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EDITORIAL

Guest Editorial: Intelligence for systems and software engineering

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Artificial intelligence (AI) has recently seen an increase in research, tool development, and application implementation [10]. Many software businesses are focusing on constructing intelligent systems, and many more are incorporating AI principles into their existing operations. Problems that are encountered by the system can be solved using concepts and principles of engineering [16]. Intelligent systems and software engineering are the next generation of computer and artificial intelligence-based solutions. In other words, we can say that Intelligent Systems are high-tech machines that can perceive and respond to their surroundings. These days the systems and applications are created in such a manner that they sense and react to their environments. Such systems collect, infer, analyze, and use data for everything from smart devices and robotics to environmental sustainability and medicine. Intelligent systems are also concerned with how these technologies interact with human users in changing and dynamic physical and social situations [18].

Intelligent systems are a field of study that deals with intelligent systems and machines [18]. These technologies take many diverse forms, ranging from self-driving cars [12] and drones [11] to voice [7] and face recognition [15] software and online shopping recommendation systems [6]. An intelligent system is a machine with an integrated, Internet-connected computer that can collect and analyze data as well as communicate with other machines. Similarly, complex AI-based software systems, such as chatbots, expert systems, and other forms of software, can be included in intelligent systems [17].

Software intelligence is information on the structural status of software assets generated by software that analyses database structure, software framework, and source code to better understand and govern complex software systems in Information Technology settings. Other programming activities, such as producing functions and data structures, can be automated, or assisted by AI. It also highlights software security rules [1], standards, policies, protocols, and some awareness [2] mechanisms. It focuses on embedding intelligence into methodologies designed to solve diverse software engineering jobs to achieve high efficacy and efficiency [4, 8].

Given the relevance of software engineering and software system research with artificial intelligence to create intelligent [3, 5, 9] and smart system [13, 14], we decided in 2022 to organize a special issue on this topic. The special issue focuses on intelligent applications in the field of system and software engineering. The three types of intelligent system which is being focused on this special issue are applications of Artificial Narrow Intelligence, Artificial General Intelligence, and Artificial Super Intelligence with respect to systems and software engineering. Specifically, we looked at studies with results obtained through any empirical approach, e.g., qualitative, quantitative, or experimental. Moreover, we focused on innovative papers that address software engineering practices and methodology for intelligent systems, fuzzy, multiagent, and neural systems engineering, systems engineering and management, hybrid and collective Intelligence, security issues in intelligent systems, intelligence for big data, embedded systems, IoT, IIoT, cyber physical system, blockchain, fiber devices to name a few.

For this special issue, we received a total of 23 submissions. All these submissions went through a rigorous peer review process, involving at least three external reviewers. Thus, relying on the reviewers' comments, the guest editors made a decision about each manuscript. After a rigorous peer review cycle, out of 23 submissions, 12 papers were accepted for the special issue, and 11 were rejected (including

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one desk-rejection). The accepted papers concerned different and complementary topics; (i) an enumerated analysis of NoSQL data models using statistical tools; (ii) smart automation in manufacturing process using industrial internet of things (IIoT) architecture; (iii) a hybrid cellular automata-based model for leakage detection in smart drip irrigation water pipeline structure using IoT sensors; (iv) a hybrid approach for effective heart disease classification and segmentation to reduce complexity; (v) a study of efficiency measurement of Jaipur metro mass transit system using data envelopment analysis; (vi) mental health issues assessment using tools during covid-19 pandemic; (vii) an efficient apriori algorithm for frequent pattern in human intoxication data; (viii) asystematic method for diagnosis of hepatitis disease using machine learning; (ix) a novel hybrid multi-resource load balancing approach using ant colony optimization with tabu search for cloud computing; (x) optimized ensemble machine learning model for software bugs prediction; (xi) optimized classification model for plant diseases using generative adversarial networks; and (xii) correlation analysis between different parameters to predict cement logistics.

The following papers were reviewed and accepted:

- "An Enumerated Analysis of NoSQL Data Models Using Statistical Tools"—In this paper, the performance analysis of big data is done in an interesting way. The performances are evaluated using an experimental approach, taking a public data set of 5 million records and executing set of queries on different platforms like SQL Server 2012 (RDBMS) and two NoSQL models, Cassandra and MongoDB. Subsequently, the experimental results are verified by two well-known tools like VIKOR (Vlsekriterijumska Optimizacija I Kompromisno Resenje) and ANOVA (Analysis of Variance) to compare the performances from a practical perspective.
- "Smart Automation in Manufacturing Process Using Industrial Internet of Things (IIoT) Architecture"—This paper presents a study conducts which showcase a descriptive and analytical review of the relevant literature in order to examine the intrinsic distinctions among intelligent manufacturing (IM) and smart manufacturing (SM) and also to elucidate the connection between the two. This paper also presents a concept for intelligent technology in manufacturing techniques based on the Industrial Internet of Things (IIoT) design, as well as its future potential.
- "A Hybrid Cellular Automata-Based Model for Leakage Detection in Smart Drip Irrigation Water Pipeline Structure using IoT Sensors"—The hybrid Cellular Automata (CA)-based leak detection model which considers flow rate, pressure, soil moisture sensors, and rain sensor reading is proposed in this paper. The proposed model describes a complex, global and continuous system using a simple, local and discrete method. Furthermore, not only is the roughness factor, friction coefficient discretely distributed along the pipe in the CA model, but also the pipe diameter, density of water, velocity, and soil moisture are all integrated and synchronized in this model to minimize the false positive cases of leakage detection. Based on the changes in flow, pressure along the pipeline and soil moisture rate in the field within a given time line, the CA model may detect and locate the leak with enhanced accuracy. Initial experimental results and discussions provide validation of the proposed hybrid CA model though more experiments and variations are required to further validate the proposed work.
- "A Hybrid Approach for Effective Heart Disease Classification and Segmentation to Reduce Complexity"—The research presented here aimed to improve the precision with which heart disease could be predicted across three distinct phases. In this study, we use the dataset's five different algorithms, Decision Tree, Naive Bayes, Random Forest, KNN, and Support Vector Machine, to compare their respective performances. In addition to age, the suggested revolutionary technique considers other characteristics such as pulse rate, cholesterol, and so on, which was not the case in earlier studies. This research also introduced a novel hybrid classification model by fusing support vector machines and K-nearest neighbor classification techniques. The new technique decreases execution value by 5% and increases accuracy by up to 8%. The suggested model outperforms state-of-the-art approaches in terms of accuracy and implementation speed.
- "A Study of Efficiency Measurement of Jaipur Metro Mass Transit System using Data Envelopment Analysis"—The current research is an attempt to find the mental health issues (anxiety and depression) that occurred during the lockdown due to the pandemic by a predesigned questionnaire. Two hundred forty-four respondents (females = 126, males = 118) filled the online survey and the result indicated that females who are students and lie between the group 21–35 are affected more than males. By using the Patient Health Questionnaire (PHQ-9) self-administered version of the PRIME-MD diagnostic instrument to find common mental disorders, we found most cases were mild, moderate, or moderately severe. This helps the practitioners and the individuals to focus on the health accordingly and adopt diagnostic measures.
- "An efficient Apriori algorithm for frequent pattern in human intoxication data"—An attempt was made in the study to discover the main rules that cause people to get hooked. We utilized an open-source dataset with 474 total instances and 212 total addicted individuals. They asked 50 questions during the data collection process. All of the questions were created using the Index of Addiction Severity and with the assistance of drug addiction psychologists.

In this study, we utilized the Apriori algorithm to extract the most important rules from the dataset.

- "A Systematic Method for Diagnosis of Hepatitis Disease using Machine Learning"—The study presented in this paper shows that machine learning approaches can contribute toward diagnosing hepatitis disease based on a few characteristics. On the UCI dataset, authors assessed distinct classifiers' performance in order to develop a systematic strategy for hepatitis disease diagnosis. The classifiers used are Support Vector Machine (SVM), Logistic Regression (LR), *K*-Nearest Neighbor (KNN), and Random Forest (RF). The classifiers were employed both without class balancing and in conjunction with class balancing using SMOTE strategy. Both studies, classification without class balancing and with class balancing, were compared in terms of different performance parameters. After adopting the class balancing, the efficiency of classifiers improved significantly. LR with SMOTE provided the highest level of accuracy.
- "A Novel Hybrid Multi-Resource Load Balancing Approach using Ant Colony Optimization with Tabu Search for Cloud Computing"—This paper designs a novel hybrid approach by integrating the ant colony optimization (ACO) with the Tabu Search (TS) approach for multi-resource load balancing. The performance metrics such as makespan, average throughput, and total cost are calculated and evaluated with the help of these metrics. The proposed ACOTS approach performs better than the existing four optimization approaches: GA, PSO, ACO, and Tabu Search. The proposed ACOTS approach performed 30% better than GA, PSO, ACO, and Tabu search algorithms in data delivery. The proposed ACOTS shows the fast file delivery and processing.
- "Optimized Ensemble Machine Learning Model for Software Bugs Prediction"—The paper presents an optimized ensemble of Logistic Regression and Extra-tree classifier machine learning algorithms on parametric software attributes for the classification and prediction of software bugs, implemented on multiple platforms (WEKA, MATLAB and PyCharm) with the sole aim of minimizing memory utilization and achieving greater accuracy rate within the shortest possible duration of time. The National Aeronautics and Space Administration (NASA) Metrics Data Program defect dataset containing 16,962 instances and 38 attributes for software predictions is used for this study. Results obtained showed a significant increase from 96.7 to 97.8% in the prediction accuracy of the un-vectorized dataset to vectorized dataset. An overall accuracy of 97.8% recorded by the model for the prediction and detection of buggy software proved that the model is sufficiently able to help in the prediction of buggy software with minimal utilization of time and memory space.
- "Optimized Classification Model for Plant Diseases using Generative Adversarial Networks"—This paper offers an analysis of these various methods. A review of different ML techniques for accurate plant disease identification is done. The major areas of system design, model design, value prediction from observation, and experience from the massive amount of data and diverse gathering are the focus of machine learning (ML), a subset of artificial intelligence techniques. Optimized convolutional neural networks (CNN) are used in this study to classify various plant leaf diseases. The dataset is enhanced using a generative adversarial network. The model is trained and tested using data from PlantVillage. Images of plant diseases on pepper, tomato, and potato plants are included in the dataset. The classifier is trained and tested using 15 categories of plant diseases. The model's overall accuracy is 98%.
- "Correlation Analysis between different parameters to predict Cement Logistics"—This paper highlights and evaluates the correlation of various factors of cement logistics using heatmaps and correlation plots. This depicts their bivariate relationships in categories of high, medium, and low relations. Data associated with the supply in specific districts from multiple sources of a cement organization have been gathered and analyzed. Invoice-based sales data are analyzed using Pearson correlation to understand the key parameters affecting the logistics efficiency for further fine-tuning of logistics in the organization.

In conclusion, we received interesting papers from the research community. We believe that the proposed approaches open important directions for future research in the mobile domain, and we hope researchers in the field gain much from this special section on Intelligence for Systems and Software Engineering.

Handling this special issue was a great experience. As guest editors, we express our gratitude to both reviewers and authors for making this such a high quality special section on Intelligence for Systems and Software Engineering. We are also grateful to the great and constant support received by the Editors-in-Chief of the journal, Mike Hinchey, which was critical for handling this special issue.

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