Titles and Abstracts

Note: Titles and Abstracts are tentative can be changed later as per requirements.

Domain: Wireless Communications

Project Code: WL01-2021

Title: Channel Estimation and Equalization for CP-OFDM-based OTFS in Fractional Doppler Channels

Abstract: Orthogonal time frequency and space (OTFS) modulation is a promising method that can meet the high Doppler requirements of future mobile systems. The delay-Doppler (DD) domain is used to encode information symbols and pilot symbols in the two-dimensional (2D) delay-Doppler (OTFS) domain. The received symbols suffer from inter-Doppler interference (IDI) in the fading channels with fractional Doppler shifts that are sampled at non-integer indices in the DD domain. IDI has been treated as an unavoidable effect because the fractional Doppler shifts cannot be obtained directly from the received pilot symbols. In this paper, we provide a solution to channel estimation for fractional Doppler channels. The proposed estimation provides new insight into the OTFS input-output relation in the DD domain as a 2D circular convolution with a small approximation. According to the input-output relation, we also provide a low-complexity channel equalization method using the estimated channel information. We demonstrate the error performance of the proposed channel estimation and equalization in several channels by simulations. The simulation results show that in high-mobility environments, the total system utilizing the proposed methods outperforms orthogonal frequency division multiplexing (OFDM) with ideal channel estimation and a conventional channel estimation method using a pseudo sequence.

Project Code: WL02-2021

Title: PAPR and Symbol Error Rate Performance Analysis of OFDMA and SCFDMA methods

Abstract: The single carrier multiple access scheme (SC-FDMA) is a novel method of radio transmission currently used in long term evolution (LTE) technology for uplink due to its high spectral efficiency with low bit error rate and lower peak-to-average power-ratio (PAPR) as compared to OFDM technique. Matlab simulation has been carried out to obtain PAPR performance of SC-FDMA and OFDMA techniques with different numbers of subcarriers. Two different approaches of assigning subcarriers have been assumed, distributed FDMA (DFDMA) and localized FDMA (LFDMA). Interleaved FDMA (IFDMA) is a special case of DFDMA where distribution of DFT outputs have been done uniformly with equal distance. Comparing the forms of SC-FDMA, we find that interleaved (FDMA) has lower PAPR than localised (FDMA). We also discuss the SER (Symbol Error Rate) performance of both LFDMA and IFDMA schemes and find that the SER performance of localised (FDMA) is better than interleaved (IFDMA) technique.

Project Code: WL03-2021

Title: Wideband Millimetre-wave OFDM Uplink with Hybrid Receiving

Abstract: In this paper, we study millimetre-wave orthogonal frequency division multiplexing uplink transmission with a wide bandwidth and hybrid receiving. By considering the spatial- and frequency-wideband effects in the channel model, the spectral efficiency of the system is analysed. The analysis and the simulation results show the beam squint effect caused by the wideband effects. Moreover, the impacts of the bandwidth and the number of subcarriers on the beam squint effect are revealed.

Project Code: WL04-2021

Title: Blind Channel Estimation for DCO-OFDM based Vehicular Visible Light Communication

Abstract: Visible light communication (VLC) is considered as a complementary technology to radio frequency (RF) based solutions in vehicular communication due to its relatively high and licence-free bandwidth, high security and low cost. Direct Current-Biased Optical Orthogonal Frequency Division Multiplexing (DCO-OFDM) is a strong candidate for vehicular VLC (V2LC), meeting the high rate data sharing requirements of autonomous and connected vehicle applications, due to its robustness, high spectral efficiency and capability of dealing with inter-symbol interference (ISI). Blind channel estimation (CE) methods for OFDM systems in the RF literature, which are also applicable to VLC systems, provide high rate communication by eliminating pilot overhead in conventional pilot based CE methods, at the cost of higher complexity and lower CE accuracy. On the other hand, in the VLC literature, there is no work regarding blind CE for OFDM systems. In this paper, we propose a novel blind CE method for V2LC with the goal of improving the CE accuracy based on the exploitation of the real data based channel characteristics. First, the normalized channel frequency response (CFR) of the V2LC channel is demonstrated to be invariant of inter-vehicular distance, relative transmitter (TX)/receiver (RX) zenith angle and ambient light based on the real vehicle-to-vehicle (V2V) communication data. This channel characteristic is then exploited in the blind CE to estimate the value of only the normalization factor instead of the separate estimation of channel state information (CSI) at each subcarrier. Extensive simulations at different vehicle speeds show that the proposed method outperforms the pilot based CE methods in both the average throughput and bit error rate (BER) for all modulation schemes, excluding 64-QAM DCO-OFDM due to the unavailability of an optimal estimator for practical reasons. Moreover, the real-time performance of the proposed blind CE is demonstrated to be very close to the maximum throughput of each modulation scheme at high signal-to-noise ratio (SNR) levels, for the realistic vehicle mobility scenario extracted from Simulation of Urban Mobility (SUMO).

Domain: Digital Image Processing

Project Code: IM01-2021

Title: A Novel Multi-Modality Anatomical Image Fusion Method Based on Contrast and Structure Extraction

Abstract: Image modalities, such as computed tomography (CT), magnetic resonance imaging (MRI), single-photon emission computed tomography (SPECT), and so on, reflect various levels of details about objects of interest that help medical practitioners to examine patients' diseases from different perspectives. A single medical image, at times, may not be sufficient for making a critical decision; therefore, providing detailed information from a different perspective may help in making a better decision. Image fusion techniques play a vital role in this regard by combining important details from different medical images into a single, information enhanced image. In this article, we present a novel weighted term multimodality anatomical medical image fusion method. The proposed method, as a first step, eliminates the distortions from the source images and afterward, extracts two pieces of crucial information: the local contrast and the salient structure. Both the local contrast and salient structure are later combined to obtain the final weight map. The obtained weights are then passed through a fast-guided filter to remove the discontinuities and noise. Lastly, the refined weight map is fused with source images using pyramid decomposition to get the final fused image. The proposed method is accessed and compared both qualitatively and quantitatively with state-of-the-art techniques.

Project Code: IM02-2021

Title: Saliency-Based Region Detection and Image Segmentation of COVID-19 Infected Cases

Abstract: Noise or artifacts in an image, such as shadow artifacts, deteriorate the performance of stateof-the-art models for the segmentation of an image. In this study, a novel saliency-based region detection and image segmentation (SRIS) model is proposed to overcome the problem of image segmentation in the existence of noise and intensity inhomogeneity. Herein, a novel adaptive level-set evolution protocol based on the internal and external functions is designed to eliminate the initialization sensitivity, thereby making the proposed SRIS model robust to contour initialization. In the level-set energy function, an adaptive weight function is formulated to adaptively alter the intensities of the internal and external energy functions based on image information. In addition, the sign of energy function is modulated depending on the internal and external regions to eliminate the effects of noise in an image. Finally, the performance of the proposed SRIS model is illustrated on complex real and synthetic images and compared with that of the previously reported state-of-the-art models.

Project Code: IM03-2021

Title: Multimodal medical image fusion algorithm in the era of big data

Abstract: In image-based medical decision-making, different modalities of medical images of a given organ of a patient are captured. Each of these images will represent a modality that will render the examined organ differently, leading to different observations of a given phenomenon (such as stroke). The accurate analysis of each of these modalities promotes the detection of more appropriate medical decisions. Multimodal medical imaging is a research field that consists in the development of robust algorithms that can enable the fusion of image information acquired by different sets of modalities. In this paper, a novel multimodal medical image fusion algorithm is proposed for a wide range of medical diagnostic problems. It is based on the application of a boundary measured pulse-coupled neural network fusion strategy and an energy attribute fusion strategy in a non-subsampled shearlet transform domain.

Project Code: IM04-2021

Title: Lane detection technique based on perspective transformation and histogram analysis for self-driving cars

Abstract: In image-based medical decision-making, different modalities of medical images of a given organ of a patient are captured. Each of these images will represent a modality that will render the examined organ differently, leading to different observations of a given phenomenon (such as stroke). The accurate analysis of each of these modalities promotes the detection of more appropriate medical decisions. Multimodal medical imaging is a research field that consists in the development of robust algorithms that can enable the fusion of image information acquired by different sets of modalities. In this paper, a novel multimodal medical image fusion algorithm is proposed for a wide range of medical diagnostic problems. It is based on the application of a boundary measured pulse-coupled neural network fusion strategy and an energy attribute fusion strategy in a non-subsampled shearlet transform domain.

Project Code: IM05-2021

Title: Robust fuzzy c-means clustering algorithm with adaptive spatial & intensity constraint and membership linking for noise image segmentation

Abstract: The fuzzy C-means (FCM) clustering method is proven to be an efficient method to segment images. However, the FCM method is not robustness and less accurate for noise images. In this paper, a modified FCM method named FCM_SICM for noise image segmentation is proposed. Firstly, fast bilateral filter is used to acquire local spatial & intensity information; secondly, absolute difference image between the original image and the bilateral filtered image is employed and the reciprocal of the difference image and the difference image itself constrain conventional FCM as well as the local spatial & intensity information respectively; finally, membership linking is achieved by summing all membership degrees calculated from previous iteration within every cluster in squared logarithmic form as the denominator of objective function.

Project Code: IM06-2021

Title: Multi-Modal Medical Image Fusion using Laplacian Re-Decomposition Framework

Abstract: Multimodal medical image fusion has become a powerful tool in clinical applications. The main aim is to fuse different multimodal medical images, obtained from different imaging modalities, into a single fused image that is extensively used by the physicians for explicit diagnosis and treatment of diseases. The field of multimodal medical image fusion has made huge progress in the past decade. However, previous methods always suffer from color distortion, blurring and noise. A novel Laplacian re-decomposition framework adapted to the multimodal medical image fusion in this work has been proposed to find out the solution.

Project Code: IM07-2021

Title: Brain Tumour segmentation using CNN and Multi SVM methods

Abstract: Among the currently proposed brain segmentation methods, brain tumor segmentation methods based on traditional image processing and machine learning are not ideal enough. Therefore, deep learning-based brain segmentation methods are widely used. In the brain tumor segmentation method based on deep learning, the convolutional network model has a good brain segmentation effect. The convolutional network model has the problems of a large number of parameters and large loss of information in the encoding and decoding process. This paper proposes a convolutional neural network fusion support vector machine algorithm (CNN-MSVM). The proposed brain tumor segmentation model is presented in the form of a GUI using Matlab tool.

Project Code: IM08-2021

Title: Skin Cancer Detection System using GLCM and SVM

Abstract: Cancer image classification is an important task to generate classification maps as no of world observation cancer increasing day by day. These cancers contain different tools capable of capturing imagery time to time and utilized for a wide range of application. Thus, classification of cancer imagery has current area of researches and classification results can be used for different real-time application. This system proposed a novel approach for classification of six different classes: actinic keratosis, Basel cell carcinoma, cherry nevus, dermatofibroma, Melanocytic nevus and Melanoma by utilizing Cancer imagery.

Project Code: IM09-2021

Title : Medical Image Denoising using Unique Woelfel Image Noise Filter

Abstract : The goal of this project was to explore methods of image processing in MATLAB by expanding the use of FIR filters into two dimensions. A brain BMP scan was used as the base image signal. Noise was randomly added to each pixel of the base image. Two FIR filters were tested to analyze and compare their performance in terms of SNR improvement and output image quality. The PSD of the uniquely filtered image had no ringing but allowed a small amount of information to pass through from the edges of the PSD in a uniform shape. This PSD matched the original image much more closely than the lowpass filtered PSD. The unique filter performed better than the ideal lowpass filter in every way. The SNR was improved, and more information was recovered from the original BMP scan. This unique filter design was more complicated and required more tuning to ensure a good performance for this image, but the lowpass filter was not precise enough to remove the noise without also blurring the information.

Project Code: IM10-2021

Title : Parking Spot Detection using Morphological enhancement and Bounding Box methods

Abstract : As the number of vehicles are increasing day by day the need of parking spots is also increasing rapidly. To deal withthis issue large parking lots are being constructed. Specificallyin metropolitan cities multi storey parking are becomingcommon but managing these parking lot is not an easy taskas it is not humanly possible to keep a track of total number of cars in the parking lot.This is a software that has been created and testedusing MATLAB. The objective of the project is basically to useimage processing to identify or detect parking spots in a parkinglot. It uses multiple steps from reading the image to giving totalnumber of parking spots available. It can be implemented on ahigher level using cameras covering the parking lot to acquireimages of the lot which can be processed further in the software.This project can be a great economic alternative option forparking detection.

Project Code: IM11-2021

Title :Cervical Cancer Cell detection using Jaccard Coefficient and Morphology

Abstract : Cervical cancer growth in women is a standout amongst the most widely recognized tumors around the world, next just to bosom disease. Moderately aged ladies between the ages of 40-55 years are for the most part influenced by this malignancy. Consistently cervical is analyzed in around 500,000 ladies comprehensively and is in charge of in excess of 280,000 deaths yearly. These days there is a wide variety in the quantity of cervical malignancy cases over the globe. Hazard factors incorporate smoking, unprotected sex or having HIV disease, delayed utilization of anti-conception medication pills. In the western side, pervasiveness of this illness is steadily diminishing a result of the early identification through customary screening. 80% of the new cervical malignant growth cases happen in creating nations, similar to India, which reports around 1/4th of the world's instances of cervical disease every year.Cervical Cancer is one of the most common cancers among women worldwide. The proposed system will reduce the workload on clinicians and makes the diagnosis of cancer faster, economical, and more accurate by making use of image processing techniques .Pathologists can use this method as a decision support in detecting cancer. This will reduce the workload on clinicians and makes the diagnosis of cancer faster, economical and more accurate.