هشتم و نهم دی ماه، ۱۴۰۰

دانشگاه علم و صنعت ایران

ICSPIS 2021

هفتمین کنفرانس بین‌المللی پردازش سیگنال و سیستم‌های هوشمند ایران

دانشگاه علم و صنعت ایران

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وزارت ارتباطات و فناوری اطلاعات

همراه اول

مرکز تحقیقات هوش مصنوعی پارت

ابر ایران سرور

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- پردازش سیگنال
- پردازش صوت و گفتار

شاخه ۲)

- پردازش تصویر و ویدیو
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شاخه ۳)

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بسم الله الرحمن الرحيم

چکیده نامه مقالات

هفتمین کنفرانس بین‌المللی پردازش سیگنال و سیستم‌های هوشمند ایران

۸ و ۹ دی ماه سال ۱۴۰۰

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دانشگاه صنعتی شاهرود


ابر ایران سرور


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هوش مصنوعی پارت
هوشمندسازی فرایندهای زندگی


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پردازش تصویر ایران

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رییس کمیته ارتباط با صنعت

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دبیر کمیته ارتباط با صنعت

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منشی

دانشگاه علم و صنعت ایران

محورهای کنفرانس

- پردازش سیگنال
- پردازش صوت و گفتار
- پردازش تصویر و ویدیو
- بینایی ماشین
- سنجش از دور
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- اینترنت اشیا

پیام رئیس کنفرانس

بسمه تعالی

با استعانت از درگاه خدای متعال، دانشگاه علم و صنعت ایران مفتخر است هفتمین کنفرانس بین‌المللی پردازش سیگنال و سیستم‌های هوشمند ایران را با همکاری دبیرخانه دائمی کنفرانس در تاریخ ۸ و ۹ دی ماه ۱۴۰۰ برگزار نماید. این کنفرانس با هدف گسترش دانش فنی از طریق ایجاد محیطی جهت تبادل نظر علمی و فنی، ارائه آخرین یافته‌های پژوهشی و همچنین تشویق مشارکت محققان برنامه‌ریزی شده است. این کنفرانس زمینه‌ای برای هم‌فکری و تبادل دانش بیشتر بین محققین و پژوهشگران علمی و فنی در موضوع پردازش سیگنال و سیستم‌های هوشمند ایجاد می‌کند.

دکتر بهروز مینایی بیدگلی
رئیس کنفرانس بین‌المللی پردازش سیگنال و سیستم‌های هوشمند ایران

سخنرانان کلیدی:

دکتر حمید سلطانیان‌زاده

دانشگاه تهران و پژوهشگاه دانش‌های بنیادی، تهران، ایران و سیستم سلامت هنری فورد، دیترویت، میشیگان، ایالات متحده آمریکا.

(موضوع ارائه: آنالیز تصاویر پزشکی با استفاده از شبکه‌های عصبی عمیق)

Abstract

Medical images play key roles in diagnosis, treatment planning, treatment evaluation, and prognosis of various diseases. While qualitative analysis of medical images by clinical experts is essential, their quantitative analysis greatly aids physicians and makes significant contributions to the diagnosis, treatment planning, treatment evaluation, and prognosis. Such quantitative analysis requires various image processing and pattern recognition algorithms for noise suppression, image restoration and enhancement, organ or structure segmentation, and tissue characterization and quantification. With the advancement of deep neural networks, many of these tasks can nowadays be done by such networks. However, the design and application of these networks are challenging. In this presentation, I will introduce deep neural networks that have been developed in recent years for addressing some of the medical image analysis problems. I will also describe a major challenge in the development of such networks and our approach to solve it. I will conclude my presentation with a summary of the achievements and the remaining problems in this exciting and impactful field.

Bio

University of Tehran and Institute for Research in Fundamental Sciences (IPM), Tehran, Iran, and Henry Ford Health System, Detroit, Michigan, USA

دکتر محمدحسین یغمایی مقدم

دانشگاه فردوسی مشهد، مشهد، ایران و دانشگاه تورنتو کانادا.

(موضوع ارائه: چگونه محاسبات ابری/ مه برنامه‌های پاسخگویی بار را بهبود می‌بخشد)

Abstract

With an increase in the utilization of appliances, meeting the energy demand of consumers by traditional power grids is an important issue. Demand Response programs have been introduced to provide balance between supply and demand. The success of demand response programs depend conclusively on real-time data communication between the consumers and the suppliers. Hence, a scalable and programmable communication network is required to handle the data generated. Due to the recent advances in Information and Communication Technology (ICT), the telecommunication industry trends have been changed. Software Defined Networking (SDN), Cloud Computing and Network Function Virtualization (NFV) are some new developments which provide huge evolution in the telecommunication industry. In this talk, the impact of cloud/fog computing on improving demand response performance is investigated.

Bio

Ferdowsi University of Mashhad, Mashhad, Iran, and University of Toronto, Canada.

دکتر حمید حسن‌پور

دانشگاه صنعتی شاهرود، شاهرود، ایران

(موضوع ارائه: سیستم‌های هوشمند و نظارت بر آزمون‌های آنلاین)

Abstract

Online exams are a necessity for today’s society, but surveillance problems impair the accuracy of this type of examination. By using intelligent systems, it is possible to closely monitor online exams and reduce the cost of holding exams without the need for a human supervisor. Two types of cheating may occur in exams: faking one’s identity and assigning the exam to a third party, or obtaining answers through unauthorized sources. Despite the accuracy that proctors have in face-to-face exams on the identity and behavior of examinees, significant cases of cheating are usually reported in this type of examination. The identity of the examinees can be recognized at the beginning and during the exam by using an intelligent monitoring system. Face recognition methods can be used to verify the identity of the examinee. In addition, just as handwriting is one of the methods of authentication, how people type can also be used as a biometric method to identify people. There are several ways to use features related to how people type for identification. Exam proctors can detect fraud by carefully monitoring the behavior of examinees. Fraud may be overt or covert. When the examinee uses a person or device such as a mobile phone during the exam, he or she is usually identified by the proctor. With advances in machine vision technology, this type of fraud can be easily detected by intelligent systems. In covert fraud, the means of fraud are hidden from the proctors' point of view, or fraud is generally done without special means. During covert cheating, the examinee exhibits unusual behavior, such as not paying attention to the exam questions. In this presentation, the detection of scenes suspected of hidden fraud in electronic tests through the behavioral analysis of the examinee is considered. This can be considered as an issue of video anomaly detection. Given that human behavior is manifested by the posture and movements of the body, they play a key role in identifying fraudulent behavior. Therefore, recognizing the state of the body, e.g. emotional states such as stress, as well as recognizing human activities are the main research fields related to this subject. In this keynote talk, while providing solutions for identifying different types of online exam fraud, various research aspects are discussed and an intelligent system is proposed for video surveillance.

Bio

Shahrood University of Technology, Shahrood, Iran.

دکتر حسین صامتی

دانشگاه صنعتی شریف، تهران، ایران.

(Language, Computing, and AI :Title)

Abstract

Text and speech processing are important subjects in AI and DSP. We start with languages and their characteristics, and go forward to look deep into the concept of computing discipline, its differences with physical sciences, and its unique role in creating intelligence and AI. AI is more explored, its progresses, obstacles, and misunderstandings are surveyed. The new challenges and opportunities in AI and NLP research are also discussed.

Bio

Sharif University of Technology, Tehran, Iran.

برنامه زمانبندی(کارگاههای آموزشی)

هفتمین کنفرانس بین‌المللی پردازش سیگنال و سیستم‌های هوشمند

ردیف	عنوان کارگاه	ارائه‌دهنده	زمان برگزاری	محل برگزاری
۱	پردازش ویدیو در لبه	دکتر محمدحسین قائمی‌نیا	**پنجشنبه ۱۰ دی ۱۴۰۰، ساعت ۹:۰۰ – ۱۱:۰۰**	جلسه مجازی کارگاه A
۲	شبکه‌های تلفن‌همراه نسل جدید: چالش‌ها و فرصت‌ها	دکتر ابوالفضل دیانت	**جمعه ۱۱ دی ۱۴۰۰، ساعت ۸:۰۰ – ۱۲:۰۰**	جلسه مجازی کارگاه A
۳	تجزیه سیگنال و تصویر و کاربردهای آن: از تبدیل فوریه تا مدل‌های تنک و عمیق	دکتر ابوذر غفاری	**جمعه ۱۱ دی ۱۴۰۰، ساعت ۸:۰۰ – ۱۲:۰۰**	جلسه مجازی کارگاه B
۴	یادگیری عمیق برای بینایی کامپیوتر با استفاده از Keras	دکتر محمدرضا محمدی	**جمعه ۱۱ دی ۱۴۰۰، ساعت ۱۳:۰۰ – ۱۷:۰۰**	جلسه مجازی کارگاه A
۵	تئوری، ثبت و پردازش سیگنال‌های EEG، EMG و ECG فیزیولوژیکی با استفاده از ماژول‌های Open EOG BCI	دکتر علی فرزام‌نیا	**جمعه ۱۱ دی ۱۴۰۰، ساعت ۱۳:۰۰ – ۱۷:۰۰**	جلسه مجازی کارگاه B

برنامه کنفرانس

چهارشنبه ۸ دی‌ماه				
	ساعت	برنامه	محل برگزاری	جزییات
صبح	۹:۰۰ – ۱۰:۰۰	افتتاحیه	جلسه مجازی اصلی	
	۱۰:۱۵ – ۱۱:۱۵	سخنرانی کلیدی	جلسه مجازی اصلی	دکتر حمید سلطانیان‌زاده
	۱۱:۱۵ – ۱۲:۱۵	سخنرانی کلیدی	جلسه مجازی اصلی	دکتر حسین صامتی
ناهار و نماز				
عصر	۱۳:۳۰ – ۱۵:۳۰	ارائه مقالات	جلسه مجازی A	۱۹۷، ۸۹، ۱۶، ۲۰، ۱۴۰، ۲۰۷ (داده‌کاوی و محاسبات نرم) دکتر حسن نادری و دکتر محمدرضا کنگاوری
			جلسه مجازی B	۱۳۱، ۱۲۷، ۶، ۱۸، ۶۰، ۶۵ (شناسایی الگو) دکتر محمدرضا محمدی و دکتر احمد محمودی ازناوه
			جلسه مجازی C	۱۸۰، ۵۹، ۹۳، ۱۱۹، ۱۷۹، ۱۸۹ (پردازش سیگنال پزشکی) دکتر محمدرضا دلیری و دکتر وحید شالچیان
			جلسه مجازی D	۳۰، ۸۶، ۱۲۴، ۷۸، ۱۱۱، ۱۹۸ (شبکه‌های الکتریکی هوشمند و اینترنت اشیا) دکتر ناصر مزینی و دکتر احمد اکبری
			جلسه مجازی E	۷۶، ۲۱۰، ۱۳۸، ۷، ۳۱ (بینایی ماشین و پردازش ویدیو) دکتر مهدی ازوجی و دکتر عباس کوچاری
	۱۵:۳۰ – ۱۶:۳۰	سخنرانی کلیدی	جلسه مجازی اصلی	دکتر محمدحسین یغمایی مقدم

برنامه کنفرانس

پنجشنبه ۹ دی‌ماه				
صبح	۸:۰۰ – ۱۰:۰۰	ارائه مقالات	جلسه مجازی A	۸۸، ۹۷، ۲۱۱، ۱۲۵، ۱۵۶، ۱۸۵ (پردازش تصویر) دکتر مهدی جم‌پور و دکتر محمدجواد فدایی اسلام
			جلسه مجازی B	۲، ۱۶۳، ۱۸۷، ۲۱۲، ۲۰۶ (سیستم‌های هوشمند) دکتر کاظم فولادی و دکتر محمدرضا جاهدمطلق
			جلسه مجازی C	۱۲۳، ۱۴۲، ۱۷۷، ۲۶، ۱۹۱ (پردازش صوت و گفتار) دکتر بابک ناصرشریف و دکتر شیما طبیبیان
			جلسه مجازی D	۲۹، ۶۲، ۱۵۷، ۱۵۸، ۱۹۰ (سنجش از دور) دکتر پیمان کبیری و دکتر مریم ایمانی
			جلسه مجازی E	۱۰۹، ۱۵، ۱۷ (پردازش سیگنال پزشکی) دکتر ابوذر غفاری و دکتر رضا حسن‌زاده
	۱۰:۰۰ – ۱۱:۰۰	سخنرانی کلیدی	جلسه مجازی اصلی	دکتر محمدعلی اخایی
	۱۱:۰۰ – ۱۲:۰۰	نشست صنعتی (هوشمندسازی اپراتور موبایل)	جلسه مجازی اصلی	همراه اول (دبیر نشست: دکتر وحید پوراحمدی)
ناهار و نماز				
عصر	۱۳:۰۰ – ۱۴:۰۰	سخنرانی کلیدی	جلسه مجازی اصلی	دکتر حمید حسن‌پور
	۱۴:۰۰ – ۱۶:۳۰	ارائه مقالات	جلسه مجازی A	۳۶، ۱۱۴، ۱۱۶، ۱۴۶، ۱۶۸، ۱۷۳، ۱۷۸ (شبکه‌های کامپیوتری هوشمند) دکتر وصال حکمی و دکتر اکبر مصطفوی
			جلسه مجازی B	۴۷، ۶۸، ۷۷، ۱۳، ۳۳، ۴۳، ۱۹۴ (پردازش تصویر) دکتر مازیار پالهنگ و دکتر غلامرضا اکبری‌زاده

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			جلسه مجازی B	۱۹۴، ۴۳، ۳۳، ۱۳، ۷۷، ۶۸، ۴۷ (پردازش تصویر) دکتر مازیار پالهنگ و دکتر غلامرضا اکبری‌زاده
			جلسه مجازی C	۱۲۲، ۱۱۰، ۱۰۳، ۷۴، ۱۱، ۱۰۵، ۲۰۳ (پردازش سیگنال) دکتر حسین سیگاری و دکتر اسداله شاه‌بهرامی
			جلسه مجازی D	۱۰۰، ۷۹، ۷۵، ۷۳، ۶۷، ۶۶ (پردازش صوت و گفتار) دکتر احمد اکبری و دکتر محمدمهدی همایون‌پور
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fNIRS Signals Classification with Ensemble Learning and Adaptive Neuro-Fuzzy Inference System

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Abstract

Brain-Computer-Interface (BCIs) is designed to acquire brain signals and then control a system that functions between a physical device and the human brain. It is aimed at assisting patients with motor disabilities. In this study, Functional near-infrared spectroscopy (fNIRS) signal, a new brain imaging technique based on measuring brain hemodynamic response on the cortical surface used in various cognitive neuroscience and neuro-rehabilitation systems, has been used to classify ٣٠ subjects' unilateral multi-classes finger and foot-tapping in the three classes of left and right-hand movement and foot tapping. The objective is the classification of the multi-class fNIRS signals with multiple classification methods and comparing the obtained results. We have used the classification methods for each of the ٣٠ subjects, followed by the voting method and stacking method as an ensemble learning approach. The results given in the form of an average for all subjects reached ٦٤,٨±١٣٪ and with ensemble learning voting method reached ٦٦,٤±١٦٪, whereas that with the ensemble learning stacking method with ANFIS reached ٦٠,٦٦±١٦٪. Finally, these results show that, based on the selected Ensemble Learning method, we may have not only an improvement in the accuracy but also shows a decrease in the standard deviation, suggesting that the classification model leads to better results by decreasing the variance of the predictions

Keywords: Brain-Computer Interface, BCI, Ensemble learning, AdaBoost, fNIRS, support vector machine, KNN, naïve bayes, ANFIS, FCM

A CNN-BiLSTM Method for Earthquake Prediction

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Abstract

Earthquakes are a very catastrophic natural event that occurs due to sudden changes in the earth's crust, leading to human, financial, and environmental losses in society. Therefore, employing an efficient and dependable method for earthquake prediction can significantly reduce casualties. In this regard, we proposed a deep neural network called the hybrid convolutional neural network and bi-directional long-short-term memory (HC-BiLSTM) to predict the mean magnitude of the future earthquake in a specific area of Japan. To achieve this goal, we suggest a strategy based on four key steps: the division of areas, the preprocessing, the spatial and temporal feature learning, and the prediction. In the division of areas step, the part of Japan is divided into ٤٩ smaller areas to better predict the next earthquake's location. The preprocessing step uses the zero-order hold method in the time series of the mean magnitude of the earthquake. In the next step, the learning spatial and temporal characteristics between earthquake data include three layers of CNN and pooling and two layers of LSTM. Finally, the prediction step has two fully connected layers that combine information supplied by HC-BiLSTM to predict the mean magnitude for the earthquake next month. As a result, using a comparative method, this study demonstrates the superiority of the proposed method over other common earthquake prediction methods.

Keywords: Earthquake prediction, Convolution neural network, Bidirectional LSTM, Time series prediction, Deep neural network

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Hybrid Deep Learning Method Based on LSTM-Autoencoder Network for Household Short-term Load Forecasting

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Abstract

Energy prediction is an essential task in smart homes for demand-side management and energy consumption reduction. Therefore, an intelligent forecasting model is necessary for predicting demand-side energy in residential buildings. Recent studies have shown that deep learning networks have higher performance than traditional machine learning methods in short- term load forecasting. In this paper, a new hybrid network is proposed that consists of Auto-Encoder LSTM layer, Bi-LSTM layer, stack of LSTM layer, and finally Fully connected layer. The experiments are conducted on an individual household electric power consumption dataset and the results demonstrate that the proposed network has the smallest value in terms of root mean square error (RMSE), mean absolute error (MAE), and mean absolute percentage error (MAPE) in comparison with other state-of-the-art approaches.

Keywords: power consumption, load forecasting, deep learning, demand-side management, autoencoder

Wind Energy Potential Approximation with Various Metaheuristic Optimization Techniques Deployment

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Abstract

Wind energy modeling is a crucial task to evaluate the feasibility and effectiveness of the implementation of any site. Wind energy modeling principally depends on wind speed distribution. Determining wind speed distribution is fundamentally based on the used distribution functions. This paper presents a comprehensive study based on five different distributions to describe the wind speed pattern, namely, Rayleigh, Gamma, Extreme Value, Logistic, and T Location-Scale. In addition, three metaheuristics optimization methods, Grey Wolf Optimization, Marine Predators Algorithm, and Multi-Verse Optimizer, are utilized to select the optimal parameter values of each distribution. Five error measures are investigated and compared to test the accuracy of the presented distributions and optimization methods. To carry out this analysis, Catalca in Istanbul, Turkey, is selected as the case study. The obtained results confirm that all introduced distributions based on optimization methods are efficient to model wind speed distribution at the selected site. Rayleigh distribution achieved the best matching while Extreme Value distribution provided the worst matching. Finally, many valuable deductions drawn from this study are also discussed.

Keywords: Wind Energy Modeling, Statistical Distributions, Probability Distribution Function (PDF), Cumulative Distribution Function (CDF), Inverse CDF (ICDF), Grey Wolf Optimization (GWO), Marine Predators Algorithm (MPA), Multi-Verse Optimizer (MVO).

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Bone Fracture Detection and Localization on MURA Database Using Faster-RCNN

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Abstract

Using computer-aided diagnosis systems for helping radiologists and reducing the time of diagnosis is vital. In this paper, Faster-RCNN with three different backbone structures for feature extraction is applied for fracture zone prediction on bone X-rays of the MURA database. We used just three subsets of all seven subsets of the database. These subsets contain X-rays from the humerus, elbow, and forearm. The results of the experiments show that Faster-RCNN with Inception-ResNet-Version-۲ as the feature extractor has the best performance. AP of this model on test samples in the best condition of parameters setting reaches ٦٦,٨٢٪ for IOU=٥٠٪.

Keywords: Bone fracture diagnosis, Fracture location, X-ray images, Faster-RCNN model, MURA database

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Genre Classification of Movies from a Single Poster Image Using Feature Fusion

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Abstract

The movie industry is one of the largest and most influential sectors of any community. Each movie in the industry consists of different elements such as actors, directors, preparation elements, posters, etc. One of the most important elements in any movie is its poster, that plays an important role in attracting the audience. Various information can be obtained from the movie poster, including the movie genre. Today, the movie genre is recognized manually. In this paper, we aim to consider the automatic detection of movie genres based on its poster. Automatic detection of movie genres can have various applications in movie archive systems, search engines, recommender systems, and more. In the proposed method of this paper, four categories of embedding features including the objects in the poster, identifying the actors, age, and gender of the actors in the poster, and their facial expressions are used. Our proposed method is compared with some outstanding previous works over the IMDB dataset poster. By incorporating an ensemble classification approach in our work, the results of our proposed method could achieve the average predicting accuracy of ۹۲٪ which could outperform the previous works.

Keywords: Movie Posters, Movie Genre, Convolutional Neural Network, Word Embedding, Ensemble classification

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Web Content Extraction by Weighing the Fundamental Contextual Rules

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Abstract

Nowadays, data access, data sharing, data extraction and data usage have become a vital issue for technology experts. With the rapid growth of content on the Web, humans need new and up-to-date approaches for data extraction from the Web. However, there is much useless and unrelated information such as navigation panel, content table, propaganda, service catalogue, and menus in these pages. Thus, the web content is considered useful (original) and useless (secondary) content. Most receivers and final users search for useful content. This research presents a new approach to extract useful content from the Web. For this purpose, child nodes are selected as the original content by weighing the fundamental contextual rules method to DOM Tree's nodes. Overall, after standardizing web page and developing DOM Tree, the best child node of the parent node are selected according to a weighing algorithm; then, the best path and the best sample node are selected. The presented solution applied on several datasets shows high accuracy rate such as Precision, Recall and F factor are ۰,۹۹۲, ۰,۹۸۳ and ۰,۹۸۸, respectively.

Keywords: Data Mining, Text Mining, Data Extraction, Weighing, Structure Content Extraction.

Metaheuristic Optimization to Improve Machine Learning in Raman Spectroscopic-based Detection of Foodborne Pathogens

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Abstract

Accurate and reliable determination of foodborne pathogens (FBPs) is necessary for food safety. Spectroscopic methods such as FT-IR and Raman spectroscopy are among the label-free and sensitive methods for diagnosing FBPs. Although Raman spectroscopy equipped with confocal microscopy is developed for multiplex detection of FBPs, machine learning methods optimized by advanced optimization algorithms can be useful for the efficient determination of FBPs in food. In this study, genetic algorithm (GA) and particle swarm optimization (PSO) were used to optimize the architecture of artificial neural networks (ANNs) to predict the type of FBPs based on their Raman data. Raman spectra of single cells of ١٢ common strains from five genera were obtained to create a dataset. The results showed that the average accuracy of GA-ANN and PSO-ANN hybrid models was ٠,٨٩ and ٠,٩٣, respectively. Moreover, ATCC ١٤٠٢٨ and ATCC ١٩١١٢, the strains of Shigella and Listeria bacteria, were predicted with the highest performance (٠,٩٦) based on the Raman spectra of their corresponding cells. The method presented in this study included Raman spectroscopy combined with neuron-based machine learning methods for the FBP efficient diagnosis.

Keywords: artificial neural networks; Raman data; bacteria; genetic algorithm, particle swarm optimization

A Joint-Entropy Approach To Time-series Classification

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Abstract

In this paper, the problem of entropy-based classification of time-series into stochastic, chaotic, and periodic is addressed, followed by proposing an alternative joint-entropy approach to time series classification. These data-driven methods describe the behavior of a signal, using the association of the entropy of a time-series with emergence and self-organization, as complex systems characteristics. First, we deduce that certain groups of entropies, namely Fuzzy entropy, and Distribution entropy, share more similarities with emergence, while permutation and dispersion entropies could be associated with self-organization. Then, we utilize these resemblances to propose a joint-entropy alternative approach, in which one of the specific entropies is presented for each characteristic. Further, in simulations, we evaluated the performance of our proposed approach, comparing with single entropy methods, using different classifiers and decision boundaries. The results reveal an excellent performance of ۹۸٪ accuracy for simultaneous utilization of the Distribution and Permutation entropies as the input features of Random Forest classifier, while this value is at best ۸۹٪ for when only a single entropy is fed to the classifier

Keywords: time-series classification; entropy; emergence; self-organization; chaotic time-series

Anomaly Detection and Resilience-Oriented Countermeasures against Cyberattacks in Smart Grids

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Abstract

Security in smart grids has been investigated by many scholars so far. Among the existing security issues, False Data Injection (FDI) attacks in energy, computers, and communication domains are still an ongoing challenge. These attacks have the ability to sabotage the grid through causing misfunctioning of measurements devices as well as changing the state estimation appraisal so that these changes, known as false data, cannot be easily recognized and identified using conventional approaches. In this paper, the degree of network resilience against FDI attacks is analyzed by simulating a randomly generated sample FDI attack, in which the false data vector has different intensity and different quantity. A steady-state AC power flow in accordance with the outage model is employed to simulate and predict the power system response after the incidence of an FDI attack, and the ability of this attack for blackout and shutting down the transmission network has been investigated. In the proposed model, the transmission line outage, load shedding, as well as voltage instability metrics are tested and analyzed on the IEEE ٣٠٠- bus test network. Given that FDI attacks are considered a serious threat to power systems, the preliminary results imply that the targeted electricity grid is resilient against these attacks in terms of the probability of outage and chain blackouts, but the transient voltage stability can be affected.

Keywords: Smart Grids, Resilience, Anomaly Detection, Cyber-Security, False Data Injection (FDI) and Sabotage.

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Listening to Sounds of Silence for Audio replay attack detection

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Abstract

Automatic Speaker Verification (ASV) is a biometric authentication system identifying a person based on the voice presented to a system. Nowadays, due to the widespread use of these systems, various attacks are carried out on them. These attacks are in four different formats, which are impersonation, speech synthesis, voice conversion and replay attack. One of the most commonly used attacks is replay attack due to its simplicity. The purpose of this study is to provide a countermeasure system against replay attacks. We found that the effect of noises generated by different recorders and playback devices on the spoof samples can be used as a criterion for attack detection. So this study analyzes the silent parts of the speech signal that include the noises of various recording and playback devices. Also due to the proper operation of deep convolutional neural networks in classification applications, we propose an ensemble classifier based on end to end neural networks architecture and residual structures to accurately distinguish spoof utterances from genuine ones. We have decreased the t-DCF metric on ASVspoof۲۰۱۹ database by almost ۱۶ ٪compared to similar models that have processed on full speech signals.

Keywords: Automatic Speech Verification, Voice Activity Detection, Replay Spoof Attack Detection

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Diagnosis of Sleep Apnea Syndrome from EEG Signals using Different Entropy measures

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Abstract

Sleep apnea is the most popular sleep disorders which may lead to physical and mental problems. A quick and accurate diagnosis helps physicians to make a suitable remedy for it. Electroencephalogram (EEG) is the electrical activity recorded from the surface of the skull. The identity of EEG is non-linear and complex, thus the study of complexity of EEG signal can be helpful to access valuable information from it. In this paper, ۱۲ entropies (Shannon, Renyi, Tsallis, threshold, permutation, spectral, wavelet, SURE, norm, log energy, fuzzy, and sample), complexity features, are extracted from six frequency bands (delta, theta, alpha, sigma, beta, and gamma) in three different EEG channels. Finally, ۷۲ features were applied to detect apneic subjects from normal ones by using support vector machine classifier (SVM), ۹۰٪ accuracy was obtained in O۱-A۲ channel with whole features which is an acceptable accuracy in comparison with other works. Also to select the most effective features, the minimum-redundancy maximum-relevance (mRMR) algorithm was used and ۸۹,۰۷٪ accuracy with ۲۸ selected features was acquired.

Keywords: Entropy; Apnea; Complexity; Electroencephalogram(EEG), Support Vector Machine (SVM), minimum-redundancy maximum-relevance (mRMR)

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Comparision of color spaces in DCD-based content-based image retrieval systems

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Abstract

Content-based image retrieval (CBIR) is one of the most applicable image processing techniques which includes two main steps: feature extraction and retrieval. A feature vector related to visual contents of image is extracted from the image in the feature extraction step. Three set features color, texture and shape are extracted from image in typical CBIR systems. Dominant color descriptor (DCD) is a method based on color information of the image. There are many color spaces to represent an image, so DCD can be implemented in any of these color spaces. In this paper color spaces RGB, CMY, HSV, CIE Lab, CIE Luv and HMMD are considered and effect of them in DCD features is investigated. Also, the CBIR precision is affected by the number of partitions in DCD method which is analyzed in this paper. Simulation results on Corel-١k dataset show that the HSV color space achieves better precision comparing the other color spaces.

Keywords: dominant color descriptor; content-based image retrieval; color space

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Experimental Study on Reducing the Oscillations of a Cable-Suspended Parallel Robot for Video Capturing Purposes using Simulated Annealing and Path Planning

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Abstract

This paper aims to smoothen the movements of an under-constrained cable-suspended parallel robot which carries a camera for video capturing purposes, especially for video capturing of football games. This goal is achieved by means of an accurate while simple PID controller optimized by the Simulated Annealing algorithm and implemented on the joint space. Moreover, a planning strategy is considered for the joint space trajectory of the robot which guarantees the zero jerk, acceleration, and velocity at the start and the end of motions. On this regard, a septic function for each joint of the robot is considered and the corresponding boundary conditions are applied to the function to make the end-effector movements less oscillatory. This method is implemented and tested on an experimental setup while the end-effector oscillation data is recorded using an IMU sensor attached to the end-effector of the robot. Applying frequency analysis on the oscillatory data of the end-effector reveals that this simple method, on average, resulted in a ۳۳,۸٪ reduction in the average amplitude of the end-effector oscillations. Moreover, the maximum joint space error was decreased by ۷۶,۶۸٪ when using septic joint profile compared to the ordinary linear Cartesian trajectory planning approach. Upon applying the proposed strategy, the error of the controller has been reduced by ۹۲,۲۶٪ with respect to the previous research performed on this experimental setup. Without requiring any knowledge on the dynamic model of the robot or the natural frequencies of the end-effector or using any complex controller, this method significantly increased the smoothness and accuracy of the robot movements. The proposed method can be regarded as a definitive asset when this robot is used for video capturing purposes.

Keywords: cable-suspended parallel robots; video capturing; controller design; path planning; simulated annealing

Multivariate Mutual Information Measures Functional Connectivity Accurately

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Abstract

Most studies use linear correlation as an estimator of functional connectivity. This measure does not detect the nonlinear dependence between two variables. During resting state, there are nonlinear relations among time series discarded by common functional connectivity measures such as Pearson correlation. Another limitation of linear correlation is the inability of calculating the association between two multivariate variables. Typically, a dimension reduction such as averaging is applied to each region time series. This reduction leads to a loss of spatial information across voxels within the region. Here, we propose to use a new information-theoretic measure as an interaction estimator between brain regions. Using simulated data, we show that this measure, multivariate mutual information (MVMI), overcomes the above mentioned limitations.

Keywords: mutual information, functional connectivity, principal component analysis, linear correlation

A new approach based on principal ERPs and LDA to improve P۳۰۰ mind spellers

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Abstract

Visual P۳۰۰ mind speller is a brain-computer interface that allows an individual to type through his mind. For this goal, the subject sits in front of a screen full of letters, and when his desired one is highlighted, there will be a P۳۰۰ response (a positive deflection nearly ۳۰۰ms after stimulus) in his brain signals. Due to the very low signal-to-noise (SNR) of the P۳۰۰ in the background activities of the brain, detection of this component is challenging. Principal ERP reduction (pERP-RED) is a newly developed method that can effectively extract the underlying templates of event-related potentials (ERPs), by employing a three-step spatial filtering procedure. In this research, we investigate the performance of pERP-RED in conjunction with linear discriminant analysis (LDA) to classify P۳۰۰ data. The proposed method is examined on a real P۳۰۰ dataset and compared to the state-of-the-art LDA and support vector machines. The results demonstrate that the proposed method achieves higher classification accuracy in low SNRs and low numbers of training data.

Keywords: Principal event-related potentials, P۳۰۰, visual mind speller, brain-computer interface.

Designing the Communication Infrastructures for Democratizing the Coverage Time of Connected Vehicles

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Abstract

Vehicular communication can be highly improved by providing network access points distributed along with the road network. Such access points for vehicles are commonly referred to as roadside units and provide a backbone integrating the whole vehicular network. However, to avoid wasting resources and maximizing network efficiency, the locations where these units are installed need special attention in such networks' design. In this work, we propose two novel strategies (Partial Time Information (PTI) and Maximum Coverage Time (MCT)) to deploy a predefined number of roadside units seeking to maximize the number of distinct vehicles crossing covered areas during a given time threshold. Instead of relying on the full trajectory of vehicles, which may incur privacy issues, the PTI strategy utilizes duplicate coverage time ratios between urban regions to infer the best locations for deploying the roadside units, while the MCT does not consider any mobility information at all. As a baseline, we consider the FPF strategy, which projects the flow of vehicles in a Markovian approach. Simulation results based on the data traffic set of Cologne, Germany demonstrate that the proposed approaches increase the vehicle to infrastructure connection time in comparison to FPF.

Keywords: Vehicular Networks, Roadside Units, Deployment, Duplicate Coverage, V۲I Connection Duration.

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Entropy-based DDoS Attack Detection in SDN using Dynamic Threshold

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Abstract

The centralized structure of software defined networks makes them vulnerable to distributed denial of service attacks. Given that these attacks can easily destroy the computational and communicational resources of controller and switches, they make the network fail in a short time. Hence, it is vital to protect the controller. Utilizing the unique features of software defined networks, this paper propounds an effective method to detect distributed denial of services attacks. For this purpose, entropy was used to detect attacks. Furthermore, this method utilizes a dynamic threshold instead of a static one to distinguish between normal and attack traffic. The dynamic threshold heightens the accuracy of attack detection in the proposed algorithm to ۹۸٪ on average while the accuracy in the benchmark algorithm using entropy and the static threshold is ۹۶٪.

Keywords: Software Defined Networks, Distributed Denial of Service Attacks, Entropy, Controller, Dynamic Threshold.

AoI-Aware Status Update Control for an Energy Harvesting Source over an Uplink mmWave Channel

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Abstract

In the new generation networks, the freshness of the data plays a prominent role in real-time systems. The novel metric of the age of information (AoI) measures the elapsed time since the generation of the latest received data. This paper considers a real-time scenario where a source node samples and forwards the measurements to a monitoring center over a millimeter-wave (mmWave) channel. The source node is also equipped with a finite rechargeable battery to harvest energy from the environment. We propose a remote monitoring problem that considers the tradeoff between the minimization of long-term average AoI and the energy usage of the source node. We formulate the problem as an MDP model, and as a model-free reinforcement learning approach, we utilize the Q-learning algorithm to obtain the optimal policy that minimizes the long-term average AoI. Our evaluations investigate the convergence property as well as the impact of changing the problem parameters on the average AoI and average energy consumption. Simulation results show that compared to two other baselines (i.e., random and greedy (myopic) policy), the proposed Q-Learning based algorithm is able to keep the data fresh and consumes less energy by considering the possible future system states.

Keywords: age of information; energy harvesting; mmWave communication; Q-learning.

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Machine Learning-Based Estimation of Suspended Sediment Concentration along Missouri River using Remote Sensing Imageries in Google Earth Engine

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Abstract

Estimation of Suspended Sediment Concentration (SSC), regarded as a crucial component of hydrological and ecological processes, can provide a better understanding of water quality. This study aims to use Sentinel-٢ (S٢) level-٢A (L٢A) images with less than ١٪ cloud coverage and supervised machine learning-based regression models to estimate SSC along the Missouri River. The model gets the reflectance values of different spectral bands and predicts the corresponding SSC value for each water pixel. Time-series data of three different ground measuring stations and surface reflectance values of the closest pixel to each station are used to train and validate the model. Two popular regression models, Support Vector Regression (SVR) and Random Forests (RF), are trained, validated, and compared online in the Google Earth Engine (GEE) processing platform by using ٦٨ satellite images, without the need to be downloaded. The results demonstrated that the RF model with a root mean square error (RMSE) and mean absolute error (MAE) of ٥٩,٥٢١ and ٤٦,٤٩٣ mg/L outperforms the SVR model. Moreover, the RF model resulted in a higher correlation between the real and predicted SSC values (R^2 = ٠,٧٩ and Pearson's r = ٠,٨٧٧). Also, the two short wave infra-red (SWIR) and red bands play more considerable roles in SSC estimation using S٢L٢A images than other bands.

Keywords: Sentinel-٢, Support Vector Regression, Random Forest, Google Earth Engine, Suspended Sediment Concentration.

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A New Spectral-Spatial Network for Feature Fusion and Classification of Hyperspectral Images

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Abstract

Hyperspectral image (HSI) classification is one of the most important applications among all types of classification fields. Proper classification of spectral data leads to discovery of important land covers. In recent years, many methods have been introduced to increase the HSI classification accuracy. Methods based on neural networks show superior results compared to other methods. Among them, the two-dimensional convolutional neural networks (2D-CNNs) inspired by the human eye retina have achieved higher accuracy in classification. In most cases, HSI classifiers use only spectral features. In this paper, the spectral-spatial feature fusion and HSI classification using 2D-CNN are focused. For this purpose, the first 2D-convolutional layer of CNN is substituted by two combined 2D-Gabor-Shapelet filter banks. This layer extracts contextual information and provides valuable joint spectral-spatial features. The experimental results on real HSI (including the urban and agricultural areas and their mixture) show that the proposed method improves the overall classification performance. Compared to several famous HSI classification based on neural networks, the proposed method has higher speed and classification accuracy.

Keywords: hyperspectral image (HSI); spectral-spatial feature fusion; classification; Gabor filters; Shapelets; 2D-CNN.

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Combination of Feature Selection and Hybrid Classifier as to Network Intrusion Detection System Adopting FA, GWO, and BAT Optimizers

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Abstract

In terms of network topology, one of the extensively utilized technologies is the intrusion detection system (IDS). Despite applying numerous machine learning approaches (supervised and unsupervised) to enhance efficacy, reaching high-grade performance is still a challenging problem for existing intrusion detection algorithms. This study presents a new technique for IDS that focuses on various deep neural networks (DNNs) and their combination for data classification. The proposed model consists of three parts: (١) the feature selection is composed of an intersection of mutual information based on the transductive model (MIT-MIT), Anova F-value, and Genetic Algorithm (GA) methods, (٢) the second section is a classifier network using a hybrid CNN-LSTM algorithm, and (٣) the hyperparameter optimization module that puts to use Firefly, BAT, and Gray Wolf algorithms. In order to validate and verify the suggested model via accuracy, F١ score, recall, and precision criteria, a benchmark dataset, namely, NSL-KDD, is employed, which compares the proposed method with the highly developed classifiers. The comparison outcomes confirmed the surpassing of the presented strategy over contrast algorithms.

Keywords: feature selection; hybrid classifier; intrusion detection system; deep learning; meta-heuristic optimization algorithms.

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An Audio-Visual System for Sound Noise Reduction Based on Deep Neural Networks

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Abstract

Audio noise has no unique definition, but in general, it includes background and environmental sounds such as objects movements, animal sounds, and etc. These sounds distract listeners and lead to loss of main content. Noise reduction is a process for removing such these unwanted sounds and extracts clear noise-free sound of an audio source. All proposed methods for this problem deal with some challenges such as residual noise, low speed performance, ambiguity in separation. In this paper an automated system is proposed to eliminate noise signal from noisy audio of an audio-visual data. This system utilizes audio and visual features of main sound source (musical instruments) to feed its two internal DNN based models: a) object detection and b) sound separation model. First, an object detection model which is designed by transfer learning method is used to identify sound source in video frames. Then based on detected source, a specific sound separation model is applied to noisy signal and extracts the noise-free audio signal. Audio and visual features play a complementary role in noise reduction process and its positive effect is obvious in obtained results. The experimental results indicate that under the noisy environment, especially in real-time applications, the proposed noise reduction scheme improves the quality of the extracted noise-free sound in comparison with other algorithms.

Keywords: noise reduction; video processing; deep learning; sound separation; object detection

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CA-Market: A Partially Categorical Annotating Approach Based on Market۱۵۰۱ Dataset for Attribute Detection

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Abstract

In this paper, a new partial categorical attributes dataset (CA-Market) based on images of the Market۱۵۰۱ dataset has been introduced, for the sake of improving the attribute detection task. Most attributes detection datasets (human appearance features detection) are not partially categorical and do not properly take into account the inner classes diversity. Increasing the diversity of inner parts (gender, head, upper-body clothes, lower-body clothes, bags, shoes, and colors) before annotating can ease the decision-making process by dividing labels into individual categories. CA-Market contains ٤٦ binary attributes in ۱۰ parts from head to foot and their colors which are annotated in image-level. For example, the attributes of the leg part are skirts, shorts, and pants which are carefully chosen to be categorized for a classification task. In this research, the effect of the labeling approach is studied. Hence, a common classification method is used and only datasets or baselines are changed for comparisons. Baselines are based on Omni-Scale, Resnet۵۰, and Hydra-Plus architectures to compare the CA-Market۱۵۰۱ dataset with the Market۱۵۰۱ attribute dataset in the same setting. CA-Market demonstrates a new representation of data as a part-based format which can gain better results. This approach, without adding any extra modules, achieved a significant enhancement. For instance, accuracy in the vectorized format is over ۹۲٪, in the categorized is over ۹۰٪ which shows the effectiveness of part-based attribute annotating. Also, hair, backpack, upper color, and lower color as the common attributes between Market۱۵۰۱-attribute and CA-Market datasets are achieved ۹۰,۲٦, ۸۸,۰٤, ۹٤,۵۵, and ۹٤,۱۸ classification accuracy which can outperform existing state-of- the-art approaches.

Keywords: Attribute detection, Attribute recognition, person re-identification, Annotating, CA-Market

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An Intelligent Approach to Detecting Novel Fault Classes for Centrifugal Pumps Based on Deep CNNs and Unsupervised Methods

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Abstract

Despite the recent success in data-driven fault diagnosis of rotating machines, there are still remaining challenges in this field. Among the issues to be addressed, is the lack of information about variety of faults the system may encounter in the field. In this paper, we assume a partial knowledge of the system faults and use the corresponding data to train a convolutional neural network. A combination of t-SNE method and clustering techniques is then employed to detect novel faults. Upon detection, the network is augmented using the new data. Finally, a test setup is used to validate this two-stage methodology on a centrifugal pump and experimental results show high accuracy in detecting novel faults.

Keywords: centrifugal pump, condition monitoring, classifi-cation, convolutional neural network, t-SNE, clustering.

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Detection of Correlated Alarms Using Graph Embedding

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Abstract

Industrial alarm systems have recently progressed considerably in terms of network complexity and the number of alarms. The increase in complexity and number of alarms presents challenges in these systems that decrease system efficiency and cause distrust of the operator, which might result in widespread damages. One contributing factor in alarm inefficiency is the correlated alarms. These alarms do not contain new information and only confuse the operator. This paper tries to present a novel method for detecting correlated alarms based on artificial intelligence methods to help the operator. The proposed method is based on graph embedding and alarm clustering, resulting in the detection of correlated alarms. To evaluate the proposed method, a case study is conducted on the well-known Tennessee-Eastman process.

Keywords: alarm systems, clustering, graph embedding, correlated alarms

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Exploring Informative Response Features of Two Temperature Modulated Gas Sensors at a Wide Range of Relative Humidity

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Abstract

The response signals of temperature modulated gas sensors contain essential information about measured target gas that must be separated from other correlated, redundant, or noisy data. This issue becomes more critical when variations in environmental factors such as relative humidity of target gas or background odors affect the sensor response. Conductance values of two electronic noses based on a single TGS-۲٦۰۲ and a single FIS SP-٥۳B sensors to four gases and clean air at a wide range of relative humidity levels were measured for analyzing the response features. The role of each feature and increasing the number of features in the accuracy of an SVM classifier are investigated. A method is proposed based on removing non-informative features and compared to four conventional feature selection techniques. It is shown that our proposed scheme with a simple SVM classifier results in ۹٦,۷٪ detection accuracy for TGS-۲٦۰۲ and ۹۸,۸٪ for FIS SP-٥۳B, which is up to the accuracy value of common or advanced methods of selecting features. It is concluded that employing feature selection techniques is more beneficial for the TGS-۲٦۰۲ dataset, which had more destructive features than FIS SP-٥۳B. In conclusion, when working with an E-Nose dataset, it is first necessary to explore the important features to find out whether feature selection is required or not, and if needed, which feature selection method provides the best accuracy.

Keywords: Electronic Nose (E-Nose); Feature selection; Informative Response Features, Metal oxide gas sensor; Temperature modulation

ParsiNorm: A Persian Toolkit for Speech Processing Normalization

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Abstract

In general, speech processing models consist of a language model along with an acoustic model. Regardless of the language model's complexity and variants, three critical pre-processing steps are needed in language models: cleaning, normalization, and tokenization. Among mentioned steps, the normalization step is so essential to format unification in pure textual applications. However, for embedded language models in speech processing modules, normalization is not limited to format unification. Moreover, it has to convert each readable symbol, number, etc., to how they are pronounced. To the best of our knowledge, there is no Persian normalization toolkits for embedded language models in speech processing modules, So in this paper, we propose an open-source normalization toolkit for text processing in speech applications. Briefly, we consider different readable Persian text like symbols (common currencies, #, @, URL, etc.), numbers (date, time, phone number, national code, etc.), and so on. Comparison with other available Persian textual normalization tools indicates the superiority of the proposed method in speech processing. Also, comparing the model's performance for one of the proposed functions (sentence separation) with other common natural language libraries such as HAZM and Parsivar indicates the proper performance of the proposed method. Besides, its evaluation of some Persian Wikipedia data confirms the proper performance of the proposed method.

Keywords: pre-processing; normalization; speech processing

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Fault Diagnosing Of An Induction Motor Based On Signal Fusion Using One-Dimensional Convolutional Neural Network

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Abstract

The detection and classification of induction motor faults using a one-dimensional convolutional neural network is discussed in this paper. A one-dimensional deep neural network is learned utilizing three-phase current and voltage signals from an induction motor system. The results of experiments show that the one-dimensional deep convolutional neural network method effectively diagnoses the induction motor conditions (Bearing fault, Rotor bar broken, short circuit stator winding ٨٪ and ١٢,٥٪).

Keywords: Classification, Deep Neural Network, Fault, In- duction Motor, One-Dimensional Convolutional Neural Network.

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Automatic Epileptic Seizure Detection: Graph Features Versus Graph Kernels

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Abstract

According to WHO ۲۰۱۹ announcement, around ۵۰ million people are suffering from epilepsy worldwide. As epilepsy causes some seizures in the brain, seizure detection can play an essential role in treating patients. In this paper, we concentrated on different graph-based methods intending to classify seizure and non-seizure states of the brain based on recorded EEG signals. We worked on Temple University Hospital (TUH) dataset which includes both focal and generalized seizures. Our goal was to reach a comprehensive comparison between these methods. Three methods were discussed: graph features, graph kernels, and graph multi-kernels. We considered each EEG channel as a node in the graph model. Also, graph edges were built through functional connectivity between every two nodes' signals. Therefore, we constructed one graph for each second of every patients' recorded EEG. Then, by using constructed graphs, we extracted some features from them, or calculated kernel matrix for each couple of them which reflects the similarity between graphs. In the multi-kernel method, these two approaches gathered together. After comparing the outcomes, we found kernel and multi-kernel methods more effective on this dataset. The best result is attained by multi-kernel method which has an accuracy of ۷۲,۱٪ and a sensitivity of ۷۱,۹٪.

Keywords: seizure detection, EEG signals, graph classification, graph features, graph kernels, graph multi-kernels

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A novel local approach for identifying bridging edges in complex networks

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Abstract

Detecting the bridging edges is a fundamental issue in complex networks, for investigating the network connectivity, modularity, immunization, and percolation. However, less attention has been paid to studying the edge importance. Also, few available edge centrality measures, are suffering from low accuracy in distinguishing the vital edges, and have high time complexity. Considering these issues, in this paper we propose a novel edge centrality measure for detecting bridging edges by utilizing local neighborhood information of the edges. The negative effect of the alternative paths between the ending nodes of the corresponding edge is also considered in the proposed formula. Experimental results indicate the superior performance of the approach in all the real-world datasets.

Keywords: Bridging edges, Complex networks, Edge centrality, Local centrality

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Intelligent Fault Diagnosis of Rolling Bearing Based on Deep Transfer Learning Using Time-Frequency Representation

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Abstract

With the expansion of deep learning (DL) and machine learning (ML) methods, fault diagnosis based on data-driven models has recently become controversial. However, due to the lack of sufficient labeled data in fault diagnosis, the depth of proposed DL models is less than other models in computer vision areas, which decreases the generalization and accuracy of models. Deep transfer convolutional neural network (DTCNN) with powerful feature extracting is used to tackle this dilemma. In this study, DenseNet٢٠١, ResNet١٥٢V٢ and, MobileNetV٢ are chosen as DTCNN models for feature extraction. Firstly, vibration signals are converted into time-frequency RGB images by continuous wavelet transform (CWT). Then, the high-level features of images are extracted by the DTCNN models. Finally, different types of bearing faults are classified by DL and ML classifiers. The experiment is validated on the famous Case Western Reserve University (CWRU) bearing data set. The result demonstrates that the proposed DTCNN models achieve the best accuracy rate in the classification task and are faster to learn than many other existing DL and ML models.

Keywords: Fault diagnosis, Transfer learning, Deep learning, Machine learning, Continuous wavelet transform

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Automated Sleep Stage Scoring Using Brain Effective Connectivity and EEG Signals

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Abstract

Sleep staging is necessary for the diagnosis of sleep disorders and evaluating the quality of sleep. Scoring of sleep stages is mainly done manually by a specialist based on Polysomnography data and mainly EEG, which is very time consuming and costly. Hence, it is essential to provide an automated method. This paper proposes an automatic sleep staging method based on brain effective connectivity. In this study, using the Granger causality criterion, causality matrices for each epoch of EEG data sampled from ۱۰ healthy individuals were extracted as features. Then, the Gaussian SVM classifier has been employed to classify sleep stages using extracted features. For feature reduction, two algorithms, PCA and RSFS, were assessed, but we did not apply feature reduction in the final method due to the insignificant effect on classification accuracy. Finally, we were able to classify sleep stages with ۷۲,۷٪ accuracy and Cohen's Kappa Coefficient of ۰,٦٥. The experimental results demonstrate that the combination of Granger causality features and SVM can be used as an efficient framework for automated sleep stage scoring with regard to promising classification performance in terms of accuracy and Cohen's Kappa coefficient.

Keywords: Sleep staging, brain effective connectivity, Electroencephalography (EEG), granger causality, sleep scoring, Polysomnography (PSG)

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Intelligent Filtering of Graph Shells in the Problem of Influence Maximization Based on the Independent Cascade Model

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Abstract

In social networks, the problem of influence maximization seeks for a solution to find individuals or nodes in different communities so that they can diffuse information influence among a wide range of other nodes. The proposed algorithms for influence maximization problem have many drawbacks. For example, the computational overhead is very high and also the seed nodes is not selected optimally. For this reason, the influence does not spread totally in the social network.for solving the problem, This paper provides the SFIM algorithm and uses the idea of layering community nodes and identifying valuable layers to limit the search space. The operation is continued only on nodes of valuable layers, which significantly reduces the algorithm's runtime. Then, the best set of influential nodes with the highest accuracy is found by considering the main criteria of centrality topology such as harmonic and degree. Accuracy in selecting a node is one of the most important needs of the problem that is best answered. Moreover, different experiments and datasets indicate that this algorithm can provide the best efficiency required to solve the problem compared to other algorithms.

Keywords: Infiltration Maximization, Social Networks, K-shell Algorithm, Centrality Topology , Harmonic Centrality

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Transcranial Magnetic Stimulation of Prefrontal Cortex Alters Functional Brain Network Architecture: Graph Theoretical Analysis

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Abstract

Transcranial magnetic stimulation (TMS) is increasingly used in basic as well as clinical research. Intermittent theta burst stimulation (iTBS) with high stimulation intensities are typically applied on frontal cortex as therapy for the modulation of functional connectivity of brain in patients with mood disorders. However, there are not yet sufficient understanding of the impacts of this technique on brain neuronal activities. In this study, we aimed to investigate the network reorganization following the offline application of iTBS to prefrontal cortex at two different intensities. The network architecture was analyzed using resting state functional magnetic resonance imaging as well as graph theory analysis. Results show that the offline iTBS, applied to just one node of the brain network, changes the whole organization of the network. Furthermore, the reorganization followed by the stimulation is dependent on the intensity of the applied stimulation. Moreover, our research suggests that the network analysis can bring new insights into the mechanism of transcranial magnetic stimulation, and improves our understanding of its local as well as global effects.

Keywords: resting state functional magnetic resonance imaging (rsfMRI); transcranial magnetic stimulation; graph theory analysis; prefrontal cortex; intermittent theta burst stimulation

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Model-Free Learning Algorithms for Dynamic Transmission Control in IoT Equipment

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Abstract

We consider an energy-harvesting IoT device transmitting delay- and jitter-sensitive data over a wireless fading channel. Given the limited harvested energy, our goal is to compute optimal transmission control policies that decide on how many packets of data should be transmitted from the buffer's head-of-line at each discrete timeslot such that a long-run criterion involving the average delay/jitter is either minimized or never exceeds a pre-specified threshold. We utilize a suite of Q-learning-based techniques (from the reinforcement learning theory) to optimize the transmission policy in a model-free fashion. Compared to prior work, our novelty lies in proposing a model-free learning algorithm that enables jitter-aware transmissions by penalizing control decisions with the variance of the delay cost function. Extensive numerical results are presented for performance evaluation.

Keywords: Delay; Energy Harvesting; Jitter; Transmission Control; Markov Decision Process; Reinforcement Learning

A Persian speaker-independent dataset to diagnose autism infected children based on speech processing techniques

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Abstract

Autism spectrum disorder is one kind of brain developmental disorders. The easiest way to diagnose persons with autism is done through speech processing techniques. However, limited researches have been done in this field. The reason may be due to the lack of valid and suitable datasets in this field. Therefore, in this paper, while analyzing the existing datasets in this field, the process of designing, collecting and evaluating a Persian speaker-independent dataset to diagnose children with autism (PersionSIChASD dataset) using speech processing methods has been discussed. Data collection has been done under the supervision of an autism specialist. The dataset includes those phonetic units that children with autism have difficulty in saying them, correctly. The results of evaluating the proposed dataset have shown speech recognition accuracies equal to ۷٦٪ and ۱۲٪ for phonetic units articulated by typical and autism infected children, respectively. The significant difference between the mentioned recognition rates (about ٦٤٪) could be exploited to diagnose autism infected children.

Keywords: Diagnose speech abnormalities; Autism; Speech Database; speech processing; Hidden Markov Model.

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Smart Grid based decentralized Peer-to-Peer Energy Trading Using Whale Optimization Algorithm

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Abstract

Increased penetration of distributed energy resources (DERs) in smart grids (SG) has sparked a new movement to consumer-centric structure as marketplaces based on peer-to-peer (P٢P) models. Participants can directly agree bilateral power transactions in P٢P markets to balance producers and consumers. The trading mechanism should be well-designed to encourage participants to operate actively in the trading activity. This article proposes a trading strategy for P٢P strategy in SG. The proposed framework is modeled using the Whale optimization algorithm (WOA). In order to evaluate the proposed optimization method, particle swarm optimization (PSO) and classical optimization methods are carried out. The compared results show that the convergency of proposed method is faster than PSO algorithm.

Keywords: Whale optimization algorithm; Smart-grids; Decentralized peer-to-peer trading

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Hardware Trojan Detection Using Thermal Imaging in FPGAs with Combined Features

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Abstract

A Hardware Trojan (HT) is a malicious modification of the circuitry of an integrated circuit. The importance of Hardware Trojan detection increases with increase in the complexity of integrated circuits. The possible effects of the insertion of a Hardware Trojan involve a range of harms from leakage of sensitive information to the complete destruction of the integrated circuit itself. Non-invasive methods of Hardware Trojan detection are divided into two general categories: performance testing and side channel analysis. Hardware Trojan detection using thermal imagery is one of the side channel analysis methods which have recently been considered. In this paper, we propose a Hardware Trojan detection method on FPGA, based on thermal image processing of defected and authentic chips assuming that a golden chip is available. We also provide a dataset of thermal images captured from multiple experiments on a certain FPGA board. Each experiment contains ۱۲ images taken in ۵۵ seconds of working FPGA. The Hardware Trojan detection method relies on extracting two different features from images and detecting the presence of a Hardware Trojan using machine learning techniques. Results shows that if proposed method is combined with a basic method, hardware Trojan detection accuracy can be increased, significantly.

Keywords: Hardware Trojan detection, side channel analysis, thermal image analysis, FPGA.

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Trajectory Clustering in Surveillance Videos Using Dynamic Time Warping

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Abstract

Adding functional analysis to the videos captured by surveillance cameras can provide handy information to their users. Mining the existing trajectories in a video is one of the most valuable features, discovering the prevalent patterns and their density in the video, and it helps reveal some unusual and abnormal movements more easily. In this paper, the data obtained through the execution of detection and tracking algorithms are processed in various steps and used to train a hierarchical clustering model by deploying a modified version of the DTW algorithm. This practical approach does not need massive datasets for the training procedure and can be applied to any surveillance video containing different types of objects. The proposed method utilizes information extracted from the objects in a video to generate the existing primary trajectories. Additionally, a practical algorithm for modeling the background in surveillance movies is proposed to illustrate clustering outputs.

Keywords: trajectory clustering, dynamic time warping, within the sum of square, background extraction, surveillance video analysis

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A powerful notch filter for PLI cancelation

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Abstract

In this work, we present a powerful notch filter for power-line interference (PLI) cancelation from biomedical signals. This filter has a unit gain and a zero-phase response. Moreover, the filter can be implemented adaptively to adjust its bandwidth based on the signal-to-noise ratio. To realize this filter, a dynamic model is defined for PLI based on its sinusoid property. Then, a constrained least square error estimation is used to emerge the PLI based on the observations while the constraint is the PLI dynamic. At last, the estimated PLI is subtracted from recordings. The proposed filter is assessed using synthetic data and real biomedical recordings in different noise levels. The results demonstrate this filter as a very powerful and effective means for canceling the PLI out.

Keywords: Power-line interference, noise cancelation, notch filter, adaptive filter, biomedical recordings.

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Perceptually Optimized Loss Function for Image Super-Resolution

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Abstract

Most of the learning based single image super-resolution networks employ intensity loss which measures pixel-wise difference between the estimated high resolution image and the ground truth. Since image components are different with respect to their saliency for HVS, it is desired to weight their impact on the loss functions accordingly. In this paper, a simple perceptual loss function is introduced based on the JPEG compression algorithm. In fact, the two compared images are transformed into DCT domain and then divided by the weighted quantization matrix. The difference between the resultant DCT coefficients shows the most effective components for HVS and can be considered as a perceptual loss function. The experimental results illustrate that employing the proposed loss promotes the convergence speed, and also, provides better outputs in terms of qualitative and quantitative measures.

Keywords: single image super-resolution, deep learning, neural networks, JPEG, DCT, loss function

A Countermeasure Based on CQT Spectrogram for Deepfake Speech Detection

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Abstract

Nowadays, biometrics like face, voice, fingerprint, and iris are widely used for the identity authentication of individuals. Automatic Speaker Verification (ASV) systems aim to verify the speaker's authenticity, but recent research has shown that they are vulnerable to various types of attacks. A large number of Text-To-Speech (TTS) and Voice Conversion (VC) methods are being used to create the so-called synthetic or deepfake speech. In recent years, numerous works have been proposed to improve the spoofing detection ability to protect ASV systems against these attacks. This work proposes a synthetic speech detection system, which uses the spectrogram of Constant Q Transform (CQT) as its input features. The CQT spectrogram provides a constant Q factor in different frequency regions similar to the human perception system. Also, compared with Short-Term Fourier Transform (STFT), CQT provides higher time resolution at higher frequencies and higher frequency resolution at lower frequencies. Additionally, the CQT spectrogram has brought us low input feature dimensions, which aids with reducing needed computation time. The Constant Q Cepstral Coefficients (CQCC) features, driven from cepstral analysis of the CQT, have been employed in some recent works for voice spoofing detection. However, to the best of our knowledge, ours is the first work using CQT magnitude and power spectrogram directly for voice spoofing detection. We also use a combination of self-attended ResNet and one class learning to provide our model the robustness against unseen attacks. Finally, it is observed that even though using input features with relatively lower dimensions and reducing computation time, we can still obtain EER ۳٫۰۵۳٪ and min t-DCF ۰٫۱۰ on ASVspoof ۲۰۱۹ Logical Access (LA) dataset, which places our model among the top performers in this field.

Keywords: Voice Spoofing Detection; Deep Neural Networks; Biometrics; Constant Q Transform; Deepfake Audio Detection

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Estimation of Free Parameters of Morphological Profiles for Building Extraction Using SAR Images

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Abstract

Nowadays, one of the most challenging issues in the field of remote sensing and satellite imagery is production of cadastral maps. Synthetic aperture radar (SAR) images are among the most widely used satellite images in the last decade. Due to radar nature of these images, the buildings in SAR images face with two problems: shadow and layover. Morphological mathematics are efficient tools for detection of buildings with providing a contextual profile containing shape and geometrical characteristics of the objects in radar images. By using the suggested method, two characteristics of shadow and brightness are detected separately. Then, the construction areas are extracted by using a fuzzy fusion approach. In this method, various parameters such as size and direction of the structural element and the weighting factor of the shadow, bright area, and the recursive parameter have to be determined independently. To this end, an iterative method using MSE is suggested. The experimental results show a detection rate of ۹٤,۳٪ achieved by the proposed method.

Keywords: morphological profile, synthetic aperture radar, building extraction, geometry visibility.

Abusive words Detection in Persian tweets using machine learning and deep learning techniques

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Abstract

Regarding the development of the web and increasing user interaction, different users' opinions about different phenomena have been observed. In recent years, the detection of Abusive language in online content used by users has become a necessity. Twitter is a platform in which users can share text messages. On Twitter, different people express their opinion on different topics with different kinds of literature, some of which are accompanied by Abusive words. On the one hand, Abusive comments can be derogatory and harmful to those who share content. On the other hand, filtering these comments in languages other than English is difficult and time-consuming. Most social media platforms are still looking for more efficient ways to filter comments because the manual method is expensive, slow, and risky. Automating helps better identify and filter Abusive comments and increase user safety. In the present article, a deep learning method is presented to detect users' Abusive words in Persian tweets. Due to the lack of appropriate data in Persian, we created a database of ۳۳۳۳۸ Persian tweets, of which ۱۰٪ contained Abusive words and ۹۰٪ were non-Abusive. Perhaps the easiest way is to use a fixed list and filter comments. So, a list of ٦٤٨ Abusive words in Persian was prepared and used to test the database (accuracy of ۷٦٪). Finally, a deep neural network is implemented to detect Abusive words using the Bert language model, and it had the best performance with an accuracy of ۹۷,۷٪.

Keywords: abusive comments, Persian tweets, machine learning, deep learning, Bert

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Combination of ConvLSTM and Attention mechanism to diagnose ADHD based on EEG signals

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Abstract

Among neurodevelopmental disorders, attention deficit hyperactivity disorder (ADHD) is the most prevalent disorder in childhood. Early diagnosis and treatment of this disorder can reduce negative impacts, such as learning difficulty, antisocial behaviours, financial problems and divorce in adulthood. Although clinical diagnoses are currently available, they are based on patient behaviours and are not reliable. Researchers developed different methods to discover a biomarker that can help accurate diagnosis. Biological signals such as electroencephalography (EEG) draw the most interest because of their ability to record neurons electrical activity. We propose a deep learning framework that combines the ConvLSTM and attention mechanism. To provide the input for this framework, we first calculate a dynamic connectivity tensor. This technique is more effective than feature extraction methods such as Fourier transform-based approaches and nonlinear analyses. Due to the structure of ConvLSTM, the model can extract temporal and spatial features simultaneously, and the attention mechanism provides insights for the model to score different time instants in EEG data. These two steps lead to effectively encoding a compact representation of EEG signals. It is the first time to apply ConvLSTM and the attention mechanism combination on time series data. To examine the proposed framework, we run our experiments on ٤٠٠ data instances. We trained our model using ٥-fold cross-validation. After ten different executions, the best model has an accuracy of ٩٩,٧٥٪, which is the superior performance among the studies on this data.

Keywords: ADHD; Attention Mechanism; ConvLSTM; Deep Learning; EEG.

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Enhancing Face Super-Resolution via Improving the Edge and Identity Preserving Network

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Abstract

Face super-resolution, known as face hallucination, is a domain-specific image super-resolution problem, which refers to generating high resolution face images from their low resolution. State-of-the-art face super-resolution methods used deep convolutional neural networks. However, due to significant pose changes and difficulty in recovering high-frequency details in facial areas, most of these methods do not deploy facial structures and identity information well, and it is tough for them to reconstruct super-resolved face images. According to previous researches, proper use of low-resolution image edges can be a solution for these problems. EIPNet (Edge and Identity Preserving Network) is one of the newest methods to achieve outstanding results in this area. In the EIPNet method, the authors used a lightweight edge extraction block in the proposed GAN structure. In this research, we intend to improve the performance of the EIPNet method by presenting a simple but efficient technique. Our proposed technique divides the face images into upper and lower parts. We train a separate network for each area. This technique reduces the number of face components to train from each area, and the networks can better be trained from their components. The results show that this technique can have an excellent effect on visual quality and quantitative measurements in face super-resolution.

Keywords: Super-resolution; Face hallucination; Generative Adversarial Network; Facial components

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WhisperNet: Deep Siamese Network For Emotion and Speech Tempo Invariant Visual-Only Lip-Based Biometric

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Abstract

In the recent decade, the field of biometrics was revolutionized thanks to the rise of deep learning. Many improvements were done on old biometric methods which reduced the security concerns. Before biometric people verification methods like facial recognition, an imposter could access people's vital information simply by finding out their password via installing a key-logger on their system. Thanks to deep learning, safer biometric approaches to person verification and person re-identification like visual authentication and audio-visual authentication were made possible and applicable on many devices like smartphones and laptops. Unfortunately, facial recognition is considered to be a threat to personal privacy by some people. Additionally, biometric methods that use the audio modality are not always applicable due to reasons like audio noise present in the environment. Lip-based biometric authentication (LBBA) is the process of authenticating a person using a video of their lips' movement while talking. In order to solve the mentioned concerns about other biometric authentication methods, we can use a visual-only LBBA method. Since people might have different emotional states that could potentially affect their utterance and speech tempo, the audio-only LBBA method must be able to produce an emotional and speech tempo invariant embedding of the input utterance video. In this article, we proposed a network inspired by the Siamese architecture that learned to produce emotion and speech tempo invariant representations of the input utterance videos. In order to train and test our proposed network, we used the CREMA-D dataset and achieved ۹۵,٤۱٪ accuracy on the validation set.

Keywords: Biometrics; Deep Siamese Network; Lip-Based Biometrics; Video Processing

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Extending AV۱ Codec to Enhance Quality in Phase Compression of Digital Holograms in Object and Hologram Planes

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Abstract

Holography is a ۳D capturing and displaying system. Many formats have been suggested to store holographic images with the highest quality and minimum file size. Here, we suggest combining two AV۱ codecs to make a secondary error image and use it in a linear regression block to compensate for the main AV۱ compression error. Since the phase part is the most challenging part of holograms, the proposed method addresses the compression problem in phase. The obtained results reveal that the proposed method can outperform the state-of-the-art codecs in terms of PSNR and SSIM criteria. Besides, comparing BD-PSNR and BD-Rate results with usual AV۱, confirms the proposed method has an average about ٥,۰٤dB, which is -۲۲,۱٪ better Object plane performance, and ٤,٥۷dB, which is -۲۰,٦٦٪ better in Holo plane performance, in terms of BDPSNR and BD-Rate, respectively.

Keywords: digital holography; object plane; holo plane; phase compression

RetinaMHSA: Improving in single-stage detector with self-attention

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Abstract

In recent years, object detection with two-stage methods is one of the highest accuracies, like faster R-CNN. One-stage methods which use a typical dense sampling of likely item situations may be speedier and more straightforward. However, it has not exceeded the two-stage detectors' accuracy. This study utilizes a Retina network with a backbone ResNet٥٠ block with multi-head self-attention (MHSA) to enhance one-stage method issues, especially small objects. RetinaNet is an efficient and accurate network and uses a new loss function. We swapped c٥ in the ResNet٥٠ block with MHSA, while we also used the features of the Retina network. Furthermore, compared to the ResNet٥٠ block, it contains fewer parameters. The results of our study on the Pascal VOC ٢٠٠٧ dataset revealed that the number ٨١,٨٦ % mAP was obtained, indicating that our technique may achieve promising performance compared to several current two-stage approaches.

Keywords: Object detection; RetinaMHSA; RetinaNet; Self-Attention.

Ascertainment of Appropriate GRC Structure for Two Area Thermal System under Seagull Optimization based ۲DOF-PID Controller

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Abstract

This paper attempted to assess the performances of two simulation models of generation rate constraint (GRC) for two area thermal systems to achieve optimal load frequency control (LFC). The dynamical models of GRC investigated in this work are coined as open loop and closed loop GRC which are extensively utilized by the researchers without providing specific analysis for their selection and suitability. This paper facilitates the selection of appropriate and most effective GRC structures based on dynamical analysis about the thermal system to obtain LFC optimally. Two area thermal system has been examined with different GRC models in the platform of MATLAB/SIMULINK under supervision of two degrees of freedom (DOF)-PID (۲DOF-PID) controller optimized with seagull optimization algorithm (SOA). Simulation results demonstrate the most suitable GRC model for the thermal system to obtain optimal LFC.

Keywords: Generation rate constraint, Load frequency control, Seagull optimization algorithm, ۲DOF-PID

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Asynchronous PSO for Distributed Optimization in Clustered Sensor Networks

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Abstract

In this paper, a new distributed boosting technique has been proposed based on particle swarm optimization (PSO) in order to efficiently perform the regression modeling in wireless sensor networks (WSNs). The proposed algorithm learns the network regressor in two stages: (i) the clusters regressors are learned using distributed PSO, and (ii) the accuracy of the obtained models are improved through a boosting technique. The results on real dataset show that the proposed algorithm could obtain high accurate model with completely acceptable energy consumption in comparison to other distributed algorithms.

Keywords: Particle Swarm Optimization; Regression; Wireless Sensor Networks; Boosting; Machine Learning.

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Speech Emotion Recognition Using a New Hybrid Quaternion-Based Echo State Network-Bilinear Filter

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Abstract

Echo state network (ESN) is a powerful and efficient tool for displaying dynamic data. However, many existing ESNs have limitations for properly modeling high-dimensional data. The most important limitation of these networks is the high amount of memory consumed due to their reservoir structure and the linear output of the ESN network, which prevents the increase of reservoir units and the effective use of higher-order statistics of the features provided by its reservoir units. In this research, a new structure based on ESN is presented, in which quaternion algebra is used to compress the network data with the simple split function, and the output linear combiner is replaced by a multidimensional bilinear filter. This filter will be used for nonlinear calculations of the output layer of the ESN. In addition, the two-dimensional principal component analysis (۲dPCA) technique is used to reduce the number of data transferred to the bilinear filter. In this study, the coefficients and the weights of the quaternion nonlinear ESN (QNESN) are optimized using genetic algorithm (GA). In order to prove the effectiveness of the proposed model compared to the previous methods, experiments for speech emotion recognition (SER) have been performed on EMODB dataset. Comparisons show that the proposed QNESN network performs better than the simple ESN and most currently SER systems.

Keywords: speech emotion recognition; echo state network; quaternion algebra; bilinear filter

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An improvement on quantum clustering

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Abstract

Data and patterns are the most important indicators in the world of information. Clustering is one of the best ways to enter the big data world. The main ability of the clustering is to enter the data space and recognize the data structure. Quantum Clustering (QC) is a innovative clustering method that aims to detect the potential components of a data set, based on physical concepts. QC is a new heuristic formulating procedure based on the Schrödinger equation. The main assumption in QC is that the number and location of minimums Schrödinger potential(V) will determine the number and centers of the clusters. In standard QC, the first step is to construct the wave function using the Parzen window symmetric estimator, and the next step is to solve the Schrödinger equation for this wave function. These hypotheses lead the clustering problem to solve the Schrödinger equation for an asymmetric harmonic oscillator. In this paper, we improve the clustering results of QC by considering the asymmetric Parzen estimator and solving the Schrödinger equation for the asymmetric harmonic oscillator.

Keywords: Machin elearning; Clustering; Quantum mechanics; Supervised learning

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A Hardware in Loop Simulation Robot Control by Weareable Electroencephalography (EEG)-Based Brain Computer Interface (BCI)

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Abstract

Brain Computer Interfaces (BCI) translating brain wave signals into practical commands to operate external devices by which augment human capabilities. However, many issues face the development of BCIs such as how to extract commands from EEGs due to the low signal-to-noise ratio (SNR) of EEG signals. This paper investigates an EEG-driven hardware-in-loop (HIL) experimental robot for BCI stimulation system individualized design and validation. Based on power spectrum data collected in real-time by the two TGAM electrodes, we developed a novel BCI stimulation system that allows us to adjust robot navigation. By using the SVM model, the EEG signals are preprocessed and converted into mental commands (e.g. forward, left...) to navigate the simulated robot. The average accuracy of the robot movement was ٦٢,٦٪, which obtained Cohen's Kappa coefficient are significantly better than chance (κ = ٠,٥٠). Our results showed that the robot control can be achieved with reduced accuracy under the respective experimental conditions in a simulation environment.

Keywords: Brain Computer Interfaces; formatting; EEG; HiL; Weareable

Protein Secondary Structure Prediction using Topological Data Analysis

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Abstract

Topological data analysis (TDA) is a new and rapidly growing field of modern data science that uses topological, geometric, and algebraic tools to extract structural features from very complex and large-scale data that are usually incomplete and noisy. The primary motivation for studying this method was to study the shape of data, which has been connected to branches of pure mathematics such as homology, cohomology, and algebraic topology. In this method, the topological space obtained from cloud data can give it an interpretation of distance, continuity, and connectedness so patterns and relationships between the data are discovered quickly. In other words, using this method, the original information can be obtained from the sample or accidental information that was lost or messed up during sampling. One of the main tools of TDA is persistent homology. In this paper, after introducing the necessary mathematical concepts, through computing persistent homology and extracting appropriate features, we provide a new dataset, and we then develop a deep learning architecture to predict the protein secondary structure from the constructed dataset. The accuracy of the proposed method is at least ۵٪ higher than the accuracy of the previous methods.

Keywords: Protein Secondary Structure Prediction, Topological Data Analysis, Deep Learning

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Signal activity detection in white Gaussian noise: Application to P۳۰۰ detection

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Abstract

In this research, we have proposed a new scheme to detect and extract the activity of an unknown smooth template in presence of white Gaussian noise with unknown variance. In this regard, the problem is modeled by a binary hypothesis test, and it is solved employing the generalized likelihood ratio (GLR) method. GLR test uses the maximum likelihood (ML) estimation of unknown parameters under each hypothesis. The ML estimation of the desired signal yields an optimization problem with smoothness constraint which is in the form of a conventional least square error estimation problem and can be solved optimally. The proposed detection scheme is studied for P۳۰۰ elicitation from the background electroencephalography signal. In addition, to assume the P۳۰۰ smoothness, two prior knowledge are considered in terms of positivity and approximate occurrence time of P۳۰۰. The performance of the method is assessed on both real and synthetic datasets in different noise levels and compared to a conventional signal detection scheme without considering smoothness priors, as well as state-of-the-art linear and quadratic discriminant analysis. The results are illustrated in terms of detection probability, false alarm rate, and accuracy. The proposed method outperforms the counterparts in low signal-to-noise ratio situations.

Keywords: Signal activity detection, hypothesis test, smooth signal, white Gaussian noise.

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Fraud Detection System in Online Ride-Hailing Services

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Abstract

Advances in technology and the human tendency to use virtual services are constantly increasing in all areas of life. Online ride-hailing services are not an exception to this rule. Due to the financial transactions in these systems, the possibility of fraud by profiteers also increases which can affect the revenue of such services significantly. In this paper, we propose a system that can detect fraud in online ride-hailing systems. We address frauds that occur using the ride collusion method or creating a fake ride using GPS spoofing applications. We have used real unlabeled data from one of the largest ride-hailing companies in Iran for this purpose. Our system first identifies the most important features that help us distinguish real rides from fake rides, then it uses unsupervised learning methods to detect ride anomalies. After identifying the anomalies and examining these rides, we label the data, and use supervised learning methods to construct the fraud detection model.

Keywords: Online ride-hailing systems, Anomaly detection, Fraud detection, Fake rides, Labeling

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Autonomous oil spill and pollution detection for large-scale conservation in marine eco-cyber-physical systems

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Abstract

In recent years, advancement of the industry and increased human activities created significant pollution in the marine environment and coastal regions of the Persian Gulf. These pollutions cause various diseases and serious damages to the human health and animal species. Early identification of various pollutions helps the coastal management to organize their resources and rapidly respond to the problems. Due to the large scale of the coastal regions, manual investigation of the pollutions is a very time-consuming task. Unmanned robots can be used as autonomous agents for rapid large-scale detection and classification of pollutions in the coastal regions. In this paper, an artificial intelligence-based vision system for autonomous marine pollution detection is proposed. A combination of computer vision and machine learning methods are used for autonomous detection of various pollutions in the coastal and marine environment. In this study, ۳۰۰۰ images of Persian Gulf coastal pollutions is collected and used for training an artificial intelligence system for coastal conservation. The experimental results shows that the proposed framework has a ۹۸٪ accuracy for identifying and classifying coastal and marine pollutions. The proposed system can be used as the vision system of an autonomous coastal conservation robot and increase the speed of coastal conservation and management significantly.

Keywords: Pollution detection; Artificial intelligence; Marine management; Coastal conservation.

A Successive Wavenumber Filtering Approach for Defect Detection in CFRP using Wavefield Scanning

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Abstract

Owing to the high sensitivity of carbon fiber reinforced polymer (CFRP) to internal damages, defect detection through Non-destructive testing (NDT) is deemed an essential task. One of the common methods in NDT to achieve this aim is measuring and analyzing the full-field guided waves propagation in CFRP plates. Scattered waves corresponding to deep defects are usually obscured by other waves due to their weak amplitude. A successful method to highlight these waves is to use wavenumber filtering (WF). However, WF suffers from the assumption that the optimal frequency range of excitation signal is known beforehand, which is not always available. Another drawback is that when more than one type of guided waves mode exist, this method is not capable of highlighting desirable waves or vibrations sufficiently. In this paper, full wavefield images are first constituted by exciting the guided waves via broadband chirp signal and registering them with scanning laser Doppler vibrometery (SLDV). Then, a successive wavenumber filtering (SWF) approach is introduced, which efficiently removes undesirable higher order guided wave modes, and removes the need to know a priori the optimal excitation frequency. Moreover, it is quantitatively and qualitatively shown that the proposed approach could lead to better discrimination between damaged and healthy area than conventional WF.

Keywords: Carbon fiber reinforced polymers, non-destructive testing, wavenumber filtering ,Scanning laser Doppler vibrometery, Guided waves , defect detection.

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POPDNet: Primitive Object Pose Detection Network Based on Voxel Data with Three Cartesian Channels

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Abstract

In this article, the vision problem in a robotic application is under focus to handle the grasping of objects based on a new method. Converting an object into primitive objects is assumed to be done in the first step of the vision scenario. The second step, which is the main contribution of this paper, is classifying a primitive object and determining its position, orientation, and dimensions. In this way, the voxel data with three Cartesian channels of a primitive object is considered the input of a convolutional neural network that extracts the required parameters. A virtual camera in the simulation tool (Gazebo) is used to prepare the necessary dataset for training the neural network. Although the use of voxel data with Cartesian channels increases the volume of input data and slows down the processing speed, it is shown in this study that it effectively improves the accuracy of the network in estimating the parameters of primitive objects. Based on the provided virtual dataset, the mean errors when using Cartesian channels are decreased ٨١٪, -٣٣٪, and ٥٣٪ for the position, orientation, and dimensions, respectively, compared to binary voxel data. In the same comparison, these errors are -٧٪, ٨٠٪, and ٥٥٪ lower than RGB data.

Keywords: bin-picking, primitive object detection, robot vision, voxel data with three Cartesian channels, voxel data processing

ارائه یک روش خوشه‌بندی فازی جدید برای داده‌های نادقیق

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چکیده

در این مقاله، یک روش خوشه‌بندی فازی جدید به منظور خوشه‌بندی داده‌های نادقیق ارائه شده است. در روش پیشنهادی از الگوریتم‌های ابتکاری استفاده شده است. در روش خوشه‌بندی فازی پیشنهادی یک نمونه می‌تواند به چندین خوشه با درجه عضویت‌های متفاوتی اختصاص یابد. برای نمایش اعداد نادقیق، اعداد فازی مثلثی مورد استفاده قرار گرفته است. روش فازی پیشنهادی قادر است مراکز خوشه فازی مثلثی و ماتریس درجه عضویت نمونه‌ها نسبت به خوشه‌ها را به دست آورد. ساختار الگوریتم ابتکاری مورد استفاده به گونه‌ای تغییر یافته است که قابل استفاده برای اعداد فازی باشد. برای محاسبه فاصله بین دو عدد فازی مثلثی از معیار میزان ناحیه اشتراک بین دو عدد فازی مثلثی استفاده شده است. به منظور بررسی کارایی روش پیشنهادی، مجموعه داده‌های ساختگی و مجموعه داده‌های حقیقی مورد استفاده قرار گرفته است. روش خوشه‌بندی پیشنهادی فازی دارای دقت بالاتری نسبت به دو روش k-میانگین و k-میانه است. همانطور که در نمودارهای خروجی نیز دیده می شود، خوشه‌بندی فازی نتیجه معقول‌تر و سازگارتری با واقعیت دارد. در مورد نمونه‌هایی که به چندین خوشه به‌طور همزمان متعلق هستند می‌توان با دقت بیشتری تصمیم گیری کرد.

کلمات کلیدی: خوشه‌بندی، خوشه‌بندی فازی، داده‌های فازی، مراکز خوشه فازی، الگوریتم های ابتکاری.

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طبقه بندی گیاهان در تصاویر هم‌جوش مرئی و فروسرخ با استفاده از شبکه عصبی پیچشی

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چکیده

تفکیک محصولات با ارزش از علف های هرز یکی از مسائل مهم در کشاورزی دقیق است. روش‌های مبتنی بر پردازش تصویر برای این منظور مورد توجه پژوهشگران قرار گرفته اند. تصاویر فروسرخ در کنار تصاویر مرئی می‌توانند اطلاعات بیشتری را برای افزایش کیفیت این تفکیک در اختیار سامانه-های خودکار قرار دهند. در این پژوهش، به منظور تفکیک گیاهان زراعی از علف هرز، از روش های همجوشی تصاویر مرئی و فروسرخ از جمله تبدیل چندمقیاس مانند تبدیل موجک، تبدیل لاپلاس و تبدیل کانتورلت بدون زیرنمونه برداری، روش زیر فضایی، روش بازنمایی تنک و ترکیب این روش ها استفاده شد. در ادامه برای طبقه بندی این تصاویر همجوش، از شبکه عصبی پیچشی استفاده شده است. پایگاه داده مورد استفاده در این پژوهش، شامل ۲۸۳ زوج-تصویرِ مرئی-فروسرخ از محصول چغندرقند است که در مزرعه ای در منطقه بون در کشور آلمان تصویربرداری شده است. دقت طبقه بندی شبکه عصبی پیچشیِ استفاده شده برای تصاویر همجوش به روش تبدیل کانتورلت بدون زیرنمونه برداری برابر ۹۶ ٪ به دست آمده است که عملکرد بهتری را نسبت به هر کدام از تصاویر مرئی و فروسرخ و سایر روشهای همجوشی آزمایش شده در این پژوهش نشان می دهد.

کلمات کلیدی: کشاورزی دقیق، همجوشی تصاویر، شبکه عصبی پیچشی، پردازش تصویر.

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حل مسئله زمانبندی کارگاهی فازی با زمان تحویل و مدت پردازش فازی توسط الگوریتم چندهدفه چرخه آب

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چکیده

مسئله زمانبندی کارگاهی فازی در هر حوزه یی که نیاز به تصمیم گیری به منظور مدیریت انجام یک یا چند کار تحت یک یا چند ماشین (واحد ارائه دهنده خدمت) داشته باشد کاربرد و نمایان دارد. این مسئله بعنوان یک نوع مسئله ارضای محدودیت خطی در زمره مسائل سخت یا NP-hard قرار می‌گیرد. باتوجه محتمل بودن خطای انسانی و استهلاک و خرابی سیستم‌ها در دنیای واقعی، عدم قطعیت طول دوره‌های پردازش و موعد تحویل کارها امری اجتناب ناپذیر است. در این مقاله برای اولین بار نسخه چند هدفه الگوریتم چرخه آب به منظور حل مسئله زمانبندی کارگاهی فازی با دوره پردازش فازی و موعد تحویل فازی تحت سه تابع هدف مورد استفاده قرار گرفته شده است. سه تابع هدف برای سه الگوریتم چندهدفه چرخه آب، ژنتیک و ازدحام ذرات برروی ۸ داده محک استاندارد فازی اجرا شده است. نتایج بدست آمده گویای مزیت نسبی عملکرد الگوریتم چرخه آب هدفه نسبت به دو الگوریتم دیگر دارد.

کلمات کلیدی: مسائل زمانبندی کارگاهی فازی، دوره پردازش فازی، موعد تحویل فازی، مک اسپین فازی، شاخص توافق، الگوریتم چندهدفه چرخه آب.

تفکیک شالیزارها در مناطق کشاورزی با توصیف دو زمانی شاخص گیاهی NDVI(CrossNDVI) و شبکه کانولوشنی

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چکیده

تامین و سلامت مواد غذایی اهمیت ویژه‌ای در جهان دارد .مسائل و تصمیم‌گیری‌های مربوط به آن نیز یک امر حیاتی در هر جامعه‌ای است. طبقه‌بندی محصولات کشاورزی از جمله کارهایی است که می‌تواند چنین اطلاعاتی را در اختیار کاربران قرار دهد. در این مقاله، با استفاده از داده‌های سنجش از دور به طبقه‌بندی محصولات کشاورزی در شمال ایران - استان مازندران به‌عنوان یکی از مناطق مهم تولید برنج در کشور، پرداخته شده است. این داده‌های سنجش از دور، تصاویر چندطیفی ماهواره‌ی سنتینل ۲ است که از بستر Google Earth Engine بدست آمده است. در این مقاله، از یک‌سو با معرفی یک شاخص گیاهی به نام Cross NDVI که اطلاعات زمانی را هم در NDVI وارد می‌کند و از سویی دیگر به کمک شبکه کانولوشنی ساده به عنوان طبقه‌بند به تفکیک شالیزارها از منطقه‌های شهری، باغ‌ها و آب‌بندها پرداخته شد. نتیجه آزمایش‌ها نشان می‌دهد که به‌کارگیری ایده‌های مذکور به تفکیک دقیقی از این مناطق انجامیده است.

کلمات کلیدی: طبقه‌بندی محصول، سنجش از دور، Cross NDVI، شبکه کانولوشنی، یادگیری عمیق.

تشخیص خودکار صحنه‌های مشکوک به تقلب در آزمون‌های آنلاین با اعمال ضرایب متفاوت در توابع ارزیاب صحنه

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چکیده

به دلیل افزایش برگزاری آزمون‌های غیرحضوری، تشخیص خودکار صحنه‌های مشکوک به تقلب در آزمون‌های دارای ناظر ویدئویی جدیداً مورد توجه بسیاری از پژوهشگران قرار گرفته است. در این میان کارایی برخی از روش‌های موجود به دلیل حجم بالای پردازش برای نظارت‌های برخط مناسب نمی‌باشد. یکی از این روش‌ها استفاده از توابع ارزیاب صحنه برای تشخیص رخداد تغییرات می‌باشد که در میان آنها روش ارزیابی شباهت ساختاری (SSIM) به دلیل الگوبرداری غیرخطی از ذهن انسان از دقت بالاتری نسبت به سایر روش‌ها برخوردار است. مشکل اصلی این روش میزان تأثیر بالای پیکسل‌های مجاور مستقل از ماهیت نواحی بوده که در این شرایط تغییرات کم‌اهمیت شامل تغییرات زمینه، تغییرات نوری و یا لرزش دوربین، خطای محاسباتی را افزایش می‌دهد. در روش پیشنهادی در ابتدای آزمون هویت فرد آزمون دهنده با استفاده از روش‌های تشخیص چهره مشخص و موقعیت بدنی فرد شامل نواحی صورت و اجزاء بدن به‌صورت نواحی هم مرز تشخیص داده می‌شوند. در ادامه هر یک از بخش‌ها بر اساس حساسیت‌های از پیش تنظیم شده به‌صورت جداگانه به توابع ارزیاب ارسال و در صورت رخداد تغییرات ساختاری به میزان اهمیت آن بخش، در ضریب نهایی تأثیرگذار خواهند بود. در پیاده‌سازی انجام شده مشخص گردید حجم بالایی از فریم‌ها (با وجود تغییرات ساختاری در نواحی بی‌اهمیت) در پردازش اولیه حذف و با کاهش حجم محاسبات، فرایند نظارت جهت تشخیص رخداد تقلب تسهیل می‌گردد.

کلمات کلیدی: تشخیص خودکار تقلب، ناظر ویدئویی آزمون‌های آنلاین، ضرایب متفاوت توابع ارزیاب صحنه، رصد حرکات بدن با توابع ریخت‌شناسی.

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حفظ حریم خصوصی در سیستم بازشناسی ارقام مجزای فارسی مبتنی بر رویکرد یادگیری مشارکتی

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چکیده

یادگیری ماشین یکی از مرسوم‌ترین روش‌های هوش مصنوعی در علوم داده است و در زمینه‌های مختلفی همچون بازشناسی گفتار، واژه‌یابی گفتار و طبقه‌بندی تصاویر مورداستفاده قرار می‌گیرد. مهم‌ترین چالش یادگیری ماشین در سال‌های اخیر باتوجه به سیاست‌ها و قوانین به وجود آمده، حفظ حریم خصوصی داده‌ها است. یکی از پرکاربردترین و با اهمیت‌ترین انواع داده‌ها در تعاملات میان انسان‌ها، انسان و ماشین و ماشین با ماشین، دادگان گفتاری هستند که در اغلب موارد حفظ حریم خصوصی در آن‌ها اهمیت زیادی دارد. در این مقاله، از روش یادگیری مشارکتی به‌عنوان یکی از پرکاربردترین روش‌های حفظ حریم خصوصی دادگان در یادگیری ماشین، در یک سیستم بازشناسی ارقام مجزای فارسی استفاده شده است. سیستم مذکور می‌تواند در گوشی‌های تلفن همراه به عنوان شماره‌گیر تلفنی فارسی، خدمات تلفن‌بانک و سایر کاربردهایی که حفظ حریم خصوصی در آن‌ها اهمیت زیادی دارد، استفاده شود. سیستم بازشناس ارقام مجزای مذکور در دو حالت استفاده از یادگیری مشارکتی و سنتی بر روی دادگان ارقام مجزای فارسی CPHPD پیاده‌سازی شده است. نتایج ارزیابی حاکی از آن است که روش یادگیری مشارکتی در عین حفظ حریم خصوصی داده‌ها، توانسته است با دقت ۹۹/۵۹٪ دادگان گفتاری را تشخیص دهد. این میزان دقت بسیار نزدیک به حالتی است که از سیستم بازشناسی گفتار سنتی استفاده شده و حریم خصوصی داده‌ها نقض شده است. همچنین، نتایج ارزیابی حاکی از آن است که بازشناسی گفتار ارقام مجزای فارسی مبتی بر شبکه‌های عصبی پیچشی در حالت یادگیری مشارکتی، نسبت به سایر رویکردهای سیستم بازشناسی گفتار ارقام مجزای فارسی در حالت سنتی، به‌صورت چشمگیری (۷٪ نسبت به متوسط عملکرد رویکردهای سیستم بازشناسی ارقام مجزا در حالت سنتی) بهتر عمل کرده است.

تشخیص ناپایداری ولتاژ به کمک داده کاوی

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چکیده

این مقاله بر پایه اطلاعات استاتیک محاسبه شده در زمان بعد از اغتشاش تشخیص روشی برای پیش‌بینی وضعیت آینده شبکه قدرت می‌پردازد. ابزار یادگیری استفاده شده در ارزیابی وضعیت پایداری ولتاژ بلند مدت شبکه، شبکه عصبی و اطلاعات مربوط به وضعیت همگرایی در دو وضعیت پخش بار متداول و بدون محدودیت توان راکتیو و ویژگی‌های موثر ژنراتورها، خطوط انتقال و شبکه توزیع ورودی‌های این ماشین و خروجی آن وضعیت پایداری شبکه است. روش پیشنهادی بلافاصله بعد از وقوع اغتشاش به پیش بینی وضعیت آینده سیستم می‌پردازد و در دسته الگوریتم‌های مبتنی بر اطلاعات اندازه‌گیری قرار می‌گیرد و برای انواع اغتشاش های اولیه منتهی به ناپایداری شامل تغییرات بار قابل استفاده است. نکته برجسته این مقاله، دقت صد درصدی الگوریتم در تشخیص سناریوهای ناپایدار (Dependability=۱۰۰٪) و حذف نگرانی اپراتور در خصوص دسته بندی اشتباه وضعیت ناپایدار به عنوان وضعیت پایدار علاوه بر دقت قابل قبول بالای ۹۹ درصدی الگوریتم در دسته بندی سناریوهای پایدار است.

کلمات کلیدی: ناپایداری ولتاژ، پخش بار بدون محدودیت، ویژگی‌های موثر، شبکه عصبی.

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شناسایی خودکار عیوب سطحی کاشی‌های سرامیکی با استفاده از تصاویر دیجیتال

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چکیده

یکی از مراحل مهم و کلیدی در فرآیند تولید کاشی‌های سرامیکی، کنترل کیفیت محصولات است که اکثراً از طریق بازرسی سطوح توسط عوامل انسانی صورت می‌پذیرد. به دلیل سرعت بالای حرکت کاشی‌ها روی نوار در کارخانه و خستگی نیروی انسانی، دقت در شناسایی عیوب کاهش می‌یابد؛ لذا نیاز به یک سیستم کنترل هوشمند جهت بررسی خودکار کاشی‌ها احساس می‌شود. پژوهش‌های گوناگونی تاکنون برای این امر انجام شده اما همگی دارای کمبودهایی هستند و غالباً این پژوهش‌ها روی کاشی‌های ساده انجام‌شده‌اند. در این پژوهش تشخیص عیوب سطحی برای چهار طرح مختلف کاشی بررسی شده است. در روش پیشنهادی از ویژگی‌های آماری و مدل مخلوط گوسی برای شناسایی عیوب سطحی کاشی استفاده شده است. برای این منظور در ابتدا تصاویر کاشی‌های طرح‌دار به قطعه‌های کوچک‌تر شکسته می‌شوند و سپس مجموعه‌ای از ویژگی‌های آماری از این قطعه‌ها استخراج شده که به عنوان ورودی مدل مخلوط گوسی قرار می‌گیرند. خروجی مدل مخلوط گوسی مقدار احتمال درست‌نمایی سالم بودن نمونه ورودی را نشان می‌دهد که با یک آستانه‌گذاری سالم یا معیوب بودن نمونه ورودی مشخص می‌شود. روش پیشنهادی بر روی عیوب مختلف با اندازه‌های متفاوت در چهار طرح کاشی ارزیابی شده که نتایج به دست‌آمده کارایی روشی پیشنهادی به‌خصوص برای کاشی‌های طرح‌دار با بافت ساده را نشان می‌دهد.

کلمات کلیدی: کنترل کیفیت، یادگیری ماشین، مدل مخلوط گوسی، عیوب سطحی کاشی، کاشی‌های طرح‌دار.

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چکیده

با توسعه محیط جهانی وب و شبکه‌های اجتماعی، کاربران می‌توانند دانش و اطلاعات خودرا از طریق مجموعه ابزارها به اشتراک بگذارند.سیستم‌های توصیه گر یکی از موفق‌ترین ابزار برای اشتراک‌گذاری اطلاعات معرفی‌شده است. مسئله‌ای موجود در این سیستم‌ها ارائه پیشنهادهای خوب و مرتبط به کاربران است، این در صورتی امکان‌پذیر است که سیستم بتواند رتبه‌های داده‌شده توسط کاربران به آیتم‌های مختلف را با دقت بالایی پیش‌بینی نماید.در این پژوهش، روش جدیدی خوشه‌بندی گراف و معیار شهرت برای بهبود کارایی سیستم‌های توصیه گر، ارائه‌شده است. سهم اصلی روش پیشنهادی استفاده از معیار شهرت به‌منظور افزایش دقت، برای پیش‌بینی رتبه‌ها برای سیستم‌های توصیه گر می‌باشد.استفاده از خوشه‌بندی گراف و معیار شهرت باعث بهبود عملکرد سیستم‌های توصیه گر می‌شود. ارزیابی نتایج روش پیشنهادی بالای داده‌های movielens انجام‌شده است.ارزیابی این روش با سایر روش ها نشان می‌دهد که، این روش نسبت به سایر روش های مورد آزمایش با استفاده از معیارهای ارزیابی MAE,MSE و RMSE دقت سیستم را افزایش می‌دهد.

کلمات کلیدی: سیستم‌های توصیه گر، تئوری گراف، شبکه‌های اجتماعی، خوشه‌بندی، معیار شهرت.

تایید خویشاوندی از روی تصاویر چهره به وسیله یادگیری سنجه در شبکه‌های عصبی پیچشی

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چکیده

بررسی خویشاوندی با استفاده از تصاویر چهره انسان‌ها یک مسئله چالش برانگیز در بینایی کامپیوتر و بیومتریک است. از جمله چالش‌های این مسئله، استخراج ویژگی مناسب برای توصیف چهره ها و نیز تعیین یک سنجه مناسب برای مقایسه این ویژگی ها و تشخیص خویشاوندی بین چهره‌ها است. در این مقاله، از شبکه عصبی پیچشی VGGFace در ساختار مبتنی بر Siamese برای استخراج ویژگی از تصاویر چهره استفاده می‌شود، و وزن‌های شبکه عصبی در این ساختار، برای نزدیک شدن ویژگی‌های تصاویر دارای خویشاوندی به یکدیگر، با استفاده ازسنجه‌های مختلف (نرم یک، ضرب داخلی و همبستگی) بازتنظیم می‌شود. نتایج روش پیشنهادی روی سه دادگان Cornell، KinfaceW-I، KinfaceW-II نشان می‌دهد که این روش نسبت به دیگر روش‌های تایید خویشاوندی چهره که از شبکه عصبی پیچشی و یادگیری سنجه استفاده می‌کنند، کارآیی بهتری دارد و بر روی این سه دادگان به ترتیب به درصد تشخیص متوسط ۸۳.۵٪، ۸۸.۵٪ و ۷۹.۱٪ دست یافته است.

کلمات کلیدی: تصویر چهره، شبکه عصبی پیچشی، تایید خویشاوندی، سنجه، VGGFace.

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ارائه روشی سبک در مدیریت اعتماد توزیع‌شده در اینترنت اشیا

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چکیده

اینترنت اشیا یک شبکه ناهمگن از اشیا به‌هم پیوسته هست که از طریق اینترنت به‌هم متصل می‌شوند. هدف اینترنت اشیا ایجاد ارتباطی یکپارچه بین اشیا و ارائه خدمات به کاربران است. این شبکه با چالش‌های امنیتی زیادی روبه‌رو می‌باشد. یک سری مکانیزم‌های سنتی برای پرداختن به امنیت و حریم خصوصی مانند کنترل دسترسی و رمزنگاری که برای حفاظت از سیستم در برابر حملات خارجی، ناهماهنگی داده‌ها و حفظ حریم خصوصی ارائه شدند. بااین‌حال مکانیزم‌های سنتی، نمی‌توانند قابلیت اطمینان سیستم را در حضور گره‌های مخرب تضمین کنند. بنابراین به یک روش مدیریت اعتماد برای ایجاد اعتماد بین دستگاه‌ها نیاز است. مدیریت اعتماد یک جنبه حیاتی از امنیت است که هدف از آن حفظ قابلیت اطمینان در یک سیستم و تضمین تبادل ایمن اطلاعات است. در این مقاله یک روش مدیریت اعتماد توزیع‌شده سبک پیشنهادشده است که به محاسبه اعتماد بین اشیا با استفاده از جمع وزنی می‌پردازد که در آن گره‌ها می‌توانند رفتار دیگر گره‌ها را ارزیابی کنند. با توجه به شبیه‌سازی انجام‌شده، روش پیشنهادی در مقایسه با روش‌های دیگر سریع‌تر و در تعداد تراکنش کم‌تری گره‌های مخرب را شناسایی می‌کند و همچنین در برابر حملات روشن و خاموش و بددهانی مقاوم است.

کلمات کلیدی: اینترنت اشیا، مدیریت اعتماد، مدیریت اعتماد توزیع‌شده، ارزیابی اعتماد.

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تشخیص و مکان‌یابی حسگر معیوب با استفاده از مشتق محلی از سیگنال روی گراف

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چکیده

امروزه بسیاری از پدیده‌های محیطی مانند دما، رطوبت و فشار توسط حسگرها ثبت می‌شوند. با استفاده از اطلاعات حسگرها می‌توان محیط را کنترل یا نظارت کرد. از آنجا که گاهی بر روی اطلاعات برخی از حسگرها تغییرات ناخواسته‌ای اعمال می‌شود و فرایند تصمیم‌گیری در آن شرایط با محدودیت‌هایی روبرو می‌شود، بنابراین تشخیص مکان و زمان رخداد این ناهنجاری‌ها حائز اهمیت است. از آنجایی که اطلاعات ثبت شده توسط حسگرها علاوه بر وابستگی زمانی، وابستگی مکانی نیز دارند، می‌توان برای تشخیص ناهنجاری از پردازش سیگنال روی گراف استفاده کرد. در این مقاله داده‌های واقعی شبکه حسگر دما با استفاده از مفاهیم گراف، مدل‌سازی شده و سپس با پردازش سیگنال روی گراف، الگوریتمی پیشنهاد شده است که به تشخیص و مکان‌یابی ناهنجاری می‌پردازد. نتایج شبیه‌سازی، عملکرد بهتر و حجم محاسباتی کم الگوریتم را در مقایسه با الگوریتم‌های موجود تایید می‌کند.

کلمات کلیدی: پردازش سیگنال روی گراف، تشخیص ناهنجاری، مکان‌یابی، فیلتر روی گراف، میانگین محلی.

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بهبود عملکرد شکل‌دهنده پرتو GSC با استفاده از میکروفون خارجی در کاربرد بهسازی گفتار

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چکیده

در دهه‌های اخیر شکل‌دهنده‌های پرتو، به‌وفور در پردازش آرایه‌ای سیگنال واردشده‌اند. شکل‌دهنده پرتو GSC به خاطر توانایی بالا در حذف نویزهای جهتی، در پردازش سیگنال‌های باند پهن همچون بهسازی و مکان‌یابی گفتار، به‌طور گسترده استفاده می‌شود. در کاربردهایی که فاصله بین میکروفونی به خاطر محدودیت فیزیکی بسیار کم است، ویژگی‌های مکانی بین میکروفون‌ها در هر برداشت زمانی به‌قدر کفایت متمایز نبوده و این امر منجر به محدودیت در میزان حذف نویز و عوامل ناخواسته می‌شود. با واردکردن میکروفون خارجی در اطراف همان فضای فیزیکی، تنوع مکانی بین میکروفون‌ها بیشتر شده که به‌طور بالقوه سبب حذف بیشتر نویز و عوامل نامطلوب می‌شود. یک استراتژی برای واردکردن میکروفون خارجی در چارچوب شکل‌دهنده پرتو GSC منجر به ساختار جدیدی به نام GSC-XM می‌شود که عملکرد بهتری نسبت به شکل‌دهنده پرتو GSC دارد. در این مقاله ساختار شکل‌دهنده پرتو جدیدی به‌عنوان AGSC-XM پیشنهاد می‌شود که ضمن حفظ مزایای شکل‌دهنده پرتو GSC-XM در استفاده از میکروفون خارجی، نیاز به تخمین موقعیت میکروفون خارجی نداشته و با نشت گفتار در نویز مرجع تولیدشده تا حد زیادی مقابله می‌کند. بررسی نتایج شبیه‌سازی در حضور چهار نویز معروف pink، white، babble و brown بهبود عملکرد AGSC-XM نسبت به GSC-XM را تائید می‌نماید.

کلمات کلیدی: شکل‌دهنده پرتو حذف‌کننده لوب فرعی تعمیم‌یافته (GSC)، میکروفون خارجی، تابع انتقال نسبی، بهسازی گفتار، نشت گفتار.

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تشخیص توده‌های خوش‌خیم و بدخیم در سرطان سینه با استفاده از ترکیب ویژگی‌های بافتی و مرزی

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چکیده

سرطان سینه شایع‌ترین نوع سرطان، به ویژه در میان زنان و یکی از کشنده ترین نوع آن‌هاست. تشخیص دقیق و زودهنگام این بیماری به عنوان کمک بزرگی در نجات جان بیماران به شمار می آید. روش‌های مختلفی برای تشخیص سرطان سینه وجود دارد، مانند: تصویربرداری ماموگرام، اولتراسوند، پزشکی هسته ای وسایر موارد. در بین روش‌های موجود، ماموگرافی یکی از قابل اعتمادترین روش‌ها برای تشخیص زودهنگام سرطان سینه و معالجه آن بوده و نرخ مرگ و میر حاصل از این سرطان را به طور چشمگیری کاهش داده است. در سیستم پیشنهادی با استفاده از ویژگی های بافتی و مرزی توده های سرطان سینه که بر روی تصاویر پایگاه داده استاندارد MIAS انجام می گیرد، به دقت قابل قبولی برای تفکیک توده ها دست پیدا کردیم. در ادامه با ترکیب ویژگی های بافتی و مرزی می توان به نقطه تمایز خوبی بین توده های خوش‌خیم و بدخیم دست پیدا کرد. در آخر از طبقه بند های SVM و ELM استفاده شد، که نتایج دقت طبقه بندی به ترتیب ۹۳.۰۲٪ و ۹۷.۴٪ حاصل شد.

کلمات کلیدی: سرطان سینه، ماتریس GLCM، ویژگی مرزی BIBS، طبقه بند ELM، ماتریس درهم ریختگی.

آشکارسازی و دسته بندی صوتی ریزپرنده‌ها با ساختار یکپارچه و سریع به کمک شبکه‌های عصبی کانولوشنی یک بعدی

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چکیده

استفاده از ریزپرنده‌ها در امور تجاری و نظامی گسترش فراوانی پیدا کرده و باعث تسهیل در انجام بسیاری از کارها شده است. در این میان امکان استفاده نادرست و تهدید آمیز از آنها بالا رفته و باعث یک تهدید جدی گردیده و از این رو شناسایی و مقابله با این تهدید، جزء دغدغه‌های اصلی سیستم‌های امنیتی شده است. در این مقاله این مهم مورد توجه قرار گرفته و در این راستا از شبکه‌های عصبی کانولوشنی یک بعدی جهت طراحی شبکه‌ای کارا و سریع در پردازش صدای دریافتی از محیط و آشکارسازی و دسته‌بندی کوادکوپترها در صورت وجود در محیط اطراف استفاده شده است. از ویژگی‌های بارز شبکه طراحی شده این است که با توجه به طراحی ابتدا به انتهای آن، مراحل استخراج ویژگی جداگانه از صدا که روشی معمول در پردازش صدا می‌باشد حذف شده است. شبکه طراحی شده علاوه بر ارزیابی با پایگاه داده موجود در مقالات، با پایگاه داده‌ای که با داده‌های واقعی و محیطی تهیه شده نیز مورد ارزیابی قرار گرفته است. نتایج بدست آمده از ارزیابی شبکه، دقت تشخیص بالای ٪۹۱ ، دقت دسته‌بندی بالای ٪۹۰ و کاهش هزینه‌های محاسباتی نسبت به روش‌های معمول معرفی شده در مقالات را تا ٪۷۷ را نشان می‌دهد.

کلمات کلیدی: ریزپرنده‌ها، آشکارسازی و دسته‌بندی صوتی سریع ، شبکه های کانولوشنی یک‌بعدی .

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تحلیل احساسات در زبان فارسی با استفاده از شبکه‌های عمیق بازگشتی دو طرفه و بیش‌نمونه‌برداری

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چکیده

گسترش روز افزون استفاده از شبکه‌های اجتماعی باعث تولید حجم بزرگی از داده‌ها شده است که درصد عمده‌ای از آنها داده‌های متنی هستند. روش‌های نوین پردازش زبان طبیعی مبتنی بر یادگیری عمیق برای استخراج اطلاعات از این داده‌ها به ما کمک می‌کند و باعث افزایش دقت و سرعت در کار می‌شود. تحلیل احساسات متن، یک مسئله در پردازش زبان طبیعی است که هدف آن تعیین میزان مثبت یا منفی بودن یک متن می‌باشد. با وجود پتانسیل بالای زبان فارسی، چالش‌هایی وجود دارد که باعث عدم توسعه‌ی یک مدل مناسب برای تحلیل احساسات در زبان فارسی شده است. در این پژوهش با ترکیب دو مدل یادگیری عمیق یعنی مدل‌های حافظه کوتاه‌مدت طولانی دو طرفه (BiLSTM) و واحد بازگشتی گیت‌گذاری شده دو طرفه (BiGRU) و نیز استفاده از روش‌های پیش‌پردازش مناسب و جاسازی کلمات، مدلی برای تحلیل احساسات در زبان فارسی ارائه شده است. با آموزش و ارزیابی این مدل بر روی مجموعه داده SentiPers که شامل نظرات کاربران وب‌سایت دیجی‌کالا است، پس از متوازن سازی داده‌ها، دقت ۹۲.۷ درصد به دست آمد.

کلمات کلیدی: تحلیل احساسات، یادگیری عمیق، شبکه حافظه طولانی کوتاه‌مدت، واحد بازگشتی گیت‌گذاری شده، جاسازی کلمات.

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بهبود پارامترهای میدان صدا به منظور ایجاد و بازتولید منطقه‌ی صوتی شخصی با بهره‌گیری از پردازش آرایه‌ای سیگنال بلندگوها

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چکیده

در این مقاله، پس از معرفی روش‌های مطرح برای ایجاد منطقه‌ی صوتی شخصی و بازتولید میدان صدا، روش‌های مبتنی بر رویکرد سنتز میدان صدا به عنوان گزینه‌ای مطلوب انتخاب می‌شود. در ادامه، با به کارگیری هندسه‌های کارا و بهینه، عملکرد میدان صدا با استفاده از روش‌های تبدیلِ SP-DS و بهره‌گیری از فیلترهای WFR مورد بررسی قرار گرفته و با ارزیابی توسطِ معیارهای توزیع فشار صدا، میانگین زمانی مربع خطا، کنتراست صوتی بین نقاط مختلفِ منطقه‌ی صدا و تعداد المان، موردِ تجزیه و تحلیل واقع می‌شود. با فرض عدم حضور بافل کروی، عملکرد بهینه روش مورد بررسی از لحاظ توزیع فشار صدا، با به کارگیری آرایه‌های بلندگوی دایره‌ای و میکروفن خطی حاصل می‌شود. همچنین با فرض حضور بافل کروی، به کارگیری آرایه‌های بلندگوی دایره‌ای و میکروفن هلالی شکل در بهبود فشارصدا توسط روش مذکور، نتیجه‌ی مطلوبی را ارائه می‌دهد. در این مقاله ضبط و بازتولید میدان صدا با اطلاع از مکان منبع و استفاده از آرایه‌های دایره‌ای نیز مورد تجزیه و تحلیل قرار می‌گیرد که نتایج حاکی از عملکرد مطلوب آن از لحاظ توزیع فشار صدا است. همچنین با به‌کارگیری آرایه‌های هلالی‌شکل و نیم‌دایره‌ای بهبود قابل قبولی در کاهش خطا در مناطق با وسعت قابل توجه حاصل می‌شود.

کلمات کلیدی: ایجاد منطقه‌ی صوتی شخصی، بازتولید میدان صدا، آرایه‌های بلندگو، پردازش آرایه‌ای.

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تخمین توان دریافتی و کیفیت ارتباط کاربران تلفن همراه با استفاده از شبکه عصبی

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چکیده

با ورود نسل چهارم تلفن همراه به عنوان یک تکنولوژی جدید در زندگی بشر ، بررسی عملکرد و توسعه این سیستم‌ها به بخش انکار ناپذیری از علم مهندسی مخابرات تبدیل شده است. تخمین توان دریافتی در سیستم‌های مخابرات بی‌سیم به جهت طراحی یک شبکه با کیفیت و پوشش مناسب از اهمیت ویژه‌ای برخوردار است. مدل‌های انتشار رادیویی به دلیل رفتار بسیار پیچیده و پارامترهای بسیار گوناگون آن همواره با چالش روبه رو بوده است. روش‌های فیزیکی محاسبه تلفات باتوجه به محدودیت‌های محاسباتی و شرایط متفاوت محیطی امکان پذیر نمی‌باشد. از طرفی با استفاده از روش‌های آماری، بدون نیاز به شبیه‌سازی همه شرایط محیطی، می‌توان تلفات محیط را به صورت محلی تخمین زد. در این مقاله یک روش تخمین توان دریافتی و کیفیت ارتباط شبکه تلفن همراه نسل چهارم بررسی شده است همچنین با استفاده از توان دریافتی تخمین زده شده، کیفیت ارتباط را پیش‌بینی می‌کند. در این مقاله با استفاده از شبکه عصبی مصنوعی MLP عملیات رگرسیون به جهت تخمین توان دریافتی بر حسب فاصله در محیط شهری انجام شده است. طرح پیشنهادی با روش‌های فیزیکی و آماری مختلف مقایسه شده است. نتایج شبیه‌سازی نشان می‌دهد روش پیشنهادی با دقت خوبی می‌تواند قدرت سیگنال دریافتی در داده‌های آزمون را برای محیط مورد نظر تخمین بزند و با استفاده از توان دریافتی کیفیت ارتباط را پیش‌بینی کند روش پیشنهادی قادر است ۷۱.۰۹ برابر دقیقتر از مدل هاتا، قدرت سیگنال دریافتی را تخمین بزند.

کلمات کلیدی: نسل چهارم، شبکه‌های عصبی، انتشار امواج، رگرسیونMLP .

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بکارگیری دسته‌بند نایو بیز در استخراج ویژگی‌های موثر و بهبود تشخیص نفوذ

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چکیده

پیشرفت شبکه‌های کامپیوتری سبب شده که امنیت به عنوان مولفه‌ای مهم در مدیریت شبکه مورد توجه قرار گیرد. بر این اساس سیستم‌های تشخیص نفوذ به عنوان ابزاری ارزشمند جهت حفاظت از داده‌ها، سیستم‌ها و کاربران، برای کشف حمله و تشخیص مشکلات امنیتی به کمک مدیران شبکه آمده‌اند. هدف این مقاله ارائه ابزار تشخیص نفوذ با روش‌های یادگیری ماشین است. در این مقاله انتخاب زیر مجموعه ویژگی‌های موثر به صورت پیشرو مبتنی بر تئوری بیز ارائه شده که به دلیل انتخاب ویژگی‌های موثر و حذف ویژگی‌های زائد و همچنین استفاده از دسته‌بند نایو بیز سبب افزایش دقت و سرعت در یادگیری شده است. به منظور ارزیابی عملکرد روش پیشنهادی مجموعه داده (NSL-KDD) مورد استفاده قرار گرفته و دقت روش پیشنهادی با روش FVBRM مبتنی بر تئوری بیز و FS-SVM مبتنی بر الگوریتم تخمین توزیع مقایسه شده است. روش پیشنهادی قادر بوده که دقت بالاتری در دسته‌بندی دوکلاسه نسبت به روش FVBRM حاصل نماید. در قیاس با روش FS-SVM در دسته‌بندی چندکلاسه، روش پیشنهادی توانسته در مورد حملاتی که تعداد کمی نمونه در مجموعه داده استاندارد داشته به خوبی عمل کرده و دقت تشخیص را به صورت قابل ملاحظه‌ای افزایش داده و باعث بهبود دقت تشخیص دسته حملات شود.

کلمات کلیدی: سیستم تشخیص نفوذ، مجموعه داده NSL-KDD، انتخاب ویژگی پیشرو، دسته‌بند نایو بیز، کاهش داده.

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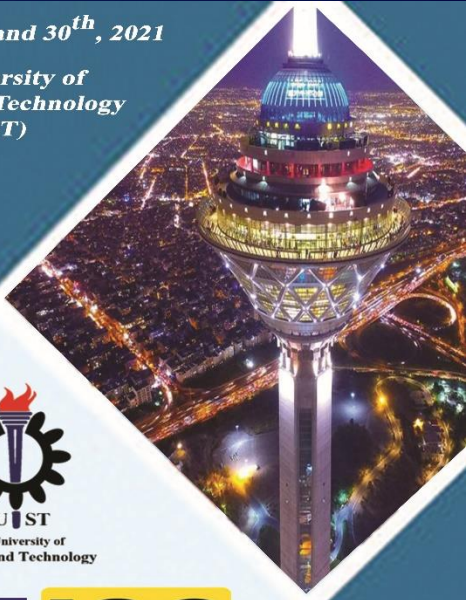

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