSR) is usually performed semi-automatically by a trained interpreter. The BSR is a geophysical marker whose presence indicates gas hydrate zones. Methane is one of the gases found in gas hydrate zones in marine profiles. Methane is a greenhouse gas that affects global warming, sea level changes, and ocean temperatures. Therefore, estimating methane concentrations in hydrate/free gas systems is essential. Since the BSR simulates the shape of the SBR (Sea-Bottom Reflector), it's what the interpreter searches into the seismic image. Because the SBR simulates the seafloor, the seafloor comes in a multitude of shapes, so an unsupervised model is required for pattern recognition. Due to the complexity of the problem, an interdisciplinary team is necessary to develop a pattern recognition model to detect parallel and non-parallel BSRs in seismic reflection images. Unsupervised automated models for seabed reflectors (SBR) and BSR localization must be more robust by including information about the physical properties of the medium and not just considering the patterns obtained from marine reflection seismic images. This proposal presents an unsupervised pattern recognition model for locating the SBR and BSR. It was developed using a theoretical model to predict the thickness between the SBR and the BSR. This theoretical model uses information from the physical properties of the medium, such as water density, temperature gradients, and seafloor temperature and pressure profiles. The unsupervised pattern recognition model for locating the BSR was tested using seismic reflection images of the Chilean margin and the Pegasus Basin, off the coast of New Zealand, obtaining the precise location of the BSR. The methodology is easy to implement on desktops or personal computers and is appropriate for parallel programming to reduce computational cost time.

Keywords: Pattern recognition; unsupervised; seismic marine images; BSR; SBR.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Optimization of Cloud Infrastructures: Calculation of Disk Space and User Quotas in Data Storage Clouds

Rosen Hristev[a,*], Vladimir Valkanov[a], Angel Golev[a]

[a]*Department of Mathematics and Informatics, University ot Plovdiv Paisii Hilendarski, 236, Bulgaria Blvd., 4000 Plovdiv, Bulgaria*

* Corresponding author. Tel.: +359-888-654-465. *E-mail address:* hristev@uni-plovdiv.bg

Abstract

This study examines the methodology for integrating private clouds into existing IT infrastructures, with the method also being applicable to public SaaS clouds. By outlining the implementation steps, calculating the required resources, and determining user quotas, the study focuses on ensuring the recovery of data arrays after data loss, including in cases of ransomware attacks. The research synthesizes formulas for calculating disk space and user quotas. It provides clear guidelines for managing cloud infrastructure in compliance with modern security standards such as ISO 27002 along with the GDPR and NIS2 directives.

Keywords: Cloud Infrstructures; Required Disk Space; User Quotas; Ransomware; Security.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Financial Decision-Making AI-Framework to Predict Stock Price Using LSTM Algorithm and NLP-Driven Sentiment Analysis Model

Hisham AbouGrad[a,*], Abdul Qadoos[a], Lakshmi Sankuru[a]

[a]*Department of Computer Science and Digital Technologies, School of Architecture, Computing and Engineering, University of East London, London, E16 2RD, UK*

* Corresponding author. *E-mail address:* h.abougrad@uel.ac.uk

Abstract

Predicting stock market fluctuation is a crucial field in artificial intelligence – AI and financial technology – FinTech research due to its significance and implications for investors and their investment strategies. It is evident from recent research studies that sentiment analysis has a significant impact on the stock market. This paper presents a stock price prediction model to conduct experiments using financial time series and financial news datasets. This study has retrieved sentiment data from News API and processed it to quantify market sentiment. Using natural language processing (NLP) techniques, sentiment scores have been evaluated as positive or negative news and analysed sentiments have been incorporated with historical stock price data retrieved from NASDAQ. Data has been pre-processed to normalize the datetime index and merge the closing price with sentiments to ensure consistency and suitability of the data for training the prediction model. A multi-layer LSTM neural network model has been identified as a suitable prediction model employed on stock prices and sentiment dynamics of the financial market for highly accurate stock price prediction. The multi-layer LSTM model has been fine-tuned using different parameters such as different neuron layers, epochs and batch size. Prediction results and model accuracy have been evaluated using the following metrics: root mean square error – RMSE, mean absolute percentage error – MAPE, and R-squared. The proposed model enhances accuracy in predicting short-term stock price trends for millennials as they are mostly aggressive investors who would like to make a profit in a shorter phase. Integrating sentiment data improved the performance of prediction models, highlighting the critical role of stakeholders' sentiment in stock market performance. The results of this study are a valuable contribution to the growing field of the AI-driven financial sector, demonstrating the viability of integrating NLP-driven sentiment analysis with deep learning to make more informed investment decisions

Keywords: LSTM Neural Network Model; Deep Learning Algorithm; NLP-Driven Sentiment Analysis; Stock Price Prediction AI-Framework; Financial Decision Making.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Healthcare Facilities Enhancement Using Artificial Intelligence Chatbots

Neha Bansal[a], Bhawna Singla[a,*]

[a]*Geeta University, Panipat, Haryana, India*

* Corresponding author. *E-mail address:* bhawna_singla@yahoo.com

Abstract

A major challenge faced by healthcare organizations, such as hospitals and medical centers, is the provision of quality services at affordable costs for every individual. ChatGPT is a machine-learning (ML) system that can be used to learn and analyze medical data. They are widely used in medical research and clinical practice. There is utmost need for a) spreading awareness regarding current and updated medical facilities with cost available at doorstep of every individual in their regional language, b) early prediction and diagnosis of disease, and c) first aid medication. Artificial intelligence chatbots are one of the most fascinating innovations in the ai world that make human-like conversations using a process known as natural language processing. Some highlighted features of AI-enabled chatbots are: a) communication in a regional language is possible, b) audio and visual communications, c) analyzing questions asked, and d) formulating responses. This study aims to enhance healthcare facilities using an AI chatbot. The major technique used here is the application of data science for the collection and analysis of data that will be further applied to AI chatbots.

Keywords: AI Chatbot; Heart Healthcare; Data Science; NLP; Python; Early Prediction/Detection; Hospital Clinic Management System.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Sustainable Green Agriculture Initiative by India

Bhawna Singla[a,*]

[a]*Geeta University, Panipat, Haryana, India*

* Corresponding author. *E-mail address:* bhawna_singla@yahoo.com

Abstract

Agriculture is a significant contributor to global greenhouse gas emissions, accounting for approximately 20% over a 20-year period, with methane and nitrous oxide being the predominant gases. To limit global warming to 1.5°C, as outlined in the 2018 IPCC report, transformative changes in agricultural practices are essential. This study explores predictive modeling for forecasting emissions and evaluates sustainable strategies to mitigate agricultural emissions. Key solutions include adopting zero-emission machinery, genetic selection for low-methane livestock, improved fertilization and water management in rice cultivation, and advanced manure processing techniques. These practices demonstrate substantial potential to reduce emissions, with significant cost savings in many cases. The findings emphasize the importance of coordinated global efforts to implement these solutions, alongside the integration of renewable energy and resource-efficient practices. Future work involves deploying predictive models as accessible tools to guide stakeholders in adopting sustainable agricultural practices, ensuring environmental and economic benefits.

Keywords: Green Agriculture; Machine Learning; Deep Learning; Ayurvedic Medicines.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

A Decentralized Energy Trading Platform for Distribution System Operators

Vu Nguyen Huynh Anh[a,b,*]

[a]*Ho Chi Minh University of Banking, 36 Ton That Dam Street, District 1, 700000 Ho Chi Minh City, Vietnam*
[b]*LouRIM-CEMIS, Université catholique de Louvain, Place des Doyens 1, 1348 Ottignies-Louvain-la-Neuve, Belgium*

* Corresponding author. *E-mail address:* vunha@hub.edu.vn; vu.nguyenhuynh@uclouvain.be

Abstract

The transitioning electricity market is characterized by increased use of renewable energy sources in the power system. However, there is a need to accommodate a decentralized energy transaction and supply system (DER) that comprises the energy produced from DERs. This paper presents the solutions to identify issues in the current energy market. It takes place to present a detailed description of the methodologies, technologies, and functioning of the decentralized energy trading platform. We demonstrate a distribution system operator (DSO)-to-consumer flexibility market platform deploying blockchain-based smart contracts for local grid congestion and voltage management. The use cases are aimed at testing, demonstrating, and validating the concept of smart grid flexibility services for congestion management and physical grid balancing.

Keywords: Blockchain; Energy Trading; Congestion Management.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

On The Bilateral Method and Its Application to Solve Initial-Value Problem for Volterra Integro-Differential Equations with Degenerate Kernel

Vagif Ibrahimov[a,*]

[a]*Institute of Control Systems of ANAS, Baku State University, Baku, Azerbaijan*

* Corresponding author. *E-mail address:* ibvag47@mail.ru

Abstract

As is known, the Volterra, in studying the memory of the earth, has met with finding the solution to the initial-value problem for the integro-differential equation. New areas for research have emerged that require solving integro-differential equations. Some problems that are described by using the initial-value problem for Volterra integro-differential equations arise in some directions of the natural sciences. Volterra himself, for studying some of the same problems, has received the integro-differential equations. For example, in solving the population problems and studying some variants of greed, he faced the need for dissection of similar problems that had been investigated by Volterra. Volterra for solving named. Problem (initial-value problem for Volterra integro-differential equation) recommended using Quadrature Methods. As with all methods, the Quadrature Methods also have their advantages and disadvantages. Taking advantage of these methods, experts have developed new numerical methods for solving the above-named problems. By using the properties of degenerate for the kernel of the integral, here is proposed one scheme by which the above-mentioned problem can be reduced to solve the initial-value problem for Ordinary Differential Equations. Then to solve the received problem they applied known methods, which are constructed to solve initial-value problem for the Ordinary Differential Equations.

Keywords: Initial-Value Problem; Multistep Methods; Stability And Degree; The Volterra Integro-Differential Equations; Bilateral Methods; Local Truncation Error.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Set Ordering Method for Scoring the Outcomes of Binet's Test

Simon Razmadze[a], Tornike Razmadze[a]

[a]*Georgian Computer Society, 8, Mirza Gelovani str, Tbilisi, 0160, Georgia*

* Corresponding author. +995-595190286. E-mail address: simonrazmadze@gmail.com

Abstract

The presented paper considers the ordering method of outcome set for the Binet test. The ordering method of the outcome set is used for estimation of results of computerized adaptive testing (CAT). The multiplicity/set of the outcomes of testing consists of atypical different-dimensional elements. The given paper defines the criteria of their comparison in case of Binet's IQ test, describes the principles of ordering of the given multiplicity and draws the getting of a final score. The ordering method of the outcome set is not tied to a specific testing procedure. Acknowledgement of this is its usage for Binet's test, which is described in the paper. The method is realized on the basis of Binet's mini-test. To sort the set of testing outcomes, five different function-criteria are discussed and comparative analysis of obtained results are performed. Five function-criterion analysis demonstrated that the ordering function of the outcome set can be different. The choice is up to the author's requirements and estimations. The given procedure is aimed to be illustrative, because a described method of assessment can be used for similar strategies. The ordered outcome set is estimated by a hundred-point system according to the normal distribution.
Applied results of our scientific research is developed as an "Adaptester" portal and available on the following address: https://adaptester.com.

Keywords: Computerized Adaptive Testing; Binet's Test; Stradaptive Testing; Multistage Adaptive Testing; Evaluation Algorithm; Ordering of a Set.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Elderly Care Related Ontology - Base for the Elderly Care Platform

Alexandre Chikalanov[a,*], Desislava Paneva-Marinova[b], Mariyana Lyubenova[c]

[a]*University for Library Studies and Information Technologies, 119 Tsarigradsko Shosse Blvd, 1784 Sofia, Bulgaria*
[b]*Institute of Mathematics and Informatics, Bulgarian Academy of Sciences, 8, G. Bonchev, Str., 1113 Sofia, Bulgaria*
[c]*Sofia University "Kliment Ohridski", 15 Tsar Osvoboditel Blvd, 1164 Sofia, Bulgaria*

* Corresponding author. *E-mail address:* ctmdevelopment@yahoo.com

Abstract

As the global population ages, the need for effective elderly care solutions becomes increasingly critical. The complex needs and diverse characteristics of the aging population need to be addressed and appropriate tools provided to help support them. This paper presents a novel elderly care platform and its key components. A specific elderly-related ontology is designed to structure the vast array of relevant data, from medical histories to personal preferences. Thus, we ensure that all aspects of care are harmonized and centered on the individual's needs. We discuss the design of the ontology, which not only supports the integration and analysis of diverse data types, but also enhances decision-making processes through semantic reasoning. The core of the platform is a dynamic elderly care system that leverages Big Data and IoT technologies to monitor health indicators, manage care schedules, and facilitate communication between caregivers and the elderly. The paper is also focused on data storage and security built on proven technology of FIWARE which allows for scalability and adaptability across different care settings.

Keywords: Elderly People; IoT; Ontology; Big Data.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Modernizing Medical Records: R-CRNN and CTC-Based Doctor's Handwriting Recognition

Ayushi Gautam[a], Bhavya Agrawal[a], Garima Saroj[a,*], Sarthak Gupta[a]

[a]*Department of Computer Science and Engineering, Ajay Kumar Garg Engineering College, Ghaziabad, India*

* Corresponding author. *E-mail address:* garimak9@protonmail.com

Abstract

Handwriting is the way to convey an idea or information through written means. But over the years, due to fewer doctors per population ratio, doctors have become well-known for their illegible cursive handwriting and have become well accepted. The legibility issue of handwritten medical documents, particularly those created by physicians, has long been a significant problem in healthcare. This study presents Doctor's Handwriting Recognition, an innovative solution to tackle the problem of illegible doctor's handwriting in medical records. Our ideation surpasses its function as a recognition system, serving as evidence of technology's ability to unite tradition and innovation in healthcare documentation. Digitizing medical records is essential for improving patient care, optimizing operations, and safeguarding data. The recognition system uses a Region-based deep Convolutional Neural network (R-CRNN) that is enhanced with the Connectionist Temporal Categorical (CTC) loss function. This allows the system to adapt to the unique handwriting of individual doctors. Doctor's Handwriting Recognition has the potential to revolutionize healthcare professionals' interactions with handwritten medical information. It offers increased efficiency, enhanced patient safety, and decreased medical errors. Adopting this technological advancement improves healthcare documentation and enhances the accessibility of medical records, ultimately benefiting patient well-being

Keywords: Region-Based Convolution Recurrent Neural Network (R-CRNN), Connectionist Temporal Categorical (CTC) Loss, Deep Learning (DL), Image Segmentation, Optical Character Recognition (OCR)

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Forecasting Expected Demand from Automotive Service Shops, Using Self-Organizing Neural Networks "SOM", on a Parallel Computing Platform "CUDA"

José Antonio Sánchez González[a,*]

[a]*Instituto Politécnico Nacional, Mexico*

* Corresponding author. *E-mail address:* direccion@capnet.com.mx.

Abstract

This paper presents an unsupervised neural network schematic, on a parallel computing platform, for the prediction of expected demand from automotive service shops. Demand prediction is done by applying artificial neural networks of self-organized maps "SOM" and to optimize computing resources, parallel processing "CUDA" is applied. From the clusters generated by the network, the common characteristics of the vehicles that present a specific failure are identified, among the characteristics are, the mileage, the time without a visit to the workshop, average visits to the workshop, vehicle model, year of the vehicle, average mileage between each visit, number of maintenance performed, number of reported failures and time of seniority as an after-sales customer. In the training of the network, data obtained from the extraction of information from 60 Hyundai brand dealerships was used. Subsequently, new experimental data were added to the network to validate the proposal. Finally, it is demonstrated that the use of self-organized neural networks manages to generate the "Clusters" that allow predicting the expected demand regarding the type of failures that will occur in the vehicles that will inform the service workshops. Likewise, the processing time was optimized through the use of the parallel computing platform "CUDA".

Keywords: Expected Demand, Fault Diagnosis, CUDA, Neural Networks, Self-Organizing Maps, Diagnostic Complexity, Productivity, Efficiency, Cluster.

Annual International Congress On
Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Identification of Gene Regulatory Modules and Potential Drug Candidates for Renal Cell Carcinoma

Aninda Astuti[a], Chia-Wei Weng[b], Hsueh-Chuan Liu[c], Ka-Lok Ng[a,d,e,*]

[a]*Department of Bioinformatics and Medical Engineering, Asia University, Taichung, 413, Taiwan*
[b]*Institute of Medicine, Chung Shan Medical University, Taichung, 402, Taiwan*
[c]*Department of Biomedical Sciences and Engineering, National Central University, Taoyuan City 320, Taiwan*
[d]*Quantum Computing Research and Development Center, Asia University, Taichung, 413, Taiwan*
[e]*Department of Medical Research, China Medical University Hospital, China Medical University, Taichung, 413, Taiwan*

* Corresponding author. Tel.: *+886-23323456 ext. 1856, E-mail address:* ppiddi@gmail.com

Abstract

Cancer cell metastasis is a highly challenging pathological phenomenon to treat and is a leading cause of patient mortality. Genetic mutations and epigenetic alterations disrupt gene expression and function, interfering with normal cellular processes, ultimately driving tumor metastasis. We have identified gene regulatory modules (GRMs) associated with tumor metastasis from complex cancer networks. The approach involves decomposing the network into smaller GRMs and then ranking these GRMs using Combinatorial Fusion Analysis (CFA). Next, the molecular mechanisms of the top-ranked GRMs are studied through enrichment analysis, drug-target gene insights, and survival analysis; hence, and demonstrates the high reliability and effectiveness of our approach. To investigate the roles of genes and pre-clinical drugs, the DepMap database was employed to analyze merged GRMs and predict potential drugs. The DepMap database provides tools for analyzing cancer vulnerabilities, along with analytical and visualization resources, supporting researchers in identifying cancer weaknesses and accelerating advancements in cancer treatment and drug discovery This study focuses on kidney cancer as a case example, but our method is versatile enough to construct GRMs for various cancer cohorts and predict pre-clinical drugs targeting metastasis in these cancers.

Keywords: Precision Medicine; Tumor Metastasis; Gene Regulation Modules; Data Fusion; Drug Discovery.

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Data Analytics - Factors Influencing the Adoption and Use of Public Hospital Information Systems in Croatia

Josipa Osvaldić Galic

* Corresponding author. Tel.: +385 99 1634234. *E-mail address:* josipa.osvald@yahoo.com

Abstract

The analysis of hospital information systems (HIS) data is important from the perspective of hospital administration, but also of employees and patients. Hospital information systems are important digital infrastructures that facilitate efficient communication and data exchange within healthcare institutions. Despite their transformative potential, HIS platforms are often underutilized. This paper analyzes key factors influencing the adoption and use of HIS in Croatian public hospitals, focusing on expected performance, effort, social influence of colleagues and administration, and institutional support. Data were collected through a survey at the Bjelovar General Hospital and analyzed using partial least squares structural equation modeling (PLS-SEM). Findings show that expected performance and ease of use significantly influence the intention to use HIS. Colleague influence positively shapes user intentions, while administrative influence seems to contribute to user resistance. A positive correlation exists between intention and daily use, while a negative association was found with occasional use.

Keywords: Hospital Information Systems, Croatia, Public Healthcare, Technology Acceptance, PLS-SEM, Performance Expectancy, Effort Expectancy, Social Influence

Annual International Congress On Computer Science

Annual International Congress on Computer Science

April 17-18, 2025
Oxford, United Kingdom

Long Short-Term Memory Development in Evaluation and Forecast of Room Occupancy Based on Sensors Data

Minh Long Hoang

Department of Engineering and Architecture, University of Parma, 43124, Parma, Italy

E-mail address: minhlong.hoang@unipr.it

Abstract

This paper presents a Deep Learning-based approach for estimating and forecasting room occupancy to enhance building energy efficiency. The study utilizes sensor data from temperature, light, sound, CO_2 levels, and passive infrared (PIR) sensors as input features to train a Long Short-Term Memory (LSTM) model. The proposed model demonstrates high accuracy with minimal prediction errors: mean absolute error of 0.03 and mean squared error 0.04 during testing, highlighting its effectiveness in capturing temporal dependencies in occupancy patterns. Furthermore, a rolling forecasting strategy is implemented, enabling real-time predictions for the next 60 minutes. This capability is essential for proactive energy management, allowing intelligent control systems to optimize heating, ventilation, and air conditioning (HVAC) operations based on predicted occupancy trends. The results underscore the potential of deep learning models in smart building applications, contributing to improved energy savings and sustainable building management.

Keywords: Long Short-Term Memory; Sensor; AI; Energy.