Region Based Image Indexing and Retrieval System

By

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(121397005)

Under Guidance of

Prof.(Mrs.) P. P. Rege

***Abstract:***

Content based image retrieval (CBIR) system is developed for accessing digital images from large image database. To improve the performance of CBIR system, Region based approach for image retrieval system is gaining a considerable attention in research area. Region based image retrieval (RBIR) system focuses on content from regions of images. Although various RBIR techniques have been developed, there are still many problems not satisfactorily solved. In this paper, a effective region based image indexing and retrieval (RBIR) framework is proposed. The proposed approach employs fast and effective statistical region merging (SRM) algorithm to segment images into meaningful regions and each region is then represented using feature vector which describes the color and texture features of region. These feature vectors are used to perform image indexing and retrieval process. Further to improve the retrieval speed and performance, images with similar regions are grouped together. Color moment, HSV color histogram and autocolor correlogram is used to extract color features whereas Gabor function is used to extract texture features from region. Experimental results and performance measurement shows the efficiency and reliability of proposed RBIR system.

***Kywords*-** Content based image retrieval (CBIR), Region based image retrieval (RBIR), Statistical region merging (SRM), Image segmentation, Indexing and retrieval system, color moment, HSV histogram, Gabor filter.

Three Phase Static Voltage Regulator Control

By

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Under Guidance of

Prof. Mr. S. G. Mali

In power systems voltages are largely affected by large load changes (non-linear/complex loads), capacitor switching. So it is the basic need in power systems to make the output voltages given to load unaffected by the different unwanted events like sags, swells, harmonics, fluctuations. Three Phase Static Voltage Regulator (SVR) is power electronics based device which protects the non-linear, complex loads by maintaining the output voltage within permissible limits irrespective of the voltage sags, voltage swell, transient voltage, harmonics, overvoltage, undervoltage and phase unbalance. When such events occur in power systems the whole system can get collapsed. The important point to overcome all these problems is the controlling method used for the operation of switching devices. There are different controlling schemes available like Sinusoidal pulse width modulation, SVPWM etc.

The operating principle of semiconductor devices/switches in SVR is based on pulse width modulation. The duty cycle of input pulses to these switches is adjusted by using Space Vector Pulse Width Modulation (SVPWM) technique which provides better results over Sinusoidal Pulse Width Modulation (SPWM). This project topic proposes the controlling scheme for three phase static voltage regulator using Space Vector Pulse Width Modulation (SVPWM) technique. In this project I have implemented the most efficient algorithm for SVPWM which requires very less computations and computation time for the proper operation of Static Voltage Regulator.

**“To develop Noise reduction technique for medical images using Transform Domain Approach”**

By

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(121397001)

Under Guidance of

**Prof. A.M.Sapkal**

Image denoising using wavelets is important area in image preprocessing. Many researchers worked in this domain and suggested variety of denoising algorithms or suggested modifications in existing algorithms but in this dissertation we haveproposed generalized methodology using Rotated wavelet filter (RWF /RDWT) which will improve the performance of any wavelet based denoising algorithms if energy and standard deviation test is satisfied. In this work we claimed three contributions based on RWF. First contribution is successful use of Rotated wavelet filters in wavelet based image denoising application for the first time. Second contribution is about the suitability of Rotated wavelet filters for performance improvement of image denoising algorithm based on image type and the third contribution is the extension of concept of rotated wavelet filter for Dual Tree DWT. We have verified the performance of the RWF with Sure Shrink, Bayes Shrink and Visu Shrink denoising algorithm. The proposed methodology tested for medical (Ultrasound and X-Ray) images and proved significant improvements in quality measures PSNR and SSIM compared with the regular wavelet based approaches. Computational complexity of the suggested algorithm is same as discrete wavelet transform based algorithms in 2-D frequency domain platform.

**Keywords:**Image denoising; Rotated wavelet filter; discrete wavelet transform; Peak Signal to Noise Ratio; Structural Similarity Index Matching.



SEARCH PATTERN IMPROVEMENT

USING CONTENT BASED ADAPTIVE

SEARCH IN HEVC

By

**Abhijeet Kailas Ghodke**

(121397006)

Under the guidance of

**Prof. Mrs. V. N. More**

**Abstract**

Visual communication via mobile devices is becoming more and

more popular.Whether we are watching TV,video clips on social sites

like Whatsapp, Facebook ,You-tube or video chatting on Skype to

survillance at critical places or industry, we daily deal with di\_erent

kinds of videos directly or indirectly.Video has become an integral

and important part of our lives.People watching videos, are concerned

about its quality and speed. Di\_erent compression standards like

MPEG-1,MPEG-2,MPEG-4,H.264 reduced size if storage, improved

quality of video to a great extent.To deal with growing video tra\_c,

quality and storage requirements,HEVC has been \_nalized in January

2013.

Content based adaptive search is introduced in Test Zone Search

algorithm during motion estimation and implemented in HEVC/H.265

standard. This thesis deals with content based adaptive pattern imple-

mentation where proposed algorithm classi\_es video content according

to type of motion present and then applies separate set of search pat-

tern for separate video motion.

The proposed algorithm used in HEVC/H.265 applied for variety

of video resolutions starting from QCIF,CIF to beyond HD videos like

FullHD and QuadHD and compared with Test Zone Search and Full

Search. The proposed algorithm provides remarkable saving in To-

tal Encoding Time(TET) and Total Motion Estimation Time(TMET)

and even higher savings at higher video resolutions like FullHD,QuadHD

without much signi\_cant loss in video quality(Y-PSNR) at cost of Bi-tRate(BR)

**Multimodal Biometric Person Authentication Using Genetic Algorithm**

By

**Preethi Medukonduru**

MIS No: 121397010

Under the guidance of:

**Dr.M.A.Joshi**

Multimodal biometric systems, by combining two or more biometric features into a single identification, achieve very high recognition rates. They thus find application in high security environments for authentication. However they often suffer from problems like noisy data, high dimensionality, speed of operation etc. that limit the accuracy and efficiency of the system. To overcome these, we propose usage of Genetic Algorithm (GA) at two stages of the multimodal biometric systemie.,for input image enhancement and for optimizing fusion strategy. Three new GA based algorithms for noise reduction, image enhancement and optimal weight selection during feature concatenation respectively are introduced.An improved recognition performance with a decrease of 6.25 % in error with respect to the reference system is achieved by designing appropriate fitness functions of GA. A flexible multimodal biometric system that can be switched between a highly secure system with a minimal FAR and a generally acceptable system with high GARis designed.

Semi Elliptical Search Pattern for Angular Motion Estimation in H.264/AVC

By

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(121397011)

Under Guidance of

Dr. M. S. Sutaone

***Abstract:***

After the development of first Television, video technology has taken great leap. Initially with analog television it was hardly possible to record and store videos in the black and white format. But in late 1970 and early 1980 new era has began i.e. digitization and video technology drawn attention of not only researchers but also whole world. It was great task of recording and storing entire digital video on limited size of storage devices and therefore lot of work was being done on the improvement of video quality with reduced size. And today everywhere there is application of image and video processing. It has become inevitable part in 21 st century. Nowadays there are different applications where video processing is used and these applications have different quality requirements. With development of HDTV(1080x720), Full HD (1920x1080), ultra HD (3840x2160) and 4k (4096x2160) videos, it has become quite cumbersome to develop tecnological solution. Researchers have come up with technological solution by developing new standards like H.264/AVC, H.265, JPEG-2000, etc. which are advancements of earlier standars and being updated timely to meet the challenges of todays technology.

H.264/AVC is most popular video processing standard today and x264 is the encoder used for implementation of video processing.These days videos have large size and therefore are visually pleasant but have large redundancy present in it, which could be removed by using efficient algorithm for processing. The main task of video processing is predicting an object in the current frame and reference frame, called motion estimation. Motion estimation and its prediction in videos have always taken the centre stage in the video encoding technology. The accurate estimation of the motion means movement of an object in present and next frame and it is encoded in the form of Motion Vector (MV). Though H.265, an improved version of H.264, published recently, all hardware implemntations are deployed using x264, therefore still there is scope of advancement in H.264 for deployed software.

H.264 video standard has Full Search, Fast Full Search (FFS), Uneven Multi Hexagon grid Search(UmHeX), UmHeX simplified and Enhanced Predictive Zonal Search (EPZS) algorithms already implemented for motion estimation. These algorithms are mainly focused on prediction using minimal number of points and used two levels of refinement i.e. Integer pel and Subpel (or fractional pel). The algorithm developed in this thesis, called Semi Elliptical Search, finds the direction of displacement of block in a frame, use this information to apply Semi Elliptical Pattern in that direction to get best match. The main advantage of this algorithm is, it works on Interpolated frame and need not require two levels of refinements and also number of search points are reduced. After first step Semi Elliptical Pattern will converge and therefore exactness will increase, hence result into good quality video.

Feature Extraction from Microwave Data using Backscatter Coefficient

By

Snehal Padhye

(121397014)

Under Guidance of

Prof.(Mrs.) P. P. Rege

Earth has plethora of geographical features. Satellite images provide aid in analysing such enormous amount of data. Different images captured at different wavelength provide useful information. For example, visible, panchromatic and infra-red images are used for mapping land and land cover. Some planetary objects in space under study would give different behaviour for different spectrums. This helps in studying and analysing geographical and physical structures. Imaging under microwave frequencies has benefits of its own. It is an active type of remote sensing which is not affected by atmospheric obstructions which proves crucial during disaster management and relief planning. This project aims at processing a microwave image to extract water bodies from it. A RISAT-1(Radar Imaging Satellite) product is used for the investigation. A digital elevation model can be used to render a three dimensional information to the available image. The second part of the thesis introduces digital elevation model. An ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) data is used to construct one.

**Keywords**: RISAT-1, microwave, C-band, backscatter coefficient, Synthetic Aperture Radar, speckle, digital elevation model.

Three Phase Active Filter Control

By

Wadile Harshal Suklal

(121397017)

Under Guidance of

Dr. Mrs. P. P. Shingare

This thesis covers the detail operation of three phase active filter and develops system that can remove harmonics up to seventh harmonic and generates pure output with only fundamental component present with least distortion. Three phase active filter principle based on space vector

modulation which basically divides whole 360 degrees rectangular system in six segments with conversion of legacy of using passive filters by introduction of digitization using Resnesas

microcontroller. Renesas microcontroller has been chosen for application because it is cheap and software is open source, does not require many efforts. It automates all the operations such as timer operation; adc conversion as well as running time is much less. Hardware must be compatible with software to achieve maximum efficiency of the system and aforementioned microcontroller provides desirable functionality that matches our requirements. Most important factor in designing circuit is control circuit. Time critical operation is easily managed by selecting proper hardware configuration. Selected inductors, transformers,DC buses, three phase load performs satisfactorily with given conditions.

Derivation of City DEMs

By

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(121397002)

Under Guidance of

Dr. Mrs. P. P. Shingare

Urban DEM poses a different challenge due to the singular nature of the underlying DEM

surface which need to be detected/derived. It should cater to identification of buildings and

steep landscapes and determination of their heights through space intersection by other

means. Special techniques based on morphological features and AI paradigms to be

developed for solving this problem. Generation of relative DEM also need to be explored. in

proposed work I initially pre-process the satellite image in Arctic software in which extract

the particular layer file of urban area which having densely located buildings and then

applying various filter on it and finally it converting to tiff format for further analysis in

matlab where using proposed algorithm I detect the building and estimating the approximate

value of height of the buildings.

UNDERWATER IMAGE ENHANCMENT USING WAVELENGTH COMPENSATION AND IMAGE DEHAZING

By

ABHIJIT S. WAVARE

(121397018)

Under Guidance of

Dr. Vibha Vyas

The underwater image processing area has received considerable attention within the last decades, showing important achievements. The underwater images are essentially characterized by their poor visibility because light is exponentially attenuated as it travels in the water and the scenes result poorly contrasted and hazy. When we go deeper, colors drop off one by one depending on their wavelength, blue color travels the longest in the water due to its shortest wavelength, making the underwater images to be dominated essentially by blue color. In summary, the images suffer from limited range visibility, low contrast, non-uniform lighting, blurring, color diminished (bluish appearance) and noise. In order to improve the perception, underwater images are post processed to enhance the quality of the image.

Light scattering and color change are two major sources of distortion for underwater photography. Light scattering is caused by light incident on objects reflected and deflected multiple times by particles present in the water before reaching the camera. This in turn lowers the visibility and contrast of the image captured. Color change corresponds to the varying degrees of attenuation encountered by light traveling in the water with different wavelengths, rendering ambient underwater environments dominated by a bluish tone. No existing underwater processing techniques can handle light scattering and color change distortions suffered by underwater images, and the possible presence of artificial lighting simultaneously.

A novel systematic approach to enhance underwater images by a de-hazing algorithm, to compensate the attenuation discrepancy along the propagation path, and to take the influence of the possible presence of an artificial light source into consideration. The performance of the proposed algorithm for wavelength compensation and image de-hazing (WCID) is evaluated both objectively and subjectively by utilizing ground-truth color patches and video downloaded from the you-tube website.

MULTIPLE WATERMARKING FOR MEDICAL IMAGES USING

4-LEVEL DWT

By

SWAPNIL R. SUKE

(121397016)

Under Guidance of

Dr. Vibha Vyas

In this dissertation report, we propose a novel approach for medical image security during their transmission over the network. Medical images like CT, MRI, X-ray contain the patient’s vital and confidential information. During transmission over network, it may face different attacks. To prevent such mishaps, embedding of watermark technique is used. In the proposed method, the system embeds multiple watermarks in the input image for more security and robustness. The method first extracts the detected feature points from the input image by Weber law descriptors (WLD) to insert the watermarks in the optimal location in the input image. Then after insertion of watermarks, the watermarked medical image is transmitted over network and then at the receiving end, the multiple watermarks are extracted. The robustness of the algorithm is checked by the weighted peak signal to noise ratio (WPSNR) calculation and the efficiency is checked by normalized correlation NC calculation.

ADAPTIVE THRESHOLDING AND SEGMENTATION FOR WAGON COUNTING

By

Pritam S. Sirpotdar

(121397013)

Under guidance of

Prof. Dr. (Mrs.) M. A. Joshi

Today automated monitoring systems are employed in many applications for speed, reliability and accuracy. Vision-based automatic wayside inspection systems for the railroad industry are mostly used in foreign countries to check the safety of railcar components and tracks. The task described within this research wok is a part of such an automated railway monitoring system. This system is designed to perform the inspection of number of railway wagons captured visually passing from side view.

The system developed can be used for automatic wagon number detection and recognition in real-time. The method used for counting the number of train wagons makes use of the videos captured during different times of the day and night. Until now, researchers have applied adaptive thresholding techniques for segmentation of background and foreground during poor illumination conditions, slow varying illuminations like day to afternoon and afternoon to evening. Literatures have many methods for detecting and counting foreground objects with dynamic backgrounds, and different environmental conditions like rainy day, images with clouds, images with fog, etc. Inherently these techniques heavily focus on videos taken either during day time or during night time only. First challenge is to develop unique segmentation algorithm which can be applied to both the videos captured for drastic illumination change from day to directly night. There is no unique technique for segmenting the railway wagons during day and night time.

A novel approach for train wagon counting during day, afternoon, evening and night time is proposed in this research work. The first video frame is considered as the background. First step of the algorithm is to determine whether the captured video belongs to the day time or to the night time. This is done by plotting the histogram of the background reference frame. Next step is to find the adaptive threshold according to the illumination condition of the video captured. The output of the adaptive thresholdingblock is given as an input to the segmentation algorithm for foreground object detection. Different from traditional segmentation algorithms, this method deals with only the central reference mask pixel values. This increases the processing speed of the algorithm as well as efficiency of the system. The pixel difference values from the central reference mask, determine the segmentation of background and the foreground objects, which here, in this case are railway wagons.

From the results we conclude that the system developed gives accurate count for the number of railway wagons even if any day, afternoon, evening or night video is fed as an input to the vision based automated railway monitoring system. In future, there is scope to add the features like axle counting of wagon, real-time speed detection of each wagon and rail direction detection to this automated train inspection system.

**Keywords:** Segmentation, Adaptive thresholding, Automated Railway monitoring system.

PERSON IDENTIFICATION USING NOSE AND FACE AS A BIOMETRIC

By

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(MIS No:121397003)

Under Guidance of

Prof. Dr. (Mrs.) M. A. Joshi

Person Identification has become important in the present era because of terrorism and increasing number of crime rate. Face Recognition (FR) has been common and well accepted biometrics for person identification. Number of algorithms have been tried for FR. The limitations of most of these algorithms are either they are computationally complex or they are less accurate. Variation in Illumination, Pose, and Expression are the major problems in FR.

The main aim of this work is to develop computationally efficient FR algorithm with increased accuracy or in short improved upon trade-off between both parameters. In proposed system, we have used three FR algorithms i.e. Principal Component analysis(PCA), Linear Discriminat Analysis(LDA) and Scale Invariant feature transform(SIFT). The results after evaluating proves that, by using Nose Classifier before FR helps to reduce the computational complexity of the algorithm at the same time increase recognition rate accuracy of all three FR systems.

We have designed a sub-classification system prior to FR using nose as a classifier, the computational complexity of all the above mentioned algorithms is improved. The sub-classes of the nose classifier are defined on the basis of geometric features of the nose of the corresponding input face images. For the incoming input face image, the geometric features of nose get calculated and compare them with class features and accordingly classify the input image. Now, only those images which belong to that particular class are loaded in the FR system. In short, FR is carried out in class-wise data. This is because input image belonging to only one particular class gets loaded into the trained database of the FR system. Thus, it helps to system to increase the accuracy and decrease the computational complexity of system.

Out of these three algorithms, SIFT is most complex. Its complexity is reduced up to 30% and simultaneously, the accuracy of the recognition rate is also increased by 4%. PCA is least complex algorithm. So its complexity is increased by 15%. However, its accuracy was least and is increasing by 35%. In short while improving the complexity, we have also improved the trade-off between accuracy and complexity.

**Dynamic Multiple Zero Watermarking for Color Video using Weber Local Descriptor and Wavelet Transform**

By

Mahavir Shantilal Dhoka

Under guidance of Prof. A.B. Patki

### ABSTRACT

Advancement in Communication Technology and Internet has enabled people to share video over communication network more efficiently. It has boosted high-speed video sharing to a large scale. Plenty of videos are shared over network through social networking sites such Facebook, Twitter, Instagram and some sites like YouTube. However, this advancement has also created issues regarding safe transmission of digital video. Any unauthorized access and modification to digital video can harm its integrity, authenticity and security. Watermarking is popular solution towards protecting the video authenticity and security. In watermarking, information regarding ownership is inserted in video, which alters its original contents and thus creates distortions. Zero watermarking is one solution over normal watermarking where instead of inserting watermark, it is created using features of the video frame. Thus, zero watermarking does not alter original content of video and achieve perfect imperceptibility. In this thesis, algorithm for Dynamic Multiple Zero Watermarking for Color Video using Weber Local Descriptor and Wavelet Transform is proposed. In this algorithm, features of video frames are obtained at different wavelet decompositions using weber local descriptor and used along with original watermarks to create zero watermarks. Arnold Transform is used for scrambling of zero watermarks in order to improve their security. The dynamic approach of my algorithm lets size of original watermarks to be solely decided by number of respective feature points and almost all watermark pixel to be used in respective zero watermark construction. Period of Arnold Transform and iterations for encryption and decryptions are decided from new size of respective original watermark. Video frames of watermarking are selected using logistic map. This algorithm achieves very high robustness against various signal processing and geometric attacks.

INTELLIGENCE INTERPOLATION TECHNIQUES FOR DEM FROM SATELLITE IMAGERY

By

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(121397009)

Under Guidance of

Dr. Mrs. P. P. Shingare

This thesis covers the Digital Elevation Module (DEM) and need of various Interpolation TechniquesDigital elevation Model is analysis of stereo data for extraction of elevation information of particular area. Different applications need different accuracy level from DEM. The accuracy of DEM depends upon various important parameters viz. Image quality, type of surface, Interpolation Method etc. Interpolation is prediction of unknown point elevation from known data points. Interpolation is used to enhance DEM. Various Interpolation techniques like Kriging, IDW, and Thin Plate Spline used for evaluation of DEM.The theory regarding various Interpolation was studied in depth and the results are analysed. Differential GPS survey has been carried out for entire area & same compared with the Interpolation results. Detail Investigation of errors in DEM carried out.

**Textural Classification of Igneous Rock Images using Classifiers**

**Narmada Kantipudi**

**121397008**

**(Signal Processing)**

**Guide: Dr.Vibha Vyas**

**Abstract**

The classification of rocks is an inherent part of modern geology. Rock images are a typical example of natural images, and their analysis is of major importance in the rock industry and in bedrock investigations. The manual identification of rock samples is a time-consuming process, and—due to the subjective nature of human judgment-burdened with risk. Anything from a tiny pebble to a large boulder is a rock. Rocks may also be covered partially by sand or occluded by other rocks. The composition of the rock may even be the same as the substrate. Variations in illumination and shadows also present challenges. Standard object recognition approaches may not work because of the variety of colors, textures and shapes of rocks. The three main geologic classes of rocks are igneous, metamorphic and sedimentary. Within each of these, geologists further distinguish different rock types. Color, texture and shape properties can be used to characterize different classes. For geologists, important properties of rock texture are granularity, directionality, polish and markings such as striations or percussion marks. Texture can be represented in different ways, some derived from older approaches in geology and some from newer techniques in computer vision. The fractal dimension and statistics of the gray level co-occurrence matrix are older methods, while newer approaches tend to involve convolving the image with a set of filter banks.

In this project classification process is mainly focused on one type of rock that is Igneous rocks. The database consists of plutonic and volcanic sub type images of igneous rocks. The main aim of project is to apply different classifiers like k-nearest neighbour algorithm, nearest mode algorithms, SVM etc. on database and check for the best one. And then use combining classifier technique i.e. AdaBoost. Verify those results and use SVM in AdaBoost as a classifier.

The research work which follows is presented in chapters and sections. Chapter 1 is the introduction to the problem statement and basic about the igneous rocks. Chapter 2 includes the literature survey i.e. the texts, papers, journals and books referred to carry forward the research work. Chapter 3 is the methodology, which explains the used techniques and their algorithms in detail. Chapter 4 is results and discussions which shows the results and analysis of those results. Chapter 5 is summary and conclusions which explains the work in brief and finally concludes the work. Next section is the literature cited which includes the references of all material which has been referred.

Keywords: classifiers, boosting, combining classifiers, texture classification.

Graphical Processing Unit (GPU) Performance Enhancement

By

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Under the guidance of:

Prof. Emeritus A B Patki

Abstract

In today’s world of smart devices, the high performance computing units like the Graphical Processing Unit (GPU) has found its mainline application in fast and high quality multimedia, gaming consoles, video processing and entertainment.

In the current study, an innovative idea is proposed extend the scope of smart devices and high computing GPUs into the heavier engineering applications in industrial domain, the proposed work evaluates the ability of the GPU present in the Nitrogen6x development board, to process and render the output of O3D3xx, a Photonic Mixer Device (PMD), sensor and camera used mainly in industrial automation applications. 2D rendering in the form of colour map of the 3D image from the camera is accomplished. The third dimension of the camera’s output being distance information of the pixel from the sensor. A 3D scene is modelled from the camera’s output and rendered in the form background plane and foreground plane, where the distance between the two planes denote the detected distance information. The rendering frame rate and CPU usage have shown tremendous improvement due to the use of hardware acceleration.

The proposed work also shows a proof-of-concept (POC) of 2D rendering application working seamlessly on iOS and Android based Smartphone. The highlight of the proposed work is that the interface between the industrial sensor and Smartphone/Nitrogen6x board is Wi-Fi/Ethernet, and shows Intranet of Things at work, discarding the need of a full-fledged PC/workstation to monitor the camera’s output.