# 2024

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Improved SVM with Hyperparameter Tuning for Fake News Detection

(2024)

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ABSTRACT: In today’s digital age, accessing information has become effortless. An abundance of resources is available online, from trustworthy news outlets providing factual information to unverified opinions shared by anonymous individuals. With the advent of modern technology, social media platforms have revolutionized interaction and staying informed, providing instant access to news and information related to a wide range of topics. They also allow us to share valuable links and content that we find interesting or informative and express our thoughts and beliefs on various issues. However, knowing if the information you see is true or fake can be challenging. This study introduces an improved SVM with hyperparameter tuning for detecting fake news on the Twitter dataset. The proposed has two phases: Check-worthiness identification and fact-checking, which include three tasks: Feature selection, fake news detection and determining whether claims within tweets are factual. The main idea for tackling complex optimization problems is to transform them into more straightforward linear or quadratic programming problems. This transformation is made possible by approximating the Gaussian kernel using Epanechnikov kernels. The process involves selecting an optimal probability distribution from a set of choices and using the minimax strategy to construct the most effective separating functions. The approach is a highly efficient and effective way of addressing optimization problems that are too complex to solve through direct methods. According to the results, the proposed method has been able to identify fake news with accuracy, precision, recall and F-measure of 99.67, 99.61, 100 and 99.81%, respectively. This framework is a game-changer in the fight against misinformation, as it allows the classification of recurring fake news and the utilization of social network users’ connections to prevent the spread of false information. © 2024 Atcharaporn Nachaithong and Kittipol Wisaeng. This open-access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.

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Neuro-symbolic artificial intelligence: a survey

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ABSTRACT: The goal of the growing discipline of neuro-symbolic artificial intelligence (AI) is to develop AI systems with more human-like reasoning capabilities by combining symbolic reasoning with connectionist learning. We survey the literature on neuro-symbolic AI during the last two decades, including books, monographs, review papers, contribution pieces, opinion articles, foundational workshops/talks, and related PhD theses. Four main features of neuro-symbolic AI are discussed, including representation, learning, reasoning, and decision-making. Finally, we discuss the many applications of neuro-symbolic AI, including question answering, robotics, computer vision, healthcare, and more. Scalability, explainability, and ethical considerations are also covered, as well as other difficulties and limits of neuro-symbolic AI. This study summarizes the current state of the art in neuro-symbolic artificial intelligence. © The Author(s), under exclusive licence to Springer-Verlag London Ltd., part of Springer Nature 2024.

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Ignat O., Jin Z., Abzaliev A., Biester L., Castro S., Deng N., Gao X., Gunal A., He J., Kazemi A., Khalifa M., Koh N., Lee A., Liu S., Min D.J., Mori S., Nwatu J., Perez-Rosas V., Shen S., Wang Z., Wu W., Mihalcea R.

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Has It All Been Solved? Open NLP Research Questions Not Solved by Large Language Models

(2024)

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85194474774&partnerID=40&md5=da532ec8c1c26818c4d423d4d6f149e3

ABSTRACT: Recent progress in large language models (LLMs) has enabled the deployment of many generative NLP applications. At the same time, it has also led to a misleading public discourse that “it's all been solved.” Not surprisingly, this has, in turn, made many NLP researchers - especially those at the beginning of their careers - worry about what NLP research area they should focus on. Has it all been solved, or what remaining questions can we work on regardless of LLMs? To address this question, this paper compiles NLP research directions rich for exploration. We identify fourteen different research areas encompassing 45 research directions that require new research and are not directly solvable by LLMs. While we identify many research areas, many others exist; we do not cover areas currently addressed by LLMs, but where LLMs lag behind in performance or those focused on LLM development. We welcome suggestions for other research directions to include: https://bit.ly/nlp-era-llm. © 2024 ELRA Language Resource Association: CC BY-NC 4.0.

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A Comprehensive Survey of Convolutions in Deep Learning: Applications, Challenges, and Future Trends

(2024)

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ABSTRACT: In today's digital age, Convolutional Neural Networks (CNNs), a subset of Deep Learning (DL), are widely used for various computer vision tasks such as image classification, object detection, and image segmentation. There are numerous types of CNNs designed to meet specific needs and requirements, including 1D, 2D, and 3D CNNs, as well as dilated, grouped, attention, depthwise convolutions, and NAS, among others. Each type of CNN has its unique structure and characteristics, making it suitable for specific tasks. It's crucial to gain a thorough understanding and perform a comparative analysis of these different CNN types to understand their strengths and weaknesses. Furthermore, studying the performance, limitations, and practical applications of each type of CNN can aid in the development of new and improved architectures in the future. We also dive into the platforms and frameworks that researchers utilize for their research or development from various perspectives. Additionally, we explore the main research fields of CNN like 6D vision, generative models, and meta-learning. This survey paper provides a comprehensive examination and comparison of various CNN architectures, highlighting their architectural differences and emphasizing their respective advantages, disadvantages, applications, challenges, and future trends. © 2013 IEEE.

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A Survey of Text Classification Algorithms and Application Scenarios [文本分类算法及其应用场景研究综述]

(2024)

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ABSTRACT: With the advent of the era of big data, text information on the internet has ushered in a blowout growth. As one of the most important technologies in natural language processing, text classification has a wide range of applications, such as sentiment analysis, news categorization, natural language inference, topic labeling, extractive question answer and fake news detection, etc. From the deepening of traditional machine learning methods to the rising of deep learning methods, related research of text classification models and ideas are constantly evolving, and various new methods, data sets, and evaluation indicators emerge in an endless stream, enriching the research in the field of text classification and achieving excellent theoretical achievements and application effects. Nevertheless, with the rapid development of advanced new technologies, the rich and diverse business application scenarios have also introduced many complex new technical challenges to this field, such as text representation learning with unbalanced data, text classification under few-shot learning scenarios, and so on. In response to the above research challenges and problems, this paper conducts an overall survey of text classification methods, and comprehensively discusses the technical challenges faced by current methods and future research directions. More specifically, this paper mainly consists of seven parts, which are (1) Introducing the relevant basic knowledge of text classification technology, including the definition of common symbols, computational paradigms and text preprocessing techniques, and so on. (2) Summarizing the text classification methods based on traditional machine learning. At the same time, in order to facilitate readers to select the appropriate models for different application scenarios, this paper summarizes the advantages and disadvantages of different classifiers, i. e., what kind of text classification problems they are good at dealing with. (3) Sorting out the text classification methods based on the emerging deep learning carefully, which are classified according to the key ideas of representative technologies in the field. Then the main methods under different categories are described, in which their advantages and disadvantages are summarized thoroughly. (4) In order to facilitate readers to verify the validity of the text classification models, this paper systematically summarizes the relevant datasets for the seven most widely used scenarios of text classification technology. (5) This paper introduces the commonly used model evaluation methods under different task objectives in detail, so as to quantitatively and reasonably evaluate the text classification model performance. (6) Based on the above, this paper summarizes and compares the performance of different types of text classification algorithms in typical application scenarios. (7) Summarizing the challenges faced by existing text classification technology and the important research directions in the future from two aspects, i. e., data limitation and model computation performance. By sorting out the development of text classification research, this paper provides a detailed summary and comparative analysis of representative technologies involved in the development of text classification research which effectively addresses the gap in the application overview of innovative technologies in the field of text classification and offers a comprehensive reference for researchers to quickly get started on related issues. © 2024 Science Press. All rights reserved.

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A New Perspective for Computational Social Systems: Fuzzy Modeling and Reasoning for Social Computing in CPSS

(2024)

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ABSTRACT: The evolution of modern mobile terminals, social networks, and other intelligent services makes everyone become a ubiquitous information perceiver, producer, and propagator. Also known as 'social sensor' and 'social IoT,' these individuals and communities generate a huge volume of social signals, which has shown prominent value for mining. These unstructured social signals provide a new perspective in the research of complex systems, which makes the traditional cyber-physical system (CPS)-oriented information computing sublimate to the cyber-physical-social system (CPSS)-oriented knowledge computing. However, there still exist great uncertainties, ambiguities, and complexities in modeling behaviors of social individuals or groups. Especially when we apply big-data-driven learning-based models in specific fields and scenarios, the lack of domain expert knowledge and characteristics of system uncertainty severely limits the performance and accuracy of these models. The introduction of fuzzy system modeling integrates data and knowledge in the social computing area, which has shown its unique advantages in solving the above issues and has drawn more attention to this topic. In this article, we conduct a review of recent advances in social computing with fuzzy technologies in CPSS. First, we briefly review the development of social computing, and analyze the characteristics and advantages of social computing through fuzzy methods. Second, we refine core fuzzy system methods for social computing and elaborate on existing fuzzy-technology-empowered social computing methodologies. As in a range of social spaces, we also review and analyze related advances in human-in-the-loop systems. We also reveal the trend of decentralized, autonomous, and organized computing in cyber-physical-social space with fuzzy-based methods and proposed a framework to categorize related studies in CPSS. Finally, we conclude the research trends and hotspots based on current studies, and discuss the challenges for future research directions. © 2014 IEEE.

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Belief Mining in Persian Texts Based on Deep Learning and Users' Opinions

(2024)

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ABSTRACT: Belief mining and the study of public opinion provide valuable information. Analyzing the feelings and belief mining of social media data leads to understanding users' opinions and has wide applications in decision making and policymaking. This article applies a new method based on deep learning to solve the problems of belief mining for Persian comments on the Twitter. In this method, first, the data is preprocessed with a deep neural network and then classified into political, cultural, economic, and sports classes, and the sentimental polarity is obtained. SentiPers is applied on four different datasets from Persian Twitter, Digikala store, Google translator, and synonym for evaluation. Then the results are compared with other machine learning and deep learning methods such as neural network, support vector machine, DNN, CNN, and LSTM. Python software has been used to implement this method. The accuracy of the proposed word embedding method for LSTM, CNN, DNN on the SentiPres dataset is 0.931, 0.923, 0.916 respectively. For the TF-IDF method, it is 0.837, 0.863, 0.883 respectively. that the accuracy of LSTM-WSD, CNN-WSD model has increased by 8% and 6% compared to TF-IDF. The results show that the LSTM and Word embedding methods work best. © 2010-2012 IEEE.

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An improved hybrid salp swarm optimization and African vulture optimization algorithm for global optimization problems and its applications in stock market prediction

(2024)

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ABSTRACT: Optimization is necessary for solving and improving the solution of various complex problems. Every meta-heuristic algorithm can have a weak point, and multiple mechanisms and methods can be used to overcome these weaknesses. Some algorithms perform well in the discovery phase and some algorithms perform better in the exploitation phase. Hybridizing algorithms can be a good solution to achieve a powerful algorithm, and hybridizing algorithms and mechanisms greedily lead to an increase in computational complexity and execution time. This paper presents a new and intelligent approach by hybridizing meta-heuristic algorithms and using different mechanisms simultaneously without significantly increasing the time complexity. For this purpose, salp swarm optimization (SSO) and the African vulture optimization algorithm (AVOA) have been hybridized to improve the optimization process of the modified choice function and learning automata mechanisms. In addition, two other improving mechanisms, named opposition-based learning (OBL) and β-hill climbing (BHC) technique, have been presented and integrated with the AVOA–SSA algorithm. Fifty-two standard benchmarks were used to test and evaluate the AVOA–SSA algorithm. Finally, an improved version of the extreme learning machine (ELM) classifier has been used with real stock market data for stock market prediction. The obtained results indicate the excellent and acceptable performance of the AVOA–SSA algorithm in `solving optimization problems and have been able to achieve high-quality solutions. According to the results obtained from the AVOA–SSA algorithm, in comparison to global optimization problems, the AVOA–SSA algorithm has been able to obtain the best results in 21 functions out of 23 standard benchmarks. Also, against CEC2017 problems, it has been able to perform best in 26 out of 29 functions. In addition, the AVOA–SSA algorithm has been able to perform better than other compared algorithms in all five datasets evaluated in the stock market. © The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2023.

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Pruning techniques for artificial intelligence networks: a deeper look at their engineering design and bias: the first review of its kind

(2024)

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ABSTRACT: Trained Artificial Intelligence (AI) models are challenging to install on edge devices as they are low in memory and computational power. Pruned AI (PAI) models are therefore needed with minimal degradation in performance. This is the first study of its kind where we have characterized three types of PAI paradigms, namely, weight pruning (WP), channel pruning (CP), and hybrid pruning (HP). Further, the study also analyses the risk of bias (RoB) in PAI models, and explainable PAI (XPAI) networks. PRISMA model was adapted for the selection of the best 145 studies. The review had two hypotheses: (i) PAI had bias and (ii) the order of performance for the three PAI is: HP > CP > WP in terms of performance. Thirty-two AI attributes using each of two experts were categorized into four clusters, namely, architecture, optimization, dataset design, and scientific validation. The RoB was analyzed in these PAI studies using AP(ai)Bias 2.0 (AtheroPoint™, CA, USA), which was based on a scoring-and-ranking strategy. This was then compared against the Butterfly model, composed of radial and regional biases, and analyzed using a Venn diagram in three independent bins based on low-moderate and moderate-high cut-offs. Recommendations were laid out for low-bias studies. PAI studies that lack adequate AI attributes were more inclined to the RoB. It has been observed that 19.64%, 21.42%, and 58.92% studies were in low-bias, moderate-bias, and high-bias bins, respectively. Pruning made inference faster and reduced sparsity. We have observed low participation of the PAI studies in the XPAI framework. The study presented the challenges and five-step recommendations for mitigating bias in PAI models. © The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2024.

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Improved SVM with Hyperparameter Tuning for Fake News Detection

(2024)

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ABSTRACT: In today’s digital age, accessing information has become effortless. An abundance of resources is available online, from trustworthy news outlets providing factual information to unverified opinions shared by anonymous individuals. With the advent of modern technology, social media platforms have revolutionized interaction and staying informed, providing instant access to news and information related to a wide range of topics. They also allow us to share valuable links and content that we find interesting or informative and express our thoughts and beliefs on various issues. However, knowing if the information you see is true or fake can be challenging. This study introduces an improved SVM with hyperparameter tuning for detecting fake news on the Twitter dataset. The proposed has two phases: Check-worthiness identification and fact-checking, which include three tasks: Feature selection, fake news detection and determining whether claims within tweets are factual. The main idea for tackling complex optimization problems is to transform them into more straightforward linear or quadratic programming problems. This transformation is made possible by approximating the Gaussian kernel using Epanechnikov kernels. The process involves selecting an optimal probability distribution from a set of choices and using the minimax strategy to construct the most effective separating functions. The approach is a highly efficient and effective way of addressing optimization problems that are too complex to solve through direct methods. According to the results, the proposed method has been able to identify fake news with accuracy, precision, recall and F-measure of 99.67, 99.61, 100 and 99.81%, respectively. This framework is a game-changer in the fight against misinformation, as it allows the classification of recurring fake news and the utilization of social network users’ connections to prevent the spread of false information. © 2024 Atcharaporn Nachaithong and Kittipol Wisaeng. This open-access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.

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Using machine learning to detect emotions and predict human psychology

(2024)

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ABSTRACT: In the realm of analyzing human emotions through Artificial Intelligence (AI), a myriad of challenges persist. From the intricate nuances of emotional subtleties to the broader concerns of ethical considerations, privacy implications, and the ongoing battle against bias, AI faces a complex landscape when venturing into the understanding of human emotions. These challenges underscore the intricate balance required to navigate the human psyche with accuracy. The book, Using Machine Learning to Detect Emotions and Predict Human Psychology, serves as a guide for innovative solutions in the field of emotion detection through AI. It explores facial expression analysis, where AI decodes real-time emotions through subtle cues such as eyebrow movements and micro-expressions. In speech and voice analysis, the book unveils how AI processes vocal nuances to discern emotions, considering elements like tone, pitch, and language intricacies. Additionally, the power of text analysis is of great importance, revealing how AI extracts emotional tones from diverse textual communications. By weaving these systems together, the book offers a holistic solution to the challenges faced by AI in understanding the complex landscape of human emotions. For researchers and educators seeking to unravel the complexities of emotion detection, the book becomes an indispensable resource, providing valuable insights for scholars in engineering, medicine, and healthcare. Beyond academia, it serves as a crucial tool for educators teaching courses at both undergraduate and postgraduate levels, bridging the gap between theoretical knowledge and practical applications in the burgeoning field of emotional intelligence. With a commitment to contributing to the evolution of human communication, the book positions itself as a great resource for the psychological research community, offering profound insights into emotions and their predictions through the lens of Artificial Intelligence. © 2024 by IGI Global. All rights reserved.

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Humanoid robot heads for human-robot interaction: A review

(2024)

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ABSTRACT: The humanoid robot head plays an important role in the emotional expression of human-robot interaction (HRI). They are emerging in industrial manufacturing, business reception, entertainment, teaching assistance, and tour guides. In recent years, significant progress has been made in the field of humanoid robots. Nevertheless, there is still a lack of humanoid robots that can interact with humans naturally and comfortably. This review comprises a comprehensive survey of state-of-the-art technologies for humanoid robot heads over the last three decades, which covers the aspects of mechanical structures, actuators and sensors, anthropomorphic behavior control, emotional expression, and human-robot interaction. Finally, the current challenges and possible future directions are discussed. © Science China Press 2023.

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Has It All Been Solved? Open NLP Research Questions Not Solved by Large Language Models

(2024)

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85194474774&partnerID=40&md5=da532ec8c1c26818c4d423d4d6f149e3

ABSTRACT: Recent progress in large language models (LLMs) has enabled the deployment of many generative NLP applications. At the same time, it has also led to a misleading public discourse that “it's all been solved.” Not surprisingly, this has, in turn, made many NLP researchers - especially those at the beginning of their careers - worry about what NLP research area they should focus on. Has it all been solved, or what remaining questions can we work on regardless of LLMs? To address this question, this paper compiles NLP research directions rich for exploration. We identify fourteen different research areas encompassing 45 research directions that require new research and are not directly solvable by LLMs. While we identify many research areas, many others exist; we do not cover areas currently addressed by LLMs, but where LLMs lag behind in performance or those focused on LLM development. We welcome suggestions for other research directions to include: https://bit.ly/nlp-era-llm. © 2024 ELRA Language Resource Association: CC BY-NC 4.0.

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A Comprehensive Survey of Convolutions in Deep Learning: Applications, Challenges, and Future Trends

(2024)

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ABSTRACT: In today's digital age, Convolutional Neural Networks (CNNs), a subset of Deep Learning (DL), are widely used for various computer vision tasks such as image classification, object detection, and image segmentation. There are numerous types of CNNs designed to meet specific needs and requirements, including 1D, 2D, and 3D CNNs, as well as dilated, grouped, attention, depthwise convolutions, and NAS, among others. Each type of CNN has its unique structure and characteristics, making it suitable for specific tasks. It's crucial to gain a thorough understanding and perform a comparative analysis of these different CNN types to understand their strengths and weaknesses. Furthermore, studying the performance, limitations, and practical applications of each type of CNN can aid in the development of new and improved architectures in the future. We also dive into the platforms and frameworks that researchers utilize for their research or development from various perspectives. Additionally, we explore the main research fields of CNN like 6D vision, generative models, and meta-learning. This survey paper provides a comprehensive examination and comparison of various CNN architectures, highlighting their architectural differences and emphasizing their respective advantages, disadvantages, applications, challenges, and future trends. © 2013 IEEE.

# 2023

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Anti-Fraud Engineering for Digital Finance: Behavioral Modeling Paradigm

(2023)

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ABSTRACT: This book offers an introduction to the topic of anti-fraud in digital finance based on the behavioral modeling paradigm. It deals with the insufficiency and low-quality of behavior data and presents a unified perspective to combine technology, scenarios, and data for better anti-fraud performance. The goal of this book is to provide a non-intrusive second security line, rather than replaced with existing solutions, for anti-fraud in digital finance. By studying common weaknesses in typical fields, it can support the behavioral modeling paradigm across a wide array of applications. It covers the latest theoretical and experimental progress and offers important information that is just as relevant for researchers as for professionals. © Tongji University Press 2023.

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Semi-supervised and un-supervised clustering: A review and experimental evaluation

(2023)

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ABSTRACT: Retrieving, analyzing, and processing large data can be challenging. An effective and efficient mechanism for overcoming these challenges is to cluster the data into a compact and meaningful format that reflect the whole data. The learning techniques for clustering can be classified into supervised, semi-supervised, and un-supervised learning. Semi-supervised and un-supervised learning are more advantageous than supervised learning because it is laborious, and that prior knowledge is unavailable for most practical real-word problems. Towards this, we provide in this paper a review on semi-supervised and un-supervised learning methods. Unfortunately, most current survey papers categorize semi-supervised and un-supervised learning algorithms into broad clustering classes and do not drive clear boundaries between the specific techniques employed by the algorithms. That is, they do not set clear distinguishable boundaries between the specific techniques adopted by the algorithms. To overcome this, we provide a detailed methodology-based taxonomy that categorizes the algorithms into hierarchically nested, specific, and fine-grained classes. The taxonomy is hierarchically nested as follows: clustering categories → clustering methods → clustering sub-methods. First, the algorithms are classified into broad categories. In turn, each category is further classified into various methods. These methods are classified into sub-methods. We survey and describe over 200 state-of-the-art algorithms that employ the underlying principles of each clustering method/sub-method. We experimentally evaluate and rank the following: (1) the various clustering sub-methods that fall under a same clustering method, (2) the various clustering methods that fall under a same clustering category, (3) the various clustering categories. © 2023 Elsevier Ltd

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Detecting technological recombination using semantic analysis and dynamic network analysis

(2023)

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ABSTRACT: Technological recombinative innovation is a crucial way of innovation, and detecting technological recombination can effectively identify the technical elements with recombinative innovation potential in the future. This study proposes a novel method for detecting technological recombination by combining semantic analysis and dynamic network analysis. The framework accurately captures the hidden semantic changes behind keywords over time and deeply excavates the dynamic evolution characteristics of keyword networks in the development process, which effectively improves the accuracy of the identification results of technological recombination. Firstly, the dynamic word embedding model is applied to generate word vectors, and construct the dynamic keyword networks. Then, the dynamic network link prediction method is trained to predict the future network and the possibility of connection between keywords is calculated, which represents the technological recombination potential value. Finally, in order to identify potential recombination opportunities of crucial technologies in the field, SLM community detection is combined with the PageRank algorithm to identify core keywords in communities of the future network, and then technological recombination candidates corresponding to core keywords are detected. A case study on artificial intelligence domain demonstrates the reliability of the methodology. © 2023, Akadémiai Kiadó, Budapest, Hungary.

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Explainable Goal-driven Agents and Robots - A Comprehensive Review

(2023)

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ABSTRACT: Recent applications of autonomous agents and robots have brought attention to crucial trust-related challenges associated with the current generation of artificial intelligence (AI) systems. AI systems based on the connectionist deep learning neural network approach lack capabilities of explaining their decisions and actions to others, despite their great successes. Without symbolic interpretation capabilities, they are 'black boxes', which renders their choices or actions opaque, making it difficult to trust them in safety-critical applications. The recent stance on the explainability of AI systems has witnessed several approaches to eXplainable Artificial Intelligence (XAI); however, most of the studies have focused on data-driven XAI systems applied in computational sciences. Studies addressing the increasingly pervasive goal-driven agents and robots are sparse at this point in time. This paper reviews approaches on explainable goal-driven intelligent agents and robots, focusing on techniques for explaining and communicating agents' perceptual functions (e.g., senses, vision) and cognitive reasoning (e.g., beliefs, desires, intentions, plans, and goals) with humans in the loop. The review highlights key strategies that emphasize transparency, understandability, and continual learning for explainability. Finally, the paper presents requirements for explainability and suggests a road map for the possible realization of effective goal-driven explainable agents and robots. © 2023 Association for Computing Machinery.

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Interpretability in Deep Learning

(2023)

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ABSTRACT: This book is a comprehensive curation, exposition and illustrative discussion of recent research tools for interpretability of deep learning models, with a focus on neural network architectures. In addition, it includes several case studies from application-oriented articles in the fields of computer vision, optics and machine learning related topic. The book can be used as a monograph on interpretability in deep learning covering the most recent topics as well as a textbook for graduate students. Scientists with research, development and application responsibilities benefit from its systematic exposition. © The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2023.

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A Survey on Hyperdimensional Computing aka Vector Symbolic Architectures, Part II: Applications, Cognitive Models, and Challenges

(2023)

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ABSTRACT: This is Part II of the two-part comprehensive survey devoted to a computing framework most commonly known under the names Hyperdimensional Computing and Vector Symbolic Architectures (HDC/VSA). Both names refer to a family of computational models that use high-dimensional distributed representations and rely on the algebraic properties of their key operations to incorporate the advantages of structured symbolic representations and vector distributed representations. Holographic Reduced Representations [321, 326] is an influential HDC/VSA model that is well known in the machine learning domain and often used to refer to the whole family. However, for the sake of consistency, we use HDC/VSA to refer to the field.Part I of this survey [222] covered foundational aspects of the field, such as the historical context leading to the development of HDC/VSA, key elements of any HDC/VSA model, known HDC/VSA models, and the transformation of input data of various types into high-dimensional vectors suitable for HDC/VSA. This second part surveys existing applications, the role of HDC/VSA in cognitive computing and architectures, as well as directions for future work. Most of the applications lie within the Machine Learning/Artificial Intelligence domain; however, we also cover other applications to provide a complete picture. The survey is written to be useful for both newcomers and practitioners. © 2023 Association for Computing Machinery.

///

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Crypto and AI: From Coevolution to Quantum Revolution

(2023)

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ABSTRACT: This book studies the intersection between cryptography and AI, highlighting the significant cross-impact and potential between the two technologies. The authors first study the individual ecosystems of cryptography and AI to show the omnipresence of each technology in the ecosystem of the other one. Next, they show how these technologies have come together in collaborative or adversarial ways. In the next section, the authors highlight the coevolution being formed between cryptography and AI. Throughout the book, the authors use evidence from state-of-the-art research to look ahead at the future of the crypto-AI dichotomy. The authors explain how they anticipate that quantum computing will join the dichotomy in near future, augmenting it to a trichotomy. They verify this through two case studies highlighting another scenario wherein crypto, AI and quantum converge. The authors study current trends in chaotic image encryption as well as information-theoretic cryptography and show how these trends lean towards quantum-inspired artificial intelligence (QiAI). After concluding the discussions, the authors suggest future research for interested researchers. © The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2023.

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Human Factors Engineering and Ergonomics: A Systems Approach, Third edition

(2023)

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85160115355&doi=10.1201%2f9781003359128&partnerID=40&md5=88783d08d0e3ae572cbbad2a98ca3014

ABSTRACT: This textbook comprehensively covers the basic principles and most recent advances regarding visual displays, auditory and tactile displays, and controls; psychophysics; cognitive processes; human–computer interaction, artificial intelligence and artificial life; stress and human performance; occupational accidents and prevention; human group dynamics and complex systems; and anthropometry, workspace, and environmental design. The systems perspective emphasizes nonlinear dynamics for system performance changes and emergent behaviors of complex person–machine systems. This book: • Surveys principles of conventional and computer-b ased machine interaction. • Assesses the relative effectiveness of accident analysis and prevention strategies. • Highlights nonlinear dynamics for system performance changes. • Examines artificial intelligence and complex systems. • Investigates sources of cognitive workload and fatigue. The textbook will be a valuable resource for advanced undergraduates and graduate students in diverse fields including ergonomics, human factors, cognitive science, computer science, operations management, and psychology. The textbook brings together core principles of person–machine interaction, accident analysis and prevention strategies, risk analysis and resilience, artificial intelligence, group dynamics, and nonlinear dynamics for an enhanced understanding of complex person–machine systems. © 2023 Stephen J. Guastello.

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Whale optimization algorithm and its application in machine learning

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ABSTRACT: Machine learning is the most well-regarded and fast-growing field in artificial intelligence. Machine learning methods have been successfully applied to solve many real-world problems, such as producing recommendations, image recognition, sentiment analysis, fraud detection, and so on. However, to make machine learning algorithms efficient, some challenges should be handled. For instance, the efficiency of machine learning algorithms highly depends on finding optimal learning parameters and assigning optimal values to the hyperparameters of machine learning methods. To tackle these challenges, we can utilize optimization algorithms. Among many types of optimization algorithms, nature-inspired algorithms are very promising methods because they are simple to implement, efficient for global search, and are unable to escape from local and fastest-optima. This chapter investigates how the Whale optimization algorithm, one of the nature-inspired algorithms, can be applied to various machine learning problems such as feature selection, tuning the parameters of SVM classifiers and K-means clustering, and tuning the hyperparameters of artificial neural networks to improve their performance. © 2024 Elsevier Inc. All rights reserved.

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A Survey on Hyperdimensional Computing aka Vector Symbolic Architectures, Part II: Applications, Cognitive Models, and Challenges

(2023)

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85147845869&doi=10.1145%2f3558000&partnerID=40&md5=5400141f938a69dc205aafe43a0707f8

ABSTRACT: This is Part II of the two-part comprehensive survey devoted to a computing framework most commonly known under the names Hyperdimensional Computing and Vector Symbolic Architectures (HDC/VSA). Both names refer to a family of computational models that use high-dimensional distributed representations and rely on the algebraic properties of their key operations to incorporate the advantages of structured symbolic representations and vector distributed representations. Holographic Reduced Representations [321, 326] is an influential HDC/VSA model that is well known in the machine learning domain and often used to refer to the whole family. However, for the sake of consistency, we use HDC/VSA to refer to the field.Part I of this survey [222] covered foundational aspects of the field, such as the historical context leading to the development of HDC/VSA, key elements of any HDC/VSA model, known HDC/VSA models, and the transformation of input data of various types into high-dimensional vectors suitable for HDC/VSA. This second part surveys existing applications, the role of HDC/VSA in cognitive computing and architectures, as well as directions for future work. Most of the applications lie within the Machine Learning/Artificial Intelligence domain; however, we also cover other applications to provide a complete picture. The survey is written to be useful for both newcomers and practitioners. © 2023 Association for Computing Machinery.

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Comprehensive Learning Strategy Enhanced Chaotic Whale Optimization for High-dimensional Feature Selection

(2023)

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ABSTRACT: Feature selection (FS) is an adequate data pre-processing method that reduces the dimensionality of datasets and is used in bioinformatics, finance, and medicine. Traditional FS approaches, however, frequently struggle to identify the most important characteristics when dealing with high-dimensional information. To alleviate the imbalance of explore search ability and exploit search ability of the Whale Optimization Algorithm (WOA), we propose an enhanced WOA, namely SCLWOA, that incorporates sine chaos and comprehensive learning (CL) strategies. Among them, the CL mechanism contributes to improving the ability to explore. At the same time, the sine chaos is used to enhance the exploitation capacity and help the optimizer to gain a better initial solution. The hybrid performance of SCLWOA was evaluated comprehensively on IEEE CEC2017 test functions, including its qualitative analysis and comparisons with other optimizers. The results demonstrate that SCLWOA is superior to other algorithms in accuracy and converges faster than others. Besides, the variant of Binary SCLWOA (BSCLWOA) and other binary optimizers obtained by the mapping function was evaluated on 12 UCI data sets. Subsequently, BSCLWOA has proven very competitive in classification precision and feature reduction. © 2023, Jilin University.

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Anti-Fraud Engineering for Digital Finance: Behavioral Modeling Paradigm

(2023)

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ABSTRACT: This book offers an introduction to the topic of anti-fraud in digital finance based on the behavioral modeling paradigm. It deals with the insufficiency and low-quality of behavior data and presents a unified perspective to combine technology, scenarios, and data for better anti-fraud performance. The goal of this book is to provide a non-intrusive second security line, rather than replaced with existing solutions, for anti-fraud in digital finance. By studying common weaknesses in typical fields, it can support the behavioral modeling paradigm across a wide array of applications. It covers the latest theoretical and experimental progress and offers important information that is just as relevant for researchers as for professionals. © Tongji University Press 2023.

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Artificial Intelligence, Game Theory and Mechanism Design in Politics

(2023)

https://www.scopus.com/inward/record.uri?eid=2-s2.0-85199839921&doi=10.1007%2f978-981-99-5103-1&partnerID=40&md5=7f7383a2f429d471aab427989319e314

ABSTRACT: This book explores how AI and mechanism design can provide a new framework for international politics. The international political system is all manners in which countries, governments and people relate. Mechanism design in international politics relates to identifying rules that define relationships between people and countries that achieve a particular outcome, e.g., peace or more trade or democracy or economic development. Artificial intelligence is technique of making machines intelligent. This book explores mechanism design and artificial intelligence in international politics and applies these technologies to politics, economy and society. This book will be of interest to scholars of international relations, politics, sustainable development, and artificial intelligence. © The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2023.

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Crypto and AI: From Coevolution to Quantum Revolution

(2023)

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ABSTRACT: This book studies the intersection between cryptography and AI, highlighting the significant cross-impact and potential between the two technologies. The authors first study the individual ecosystems of cryptography and AI to show the omnipresence of each technology in the ecosystem of the other one. Next, they show how these technologies have come together in collaborative or adversarial ways. In the next section, the authors highlight the coevolution being formed between cryptography and AI. Throughout the book, the authors use evidence from state-of-the-art research to look ahead at the future of the crypto-AI dichotomy. The authors explain how they anticipate that quantum computing will join the dichotomy in near future, augmenting it to a trichotomy. They verify this through two case studies highlighting another scenario wherein crypto, AI and quantum converge. The authors study current trends in chaotic image encryption as well as information-theoretic cryptography and show how these trends lean towards quantum-inspired artificial intelligence (QiAI). After concluding the discussions, the authors suggest future research for interested researchers. © The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2023.

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Semi-supervised and un-supervised clustering: A review and experimental evaluation

(2023)

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ABSTRACT: Retrieving, analyzing, and processing large data can be challenging. An effective and efficient mechanism for overcoming these challenges is to cluster the data into a compact and meaningful format that reflect the whole data. The learning techniques for clustering can be classified into supervised, semi-supervised, and un-supervised learning. Semi-supervised and un-supervised learning are more advantageous than supervised learning because it is laborious, and that prior knowledge is unavailable for most practical real-word problems. Towards this, we provide in this paper a review on semi-supervised and un-supervised learning methods. Unfortunately, most current survey papers categorize semi-supervised and un-supervised learning algorithms into broad clustering classes and do not drive clear boundaries between the specific techniques employed by the algorithms. That is, they do not set clear distinguishable boundaries between the specific techniques adopted by the algorithms. To overcome this, we provide a detailed methodology-based taxonomy that categorizes the algorithms into hierarchically nested, specific, and fine-grained classes. The taxonomy is hierarchically nested as follows: clustering categories → clustering methods → clustering sub-methods. First, the algorithms are classified into broad categories. In turn, each category is further classified into various methods. These methods are classified into sub-methods. We survey and describe over 200 state-of-the-art algorithms that employ the underlying principles of each clustering method/sub-method. We experimentally evaluate and rank the following: (1) the various clustering sub-methods that fall under a same clustering method, (2) the various clustering methods that fall under a same clustering category, (3) the various clustering categories. © 2023 Elsevier Ltd

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IGJO: An Improved Golden Jackel Optimization Algorithm Using Local Escaping Operator for Feature Selection Problems

(2023)

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ABSTRACT: Feature Selection (FS) is an essential process that is implicated in data mining and machine learning for data preparation by removing redundant and irrelevant features, thereby falling the possible risk associated with the expletive of dimensionality caused by the large dataset. As a result, FS is thought to be a combinatorial NP-hard problem, which refers to a situation where the computation time increases as the problem dimension increases. Recently, researchers have focused on metaheuristic algorithms to perform this task. Therefore, this paper proposes an effective metaheuristic which is a new variant of the recently reported Golden Jackel Optimization (GJO) algorithm called Improved GJO (IGJO). The basic GJO algorithm suffers from a local optima trap when handling large dimensional feature selection problems. Therefore, the effectiveness of the GJO is improved by considering the operators from the gradient-based optimizer. The proposed IGJO is based on the local escaping operator and the direction of population movement to improve the exploration and exploitation ability of the basic GJO algorithm. The superiority of the IGJO algorithm is tested on 23 standard numerical benchmark problems, 29 CEC2017 optimization problems, and 33 CEC2020 constrained real-world engineering design problems. Additionally, the IGJO is transformed to its binary version for the FS problem using a new nonlinear time-varying sigmoid transfer function, and finally, the binary variant is validated on FS problems with different benchmark datasets. The performance of the IGJO is compared with well-known algorithms to validate its superiority. The obtained results show that the IGJO is a reliable tool for numerical optimization problems and FS problems. © 2023, The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature.

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An Unobtrusive Approach to Emotion Detection in E-Learning Systems

(2023)

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ABSTRACT: Researchers have proved that emotions play vital role in a human's life. They affect our way of living, making decisions and also our way of learning. There are many methods for emotion detection in e-learning. However, each of them comes with its own set of disadvantages discussed in the literature review. In this paper, the attributes that have been identified are purely unobtrusive in nature; attributes that do not interfere with the learner's activity and less is known to them that their emotions are being monitored. A methodology is presented to detect the emotions of the learner using keystrokes, mouse clicks, forum discussions and the results of assessments. Machine learning models have been trained and tested to predict the learner's emotions. The logistic regression performed fairly well in comparison to the other algorithms with an accuracy of about 85% and cross-validation score of 86%. During this study, interesting patterns are observed in learner's emotions that are discussed. Future directions include collecting diverse data to understand emotions of learners from various age groups and observing patterns in their emotional changes. © 2022 The British Computer Society. All rights reserved.

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Human Factors Engineering and Ergonomics: A Systems Approach, Third edition

(2023)

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ABSTRACT: This textbook comprehensively covers the basic principles and most recent advances regarding visual displays, auditory and tactile displays, and controls; psychophysics; cognitive processes; human–computer interaction, artificial intelligence and artificial life; stress and human performance; occupational accidents and prevention; human group dynamics and complex systems; and anthropometry, workspace, and environmental design. The systems perspective emphasizes nonlinear dynamics for system performance changes and emergent behaviors of complex person–machine systems. This book: • Surveys principles of conventional and computer-b ased machine interaction. • Assesses the relative effectiveness of accident analysis and prevention strategies. • Highlights nonlinear dynamics for system performance changes. • Examines artificial intelligence and complex systems. • Investigates sources of cognitive workload and fatigue. The textbook will be a valuable resource for advanced undergraduates and graduate students in diverse fields including ergonomics, human factors, cognitive science, computer science, operations management, and psychology. The textbook brings together core principles of person–machine interaction, accident analysis and prevention strategies, risk analysis and resilience, artificial intelligence, group dynamics, and nonlinear dynamics for an enhanced understanding of complex person–machine systems. © 2023 Stephen J. Guastello.

# 2022

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Recent Progress in the Discovery and Design of Antimicrobial Peptides Using Traditional Machine Learning and Deep Learning

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ABSTRACT: Antimicrobial resistance has become a critical global health problem due to the abuse of conventional antibiotics and the rise of multi-drug-resistant microbes. Antimicrobial peptides (AMPs) are a group of natural peptides that show promise as next-generation antibiotics due to their low toxicity to the host, broad spectrum of biological activity, including antibacterial, antifungal, antiviral, and anti-parasitic activities, and great therapeutic potential, such as anticancer, anti-inflammatory, etc. Most importantly, AMPs kill bacteria by damaging cell membranes using multiple mechanisms of action rather than targeting a single molecule or pathway, making it difficult for bacterial drug resistance to develop. However, experimental approaches used to discover and design new AMPs are very expensive and time-consuming. In recent years, there has been considerable interest in using in silico methods, including traditional machine learning (ML) and deep learning (DL) approaches, to drug discovery. While there are a few papers summarizing computational AMP prediction methods, none of them focused on DL methods. In this review, we aim to survey the latest AMP prediction methods achieved by DL approaches. First, the biology background of AMP is introduced, then various feature encoding methods used to represent the features of peptide sequences are presented. We explain the most popular DL techniques and highlight the recent works based on them to classify AMPs and design novel peptide sequences. Finally, we discuss the limitations and challenges of AMP prediction. © 2022 by the authors.

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Indicators and Measures for Measuring the Level of Information Intelligence

(2022)

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ABSTRACT: The concept of information intelligence encompasses various aspects such as information and communication skills, information literacy, information behavior, individual and collective creativity, intelligence, and cognitive-perceptual issues. Measuring information intelligence is very important in information societies. Addressing the effective indicators in this issue is one of the determining issues in the use of information and data in information societies. The present study aimed to identify indicators and measures effective in measuring information intelligence. The research is applied and uses a qualitative method including library studies, content analysis, and analysis of expert opinions. Data collection tools included the study of scientific literature related to the subject, content-coding, and interviews with experts familiar with the subject of information intelligence (8 experts in knowledge and information science and 7 experts in psychology). The research population included related published literature related to scientific theories, information science experts, and psychology experts. In the subject of intelligence, Gardner’s multiple intelligence theory has been used, and in the subject of information-seeking behavior various scientific theories have been used. Based on the research findings, 14 indicators and 97 measures were identified as effective for measuring information intelligence in two dimensions management and information retrieval. Finally, a proposed framework is presented for measuring information intelligence. From the findings, it was concluded that in the information society, policymakers and managers of the organization or responsible organizations in relation to increasing the level of information intelligence of the society should consider the specific strategies of the information intelligence of the society in formulating their general strategies. One of these strategic goals can be increasing the level of information intelligence of individuals, organizations, and society. To do this, effective indicators must be identified for measuring and strategies to increase the level of information intelligence of the target community. It is suggested that this matter is placed in the priorities of the information society and the native measurement tool of information intelligence can be prepared based on the findings of this research. © 2022 Iranian Research Institute for Scientific Information and Documentation. All rights reserved.

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A ship motion forecasting approach based on empirical mode decomposition method hybrid deep learning network and quantum butterfly optimization algorithm

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ABSTRACT: Ship motion (SHM) forecasting value is an important parameter for ship navigation and operation. However, due to the coupling effect of wind, wave, and current, its time series has strong nonlinear characteristics, so it is a great challenge to obtain accurate forecasting results. Therefore, considering the strong nonlinear of SHM time series, firstly, this paper decomposes the original time series into multiple intrinsic mode functions (IMF) using empirical mode decomposition (EMD) technology and then establishes a hybrid deep learning network for each IMF based on convolutional neural network (CNN) and gated recurrent unit (GRU) according to the characteristics of SHM time series. On this basis, the EMD-CNN-GRU (ECG) hybrid forecasting model of SHM is constructed by integrating a component forecasting model. Secondly, considering the difficulty of hyper-parameters selection of ECG model, this paper improves the butterfly optimization algorithm (BOA) based on quantum theory, designs the quantum coding rules of butterfly spatial position, establishes the optimization process of butterfly algorithm based on quantum coding, and then proposes the quantum butterfly optimization algorithm (QBOA). Finally, a hybrid forecasting approach integrating ECG and QBOA is proposed, namely ECG & QBOA. To evaluate the feasibility and performance of the proposed approach. A prediction experiment was carried out with the SHM data of a real ship. The results indicate that, compared with the other comparison models selected in this paper, ECG-based models have significant higher forecasting accuracy (with MAPE values of 10.86% and 12.69% in two experiments, respectively, and with significant accuracy improvement of at least 10% than other compared models), and the QBOA has obtained more appropriate hyper-parameters combination of ECG model. © 2021, The Author(s), under exclusive licence to Springer Nature B.V.

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Fundamentals

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ABSTRACT: Machine Learning under Resource Constraints addresses novel machine learning algorithms that are challenged by high-throughput data, by high dimensions, or by complex structures of the data in three volumes. Resource constraints are given by the relation between the demands for processing the data and the capacity of the computing machinery. The resources are runtime, memory, communication, and energy. Hence, modern computer architectures play a significant role. Novel machine learning algorithms are optimized with regard to minimal resource consumption. Moreover, learned predictions are executed on diverse architectures to save resources. It provides a comprehensive overview of the novel approaches to machine learning research that consider resource constraints, as well as the application of the described methods in various domains of science and engineering. Volume 1 establishes the foundations of this new field. It goes through all the steps from data collection, their summary and clustering, to the different aspects of resource-aware learning, i.e., hardware, memory, energy, and communication awareness. Several machine learning methods are inspected with respect to their resource requirements and how to enhance their scalability on diverse computing architectures ranging from embedded systems to large computing clusters. Ranges from embedded systems to large computing clusters. Provides application of the methods in various domains of science and engineering. © 2023 Katharina Morik and Peter Marwedel. All rights reserved.

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Hybrid Onion Layered System for the Analysis of Collective Subjectivity in Social Networks

(2022)

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ABSTRACT: This research aims to analyze the Digital Social Networks (DSN) behavior, constructed from the network's relationships, interactions, and expressions of users' private states through collective subjectivity. For this purpose, an onion-ring system called COSSOL has been built in a case study for Twitter, following a hybrid approach to integrate Machine Learning classifiers and structural metrics from Computational Linguistics and Computational Sociology disciplines, respectively. The paper designs two experimentation scenarios divided into cases of collective subjectivity analysis for Colombia under different levels of communities' granularity. The first case validates the system by performing a cointegration test on the metrics of each construct for the onion rings' communities. The results show that some communities better propagate their subjective expressions against the disclosed topic when they have a higher network density and a common polarity. Moreover, the most stable communities in polarity towards a topic are those whose members are highly connected. Conversely, communities with a higher centrality index in a subset of members do not exhibit stability in collective subjectivity towards a topic disclosed in that community. The second case validates the model with a series of Social Network Analysis (SNA) metrics with a polarity layer to describe the second onion ring subcommunities and their temporal variation through community recalculation. The results show no polar distributions similar to the bimodal ones representing consensus in the values of the common Thinking Acting and Feeling (TAF) forms. In addition, general negative sentiment is identified for the ten most representative nodes of the subcommunities analyzed. © 2013 IEEE.

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An enhanced Cauchy mutation grasshopper optimization with trigonometric substitution: engineering design and feature selection

(2022)

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ABSTRACT: Selecting a subset of important features from a high-dimensional dataset is an important prerequisite for data mining. Meta-heuristic algorithms have gained attention in this field in recent years. The grasshopper optimization algorithm (GOA) is a meta-heuristic algorithm recently proposed based on the migration and hunting of grasshoppers in nature. However, the method suffers from a low diversity of the agents, which results in the stagnation problems, or immature convergence. To make GOA more competent in various situations, this paper stabilizes an improved GOA with new exploratory and exploitative features, which we have called it the SCGOA. The mechanism and structure of the proposed SCGOA are mainly divided into two steps: First, to balance the exploration and exploitation stages, trigonometric substitution is utilized for perturbation of the updating (evolution) of the position vectors of the individuals. Secondly, the diversity of the population is boosted using can Cauchy mutation-based strategy, which can help the grasshopper population to avoid the stagnation and lazy convergence. Therefore, Cauchy mutation is introduced to assist in an adequate variety of the position of the grasshopper population. Performance of SCGOA was validated on the latest IEEE CEC2017 benchmark functions in comparison with several well-known meta-heuristic algorithms. Various extensive results reveal that the proposed SCGOA has achieved a significant advantage over the other rivals. Finally, the Cauchy mutation-based SCGOA was also used for tackling four engineering design problems, and the results showed that SCGOA was superior to some state-of-the-art algorithms. We also developed the binary version of Cauchy mutation-based SCGOA in dealing with many feature selection datasets. The results on feature selection reveal that the binary version can outperform original GOA and other optimization algorithms, with higher classification accuracy, smaller error rate, and less number of features. We think the proposed optimizer can be widely tool for solving forms of the optimization problems. The research will be supported by open access materials and web service for any user guide at https://aliasghaheidari.com. © 2021, The Author(s), under exclusive licence to Springer-Verlag London Ltd., part of Springer Nature.

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Artificial Intelligence and Quantum Computing for Advanced Wireless Networks

(2022)

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ABSTRACT: ARTIFICIAL INTELLIGENCE AND QUANTUM COMPUTING FOR ADVANCED WIRELESS NETWORKS: A comprehensive presentation of the implementation of artificial intelligence and quantum computing technology in large-scale communication networks Increasingly dense and flexible wireless networks require the use of artificial intelligence (AI) for planning network deployment, optimization, and dynamic control. Machine learning algorithms are now often used to predict traffic and network state in order to reserve resources for smooth communication with high reliability and low latency. In Artificial Intelligence and Quantum Computing for Advanced Wireless Networks, the authors deliver a practical and timely review of AI-based learning algorithms, with several case studies in both Python and R. The book discusses the game-theory-based learning algorithms used in decision making, along with various specific applications in wireless networks, like channel, network state, and traffic prediction. Additional chapters include Fundamentals of ML, Artificial Neural Networks (NN), Explainable and Graph NN, Learning Equilibria and Games, AI Algorithms in Networks, Fundamentals of Quantum Communications, Quantum Channel, Information Theory and Error Correction, Quantum Optimization Theory, and Quantum Internet, to name a few. The authors offer readers an intuitive and accessible path from basic topics on machine learning through advanced concepts and techniques in quantum networks. Readers will benefit from: A thorough introduction to the fundamentals of machine learning algorithms, including linear and logistic regression, decision trees, random forests, bagging, boosting, and support vector machines An exploration of artificial neural networks, including multilayer neural networks, training and backpropagation, FIR architecture spatial-temporal representations, quantum ML, quantum information theory, fundamentals of quantum internet, and more Discussions of explainable neural networks and XAI Examinations of graph neural networks, including learning algorithms and linear and nonlinear GNNs in both classical and quantum computing technology Perfect for network engineers, researchers, and graduate and masters students in computer science and electrical engineering, Artificial Intelligence and Quantum Computing for Advanced Wireless Networks is also an indispensable resource for IT support staff, along with policymakers and regulators who work in technology. © 2022 John Wiley & Sons Ltd. All rights reserved.

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DravidianCodeMix: sentiment analysis and offensive language identification dataset for Dravidian languages in code-mixed text

(2022)

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ABSTRACT: This paper describes the development of a multilingual, manually annotated dataset for three under-resourced Dravidian languages generated from social media comments. The dataset was annotated for sentiment analysis and offensive language identification for a total of more than 60,000 YouTube comments. The dataset consists of around 44,000 comments in Tamil-English, around 7000 comments in Kannada-English, and around 20,000 comments in Malayalam-English. The data was manually annotated by volunteer annotators and has a high inter-annotator agreement in Krippendorff’s alpha. The dataset contains all types of code-mixing phenomena since it comprises user-generated content from a multilingual country. We also present baseline experiments to establish benchmarks on the dataset using machine learning and deep learning methods. The dataset is available on Github and Zenodo. © 2022, The Author(s).

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Meta-heuristic optimization algorithms for solving real-world mechanical engineering design problems: a comprehensive survey, applications, comparative analysis, and results

(2022)

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ABSTRACT: Real-world engineering design problems are widespread in various research disciplines in both industry and industry. Many optimization algorithms have been employed to address these kinds of problems. However, the algorithm’s performance substantially reduces with the increase in the scale and difficulty of problems. Various versions of the optimization methods have been proposed to address the engineering design problems in the literature efficiently. In this paper, a comprehensive review of the meta-heuristic optimization methods that have been used to solve engineering design problems is proposed. We use six main keywords in collecting the data (meta-heuristic, optimization, algorithm, engineering, design, and problems). It is worth mentioning that there is no survey or comparative analysis paper on this topic available in the literature to the best of our knowledge. The state-of-the-art methods are presented in detail over several categories, including basic, modified, and hybrid methods. Moreover, we present the results of the state-of-the-art methods in this domain to figure out which version of optimization methods performs better in solving the problems studied. Finally, we provide remarkable future research directions for the potential methods. This work covers the main important topics in the engineering and artificial intelligence domain. It presents a large number of published works in the literature related to the meta-heuristic optimization methods in solving various engineering design problems. Future researches can depend on this review to explore the literature on meta-heuristic optimization methods and engineering design problems. © 2022, The Author(s), under exclusive licence to Springer-Verlag London Ltd., part of Springer Nature.

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Hybrid Onion Layered System for the Analysis of Collective Subjectivity in Social Networks

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ABSTRACT: This research aims to analyze the Digital Social Networks (DSN) behavior, constructed from the network's relationships, interactions, and expressions of users' private states through collective subjectivity. For this purpose, an onion-ring system called COSSOL has been built in a case study for Twitter, following a hybrid approach to integrate Machine Learning classifiers and structural metrics from Computational Linguistics and Computational Sociology disciplines, respectively. The paper designs two experimentation scenarios divided into cases of collective subjectivity analysis for Colombia under different levels of communities' granularity. The first case validates the system by performing a cointegration test on the metrics of each construct for the onion rings' communities. The results show that some communities better propagate their subjective expressions against the disclosed topic when they have a higher network density and a common polarity. Moreover, the most stable communities in polarity towards a topic are those whose members are highly connected. Conversely, communities with a higher centrality index in a subset of members do not exhibit stability in collective subjectivity towards a topic disclosed in that community. The second case validates the model with a series of Social Network Analysis (SNA) metrics with a polarity layer to describe the second onion ring subcommunities and their temporal variation through community recalculation. The results show no polar distributions similar to the bimodal ones representing consensus in the values of the common Thinking Acting and Feeling (TAF) forms. In addition, general negative sentiment is identified for the ten most representative nodes of the subcommunities analyzed. © 2013 IEEE.

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Magnetic Force Classifier: A Novel Method for Big Data Classification

(2022)

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ABSTRACT: There are a plethora of invented classifiers in Machine learning literature, however, there is no optimal classifier in terms of accuracy and time taken to build the trained model, especially with the tremendous development and growth of Big data. Hence, there is still room for improvement. In this paper, we propose a new classification method that is based on the well-known magnetic force. Based on the number of points belonging to a specific class/magnet, the proposed magnetic force (MF) classifier calculates the magnetic force at each discrete point in the feature space. Unknown examples are classified using the magnetic forces recorded in the trained model by various magnets/classes. When compared to existing classifiers, the proposed MF classifier achieves comparable classification accuracy, according to the experimental results utilizing 28 different datasets. More importantly, we found that the proposed MF classifier is significantly faster than all other classifiers tested, particularly when applied to Big datasets and hence could be a viable option for structured Big data classification with some optimization. © 2013 IEEE.

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Enhancing sentiment analysis using Roulette wheel selection based cuckoo search clustering method

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ABSTRACT: Sentiment analysis is a type of contextual text mining that assesses how users feel about emotive topics that are frequently discussed on social media. To analyze the sentiments of the textual data, a number of sentiment analysis methods such as lexicon-based, machine learning-based, and hybrid methods have been proposed. Among all methods, unsupervised methods, especially clustering methods are generally preferred, as they can directly be applied over the unlabelled datasets. Therefore, in this paper, a roulette wheel-based cuckoo search clustering method has been proposed for sentiment analysis. The proposed clustering method finds the optimal cluster centroids from the contents of sentimental datasets which are further used for determining the sentiment polarity of a document. The efficiency of the proposed roulette wheel cuckoo search clustering method has been evaluated on nine sentimental datasets including Twitter and Spam review datasets and compared with K-means, cuckoo search, grey wolf optimizer, grey wolf optimizer with simulated annealing, hybrid step size based cuckoo search, and spiral cuckoo search. The experimental analysis shows that the proposed methods attain the best mean accuracy, mean precision, and mean recall over 80% of the datasets. To statistically validate the efficacy of the proposed approach, box plots and paired t-test are also carried out. From the statistical analysis and experimental findings, the efficacy of the proposed method can be observed. The proposed clustering approach has theoretical implications for further studies to examine the sentimental data. Furthermore, the proposed method has significant practical implications for establishing a system that can generate conclusive comments on any societal issue. © 2021, The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature.

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Artificial Intelligence and Quantum Computing for Advanced Wireless Networks

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ABSTRACT: ARTIFICIAL INTELLIGENCE AND QUANTUM COMPUTING FOR ADVANCED WIRELESS NETWORKS: A comprehensive presentation of the implementation of artificial intelligence and quantum computing technology in large-scale communication networks Increasingly dense and flexible wireless networks require the use of artificial intelligence (AI) for planning network deployment, optimization, and dynamic control. Machine learning algorithms are now often used to predict traffic and network state in order to reserve resources for smooth communication with high reliability and low latency. In Artificial Intelligence and Quantum Computing for Advanced Wireless Networks, the authors deliver a practical and timely review of AI-based learning algorithms, with several case studies in both Python and R. The book discusses the game-theory-based learning algorithms used in decision making, along with various specific applications in wireless networks, like channel, network state, and traffic prediction. Additional chapters include Fundamentals of ML, Artificial Neural Networks (NN), Explainable and Graph NN, Learning Equilibria and Games, AI Algorithms in Networks, Fundamentals of Quantum Communications, Quantum Channel, Information Theory and Error Correction, Quantum Optimization Theory, and Quantum Internet, to name a few. The authors offer readers an intuitive and accessible path from basic topics on machine learning through advanced concepts and techniques in quantum networks. Readers will benefit from: A thorough introduction to the fundamentals of machine learning algorithms, including linear and logistic regression, decision trees, random forests, bagging, boosting, and support vector machines An exploration of artificial neural networks, including multilayer neural networks, training and backpropagation, FIR architecture spatial-temporal representations, quantum ML, quantum information theory, fundamentals of quantum internet, and more Discussions of explainable neural networks and XAI Examinations of graph neural networks, including learning algorithms and linear and nonlinear GNNs in both classical and quantum computing technology Perfect for network engineers, researchers, and graduate and masters students in computer science and electrical engineering, Artificial Intelligence and Quantum Computing for Advanced Wireless Networks is also an indispensable resource for IT support staff, along with policymakers and regulators who work in technology. © 2022 John Wiley & Sons Ltd. All rights reserved.

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Indicators and Measures for Measuring the Level of Information Intelligence

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ABSTRACT: The concept of information intelligence encompasses various aspects such as information and communication skills, information literacy, information behavior, individual and collective creativity, intelligence, and cognitive-perceptual issues. Measuring information intelligence is very important in information societies. Addressing the effective indicators in this issue is one of the determining issues in the use of information and data in information societies. The present study aimed to identify indicators and measures effective in measuring information intelligence. The research is applied and uses a qualitative method including library studies, content analysis, and analysis of expert opinions. Data collection tools included the study of scientific literature related to the subject, content-coding, and interviews with experts familiar with the subject of information intelligence (8 experts in knowledge and information science and 7 experts in psychology). The research population included related published literature related to scientific theories, information science experts, and psychology experts. In the subject of intelligence, Gardner’s multiple intelligence theory has been used, and in the subject of information-seeking behavior various scientific theories have been used. Based on the research findings, 14 indicators and 97 measures were identified as effective for measuring information intelligence in two dimensions management and information retrieval. Finally, a proposed framework is presented for measuring information intelligence. From the findings, it was concluded that in the information society, policymakers and managers of the organization or responsible organizations in relation to increasing the level of information intelligence of the society should consider the specific strategies of the information intelligence of the society in formulating their general strategies. One of these strategic goals can be increasing the level of information intelligence of individuals, organizations, and society. To do this, effective indicators must be identified for measuring and strategies to increase the level of information intelligence of the target community. It is suggested that this matter is placed in the priorities of the information society and the native measurement tool of information intelligence can be prepared based on the findings of this research. © 2022 Iranian Research Institute for Scientific Information and Documentation. All rights reserved.

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(MF)2LS: Memetic framework with memory based fuzzy local search

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ABSTRACT: The Memetic algorithm (MA) breaks down complex optimization problems into smaller sub-parts called memes and operates on them to find optimal solutions. MA uses local search to increase its exploitation capabilities, which makes it a high-performing universal heuristic. This inspires us to work on MA and we attempt to improve the local search ability of the MA which is its core part. Here we propose a new memory-based fuzzy local search method in association with MA with dynamic mutation and a problem specific guided population initialization. This framework is used to solve feature selection and class imbalance problems. Feature selection is a technique used to find the most important subset of features from a high-dimensional dataset to reduce space and computational needs. The class imbalance problem deals with highly imbalanced datasets where the goal is to identify the optimal number of the majority class samples. Otherwise, the classifier becomes biased towards the majority class due to the presence of a huge number of samples and ignores the minority class which might hold the important data. We have named our framework as Memetic Framework with Memory based Fuzzy Local Search ((MF)2LS). It has been applied on standard datasets for the respective domains and compared with state-of-the-art methods. For feature selection and class imbalance problems, the proposed method proves to be superior to the state-of-the-art methods. This shows that a good initialization strategy, local search and dynamic mutation contribute significantly to the model's effectiveness. The source code for this method is available on Github. © 2022

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Synthesis Lectures on Human Language Technologies

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ABSTRACT: This book discusses the state of the art of automated essay scoring, its challenges and its potential. One of the earliest applications of artificial intelligence to language data (along with machine translation and speech recognition), automated essay scoring has evolved to become both a revenue-generating industry and a vast field of research, with many subfields and connections to other NLP tasks. In this book, we review the developments in this field against the backdrop of Elias Page's seminal 1966 paper titled "The Imminence of Grading Essays by Computer."Part 1 establishes what automated essay scoring is about, why it exists, where the technology stands, and what are some of the main issues. In Part 2, the book presents guided exercises to illustrate how one would go about building and evaluating a simple automated scoring system, while Part 3 offers readers a survey of the literature on different types of scoring models, the aspects of essay quality studied in prior research, and the implementation and evaluation of a scoring engine. Part 4 offers a broader view of the field inclusive of some neighboring areas, and Part \ref{part5} closes with summary and discussion.This book grew out of a week-long course on automated evaluation of language production at the North American Summer School for Logic, Language, and Information (NASSLLI), attended by advanced undergraduates and early-stage graduate students from a variety of disciplines. Teachers of natural language processing, in particular, will find that the book offers a useful foundation for a supplemental module on automated scoring. Professionals and students in linguistics, applied linguistics, educational technology, and other related disciplines will also find the material here useful. © 2021 by Morgan & Claypool.

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An enhanced Cauchy mutation grasshopper optimization with trigonometric substitution: engineering design and feature selection

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ABSTRACT: Selecting a subset of important features from a high-dimensional dataset is an important prerequisite for data mining. Meta-heuristic algorithms have gained attention in this field in recent years. The grasshopper optimization algorithm (GOA) is a meta-heuristic algorithm recently proposed based on the migration and hunting of grasshoppers in nature. However, the method suffers from a low diversity of the agents, which results in the stagnation problems, or immature convergence. To make GOA more competent in various situations, this paper stabilizes an improved GOA with new exploratory and exploitative features, which we have called it the SCGOA. The mechanism and structure of the proposed SCGOA are mainly divided into two steps: First, to balance the exploration and exploitation stages, trigonometric substitution is utilized for perturbation of the updating (evolution) of the position vectors of the individuals. Secondly, the diversity of the population is boosted using can Cauchy mutation-based strategy, which can help the grasshopper population to avoid the stagnation and lazy convergence. Therefore, Cauchy mutation is introduced to assist in an adequate variety of the position of the grasshopper population. Performance of SCGOA was validated on the latest IEEE CEC2017 benchmark functions in comparison with several well-known meta-heuristic algorithms. Various extensive results reveal that the proposed SCGOA has achieved a significant advantage over the other rivals. Finally, the Cauchy mutation-based SCGOA was also used for tackling four engineering design problems, and the results showed that SCGOA was superior to some state-of-the-art algorithms. We also developed the binary version of Cauchy mutation-based SCGOA in dealing with many feature selection datasets. The results on feature selection reveal that the binary version can outperform original GOA and other optimization algorithms, with higher classification accuracy, smaller error rate, and less number of features. We think the proposed optimizer can be widely tool for solving forms of the optimization problems. The research will be supported by open access materials and web service for any user guide at https://aliasghaheidari.com. © 2021, The Author(s), under exclusive licence to Springer-Verlag London Ltd., part of Springer Nature.

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# 2021

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Handbook of research on machine learning techniques for pattern recognition and information security

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ABSTRACT: The artificial intelligence subset machine learning has become a popular technique in professional fields as many are finding new ways to apply this trending technology into their everyday practices. Two fields that have majorly benefited from this are pattern recognition and information security. The ability of these intelligent algorithms to learn complex patterns from data and attain new performance techniques has created a wide variety of uses and applications within the data security industry. There is a need for research on the specific uses machine learning methods have within these fields, along with future perspectives. The Handbook of Research on Machine Learning Techniques for Pattern Recognition and Information Security is a collection of innovative research on the current impact of machine learning methods within data security as well as its various applications and newfound challenges. While highlighting topics including anomaly detection systems, biometrics, and intrusion management, this book is ideally designed for industrial experts, researchers, IT professionals, network developers, policymakers, computer scientists, educators, and students seeking current research on implementing machine learning tactics to enhance the performance of information security. © 2021 by IGI Global. All rights reserved.

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An Introduction to Learning Automata and Optimization

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ABSTRACT: Learning automaton (LA) is one of the reinforcement learning techniques in artificial intelligence. Learning automata’s learning ability in unknown environments is a useful technique for modeling, controlling, and solving many real problems in the distributed and decentralized environments. In this chapter, first, we provide an overview of LA concepts and recent variants of LA models. Then, we present a brief description of the recent reinforcement learning mechanisms for solving optimization problems. Finally, the evolution of the recent LA models for optimization is presented. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

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Handbook of research on applied data science and artificial intelligence in business and industry

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ABSTRACT: The contemporary world lives on the data produced at an unprecedented speed through social networks and the internet of things (IoT). Data has been called the new global currency, and its rise is transforming entire industries, providing a wealth of opportunities. Applied data science research is necessary to derive useful information from big data for the effective and efficient utilization to solve real-world problems. A broad analytical set allied with strong business logic is fundamental in today's corporations. Organizations work to obtain competitive advantage by analyzing the data produced within and outside their organizational limits to support their decision-making processes. This book aims to provide an overview of the concepts, tools, and techniques behind the fields of data science and artificial intelligence (AI) applied to business and industries. The Handbook of Research on Applied Data Science and Artificial Intelligence in Business and Industry discusses all stages of data science to AI and their application to real problems across industries-from science and engineering to academia and commerce. This book brings together practice and science to build successful data solutions, showing how to uncover hidden patterns and leverage them to improve all aspects of business performance by making sense of data from both web and offline environments. Covering topics including applied AI, consumer behavior analytics, and machine learning, this text is essential for data scientists, IT specialists, managers, executives, software and computer engineers, researchers, practitioners, academicians, and students. © 2021 by IGI Global. All rights reserved.

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A new random forest algorithm based on learning automata

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ABSTRACT: The goal of aggregating the base classifiers is to achieve an aggregated classifier that has a higher resolution than individual classifiers. Random forest is one of the types of ensemble learning methods that have been considered more than other ensemble learning methods due to its simple structure, ease of understanding, as well as higher efficiency than similar methods. The ability and efficiency of classical methods are always influenced by the data. The capabilities of independence from the data domain, and the ability to adapt to problem space conditions, are the most challenging issues about the different types of classifiers. In this paper, a method based on learning automata is presented, through which the adaptive capabilities of the problem space, as well as the independence of the data domain, are added to the random forest to increase its efficiency. Using the idea of reinforcement learning in the random forest has made it possible to address issues with data that have a dynamic behaviour. Dynamic behaviour refers to the variability in the behaviour of a data sample in different domains. Therefore, to evaluate the proposed method, and to create an environment with dynamic behaviour, different domains of data have been considered. In the proposed method, the idea is added to the random forest using learning automata. The reason for this choice is the simple structure of the learning automata and the compatibility of the learning automata with the problem space. The evaluation results confirm the improvement of random forest efficiency. Copyright © 2021 Mohammad Savargiv et al.

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An Improved Binary Grey-Wolf Optimizer with Simulated Annealing for Feature Selection

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ABSTRACT: This paper proposes improvements to the binary grey-wolf optimizer (BGWO) to solve the feature selection (FS) problem associated with high data dimensionality, irrelevant, noisy, and redundant data that will then allow machine learning algorithms to attain better classification/clustering accuracy in less training time. We propose three variants of BGWO in addition to the standard variant, applying different transfer functions to tackle the FS problem. Because BGWO generates continuous values and FS needs discrete values, a number of V-shaped, S-shaped, and U-shaped transfer functions were investigated for incorporation with BGWO to convert their continuous values to binary. After investigation, we note that the performance of BGWO is affected by the selection of the transfer function. Then, in the first variant, we look to reduce the local minima problem by integrating an exploration capability to update the position of the grey wolf randomly within the search space with a certain probability; this variant was abbreviated as IBGWO. Consequently, a novel mutation strategy is proposed to select a number of the worst grey wolves in the population which are updated toward the best solution and randomly within the search space based on a certain probability to determine if the update is either toward the best or randomly. The number of the worst grey wolf selected by this strategy is linearly increased with the iteration. Finally, this strategy is combined with IBGWO to produce the second variant of BGWO that was abbreviated as LIBGWO. In the last variant, simulated annealing (SA) was integrated with LIBGWO to search around the best-so-far solution at the end of each iteration in order to identify better solutions. The performance of the proposed variants was validated on 32 datasets taken from the UCI repository and compared with six wrapper feature selection methods. The experiments show the superiority of the proposed improved variants in producing better classification accuracy than the other selected wrapper feature selection algorithms. © 2013 IEEE.

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An Introduction to Learning Automata and Optimization

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ABSTRACT: Learning automaton (LA) is one of the reinforcement learning techniques in artificial intelligence. Learning automata’s learning ability in unknown environments is a useful technique for modeling, controlling, and solving many real problems in the distributed and decentralized environments. In this chapter, first, we provide an overview of LA concepts and recent variants of LA models. Then, we present a brief description of the recent reinforcement learning mechanisms for solving optimization problems. Finally, the evolution of the recent LA models for optimization is presented. © 2021, The Author(s), under exclusive license to Springer Nature Switzerland AG.

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Advances in meta-heuristic optimization algorithms in big data text clustering

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ABSTRACT: This paper presents a comprehensive survey of the meta-heuristic optimization algorithms on the text clustering applications and highlights its main procedures. These Artificial Intelligence (AI) algorithms are recognized as promising swarm intelligence methods due to their successful ability to solve machine learning problems, especially text clustering problems. This paper reviews all of the relevant literature on meta-heuristic-based text clustering applications, including many variants, such as basic, modified, hybridized, and multi-objective methods. As well, the main procedures of text clustering and critical discussions are given. Hence, this review reports its advantages and disadvantages and recommends potential future research paths. The main keywords that have been considered in this paper are text, clustering, meta-heuristic, optimization, and algorithm. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

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ABSTRACT: The artificial intelligence subset machine learning has become a popular technique in professional fields as many are finding new ways to apply this trending technology into their everyday practices. Two fields that have majorly benefited from this are pattern recognition and information security. The ability of these intelligent algorithms to learn complex patterns from data and attain new performance techniques has created a wide variety of uses and applications within the data security industry. There is a need for research on the specific uses machine learning methods have within these fields, along with future perspectives. The Handbook of Research on Machine Learning Techniques for Pattern Recognition and Information Security is a collection of innovative research on the current impact of machine learning methods within data security as well as its various applications and newfound challenges. While highlighting topics including anomaly detection systems, biometrics, and intrusion management, this book is ideally designed for industrial experts, researchers, IT professionals, network developers, policymakers, computer scientists, educators, and students seeking current research on implementing machine learning tactics to enhance the performance of information security. © 2021 by IGI Global. All rights reserved.

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