**BIG DATA AND MACHINE LEARNING WITH HYPERSPECTRAL**

**INFORMATION IN URBAN**

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**ABSTRACT -** With the advancement of remote detecting innovation, the utilization of hyper otherworldly pictures is turning out to be increasingly inescapable. The precise characterization of ground highlights through hyper ghostly pictures is a significant exploration content and has drawn in broad consideration. Numerous strategies have accomplished great order and bring about the arrangement of hyper spectral pictures. Hyper spectral information distinguishing can get two or three hundred ridiculous gatherings that cover the electromagnetic scope of an observational scene in a singular getting. The resulting hyper spectral data 3D square contains a huge volume of spatial and urban information. The hyper spectral gathering of pictures forms the data age speed and volume which lead to the Big data challenges particularly in provincial remote recognizing applications.Project is coordinated to at first give an intensive study of agent studies to give pieces of information into basic investigation tries in urban using Big data, AI and significant learning with the accentuation on constructions or plans, information taking care of and assessment with hyper spectral and multispectral data.

**Keywords :**Hyperspectral Data, Spatial data, Big Data

**1.INTRODUCTION**

**1.1 IMAGE PROCESSING**

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually an Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them.

It is among rapidly growing technologies today, with its applications in various aspects of a business. Image Processing forms a core research area within engineering and computer science disciplines too.

Image processing basically includes the following three steps.

* Importing the image with an optical scanner or by digital photography.
* Analyzing and manipulating the image which includes data Compression & restoration and image enhancement and spotting patterns that are not to human eyes like satellite photographs.
* Output is the last stage in which the result can be altered by an image or report that is based on image analysis.

**1.2 PURPOSE OF IMAGE PROCESSING**

The purpose of image processing is divided into 5 groups.

They are:

1.      Visualization - Observe the objects that are not visible.

2.      Image sharpening and restoration - To create a better image.

3.      Image retrieval - Seek for the image of interest.

4.      Measurement of pattern – Measures various objects in an image.

5.      Image Recognition – Distinguish the objects in an image.

**TYPES**

The two types of **methods used for Image Processing** are **Analog and Digital**  Image Processing.

Analog or visual techniques of image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. The image processing is not just confined to an area that has to be studied but on the knowledge of analysts. Association is another important tool in image processing through visual techniques. So analysts apply a combination of personal knowledge and collateral data to image processing.

Digital Processing techniques help in manipulation of the digital images by using computers. As raw data from imaging sensors from satellite platforms contains deficiencies. To get over such flaws and to get originality of information, it has to undergo various phases of processing. The three general phases that all types of data have to undergo while using digital techniques are Pre- processing, enhancement and display, and information extraction.

**1.3 APPLICATIONS**

1.      **Intelligent Transportation Systems** – This technique can be used in Automatic number plate recognition and Traffic sign recognition.

2.      **Remote Sensing** – For this application, sensors capture the pictures of the earth’s surface in remote sensing satellites or multi – spectral scanner which is mounted on an aircraft. These pictures are processed by transmitting it to the Earth station. Techniques used to interpret the objects and regions are used in flood control, city planning, resource mobilization, agricultural production monitoring, etc.

3.      **Moving object tracking** – This application enables to measure motion parameters and acquire visual record of the moving object. The different types of approach to track an object are:

* Motion based tracking
* Recognition based tracking

4.      **Defense surveillance**– Aerial surveillance methods are used to continuously keep an eye on the land and oceans. This application is also used to locate the types and formation of naval vessels of the ocean surface. The important duty is to divide the various objects present in the water body part of the image. The different parameters such as length, breadth, area, perimeter, compactness are set up to classify each of the divided objects. It is important to recognize the distribution of these objects in different directions that are east, west, north, south, northeast, northwest, southeast and south west to explain all possible formations of the vessels. We can interpret the entire oceanic scenario from the spatial distribution of these objects.

5.      **Biomedical Imaging techniques** – For medical diagnosis, different types of imaging tools such as X- ray, Ultrasound, computer aided tomography (CT) etc are used. The diagrams of X- ray, MRI, and computer aided tomography (CT) are given below.

Some of the applications of Biomedical imaging applications are as follows :

* Heart disease identification–

The important diagnostic features such as size of the heart and its shape are required to know in order to classify the heart diseases. To improve the diagnosis of heart diseases, image analysis techniques are employed to radiographic images.

* Lung disease identification –

In X- rays, the regions that appear dark contain air while regions that appear lighter are solid tissues. Bones are more radiopaque than tissues. The ribs, the heart, thoracic spine, and the diaphragm that separates the chest cavity from the abdominal cavity are clearly seen on the X-ray film.

* Digital mammograms –

This is used to detect the breast tumor. Mammograms can be analyzed using Image processing techniques such as segmentation, shape analysis, contrast enhancement, feature extraction, etc.

6.      **Automatic Visual Inspection System** – This application improves the quality and productivity of the product in the industries.

* Automatic inspection of incandescent lamp filaments –

This involves examination of the bulb manufacturing process. Due to no uniformity in the pitch of the wiring in the lamp, the filament of the bulb gets fused within a short duration. In this application, a binary image slice of the filament is created from which the silhouette of the filament is fabricated. Silhouettes are analyzed to recognize the non uniformity in the pitch of the wiring in the lamp. This system is being used by the General Electric Corporation.

* Automatic surface inspection systems –

In metal industries it is essential to detect the flaws on the surfaces. For instance, it is essential to detect any kind of aberration on the rolled metal surface in the hot or cold rolling mills in a steel plant. Image processing techniques such as texture identification, edge detection, fractal analysis etc are used for the detection.

* Faulty component identification –

This application identifies the faulty components in electronic or electromechanical systems. Higher amount of thermal energy is generated by these faulty components. The Infra-red images are produced from the distribution of thermal energies in the assembly. The faulty components can be identified by analyzing the Infra-red images.

**1.4 SCOPE OF THE PROJECT**

A wide research is being done in the Image processing technique.

1.      Cancer Imaging –

Different tools such as PET, MRI, and Computer aided Detection helps to diagnose and be aware of the tumor.

2.      Brain Imaging –

Focuses on the normal and abnormal development of brain, brain aging and common disease states.

3.      Image processing –

This research incorporates structural and functional MRI in neurology, analysis of bone shape and structure, development of functional imaging tools in oncology, and PET image processing software development.

4.      Imaging Technology –

Development in image technology has formed the requirement to establish whether new technologies are effective and cost beneficial. This technology works under the following areas:

* Magnetic resonance imaging of the knee
* Computer aided detection in mammography
* Endoscopic ultrasound in staging the oesophageal cancer
* Magnetic resonance imaging in low back pain
* Ophthalmic Imaging – This works under two categories:

5.      Development of automated software -

Analyzes the retinal images to show early sign of diabetic retinopathy

6.      Development of instrumentation –

Concentrates on development of scanning laser ophthalmoscope

Image processing is a technique to perform operations on an image, with a specific goal to get an enhanced image or to extract some helpful information from it. It is a kind of signal processing in which input is an image and output might be image or characteristics / features associated with that image. These days, image processing is among quickly growing technologies. It forms a core research area within engineering and computer science disciplines as well . It is a kind of signal dispensation in which input is image, similar to video frame or photograph and output might be image or characteristics associated with that image. Typically an image processing system includes treating images as two dimensional signals while applying effectively set signal processing methods to them. The two sorts of methods utilized for Image Processing are Analog and Digital Image Processing. Analog or visual techniques of image processing can be utilized for the printed versions like printouts and photographs. Digital Processing techniques help in manipulation of the digital images by using computers.

Image Compression & restoration is an application of data Compression & restoration that encodes the original image with a couple of bits. The objective of image Compression & restoration is to reduce the redundancy of the image and to store or transmit data in an efficient form. The goal of such a system is to reduce storage quantity, and the decoded image displayed in the monitor can be similar to the original image as much as anyone might imagine. There are mainly two types of image Compression & restoration techniques. Lossy image Compression & restoration is the sort of image Compression & restoration where there is a loss of information. In the event that the compressed image is decompressed then it won't be identical to the original image yet close to it. Lossless image Compression & restoration is the kind of image Compression & restoration where there is no loss of information. In the event that the compressed image is decompressed then it will be identical to the original image.

In Image Compression & restoration , there are different lossless image Compression & restoration s methods are use discussed below :

1. **Lossless methods based on substitution Models:** The methods that were earlier used for compressing the images were mostly based on substitution techniques. The redundancy which exists in the data of an image is made use of by making it in relation with the adjacent pixels. Bitmap Compression & restoration and RLE (run length encoding) are the methods used.
2. **Lossless methods based on statistical models:** The redundancy of the pixels can be reduced in the statistical models. They are both static as well as adaptive in nature. The probability of occurrence in the image can be the reason for reduction of redundancy. Shannon-Fano Coding, Huffman Coding, and Arithmetic Coding are some of the most known methods.
3. **Lossless methods based on dictionary models:** The string of variables can be replaced by the code which is used by the dictionary technique models. The input pixels are processed by the encoder. The correspondence is also found out by the encoder by running through the dictionary. The pointer is set where the string is found. This is used as a code. If any match has not been found, the string is added to the dictionary.

**4) Lossless methods based on spatial domain models:** The spatial redundancy of an already existing image is removed using the models which are available in the space domain. The technique used can be implemented locally as well as globally. The statistical models of substitution are used for the coding process. The lossless JPEG standard is the most significant technique. The result of the prediction of a pixel is a value very close to zero or residual prediction error .

**1.5 IMAGE COMPRESSION & RESTORATION**

The development of the higher quality and cheaper image acquisition devices has produced steady increases in both resolution and image size, and a greater consequence for the design of efficient Compression & restoration techniques. Although the storage capacity and transfer bandwidth has grown accordingly in past years, many applications still require Compression & restoration .

Uncompressed multimedia (graphics, video and audio) data requires storage capacity and transmission bandwidth. Despite the frequent progress in mass-storage density, processor speeds, and the performance of digital communication systems, demands for data storage capacity and data-transfer bandwidth. The frequent growth of data intensive multimedia-based web applications have not only maintained the need for more efficient ways to encode signals and images but also have made Compression & restoration of such signals central to storage and communication technology. The amount of data related to visual information is so large that its storage would require more storage capacity. Although the capacities of several storage media are essential, their access speeds are usually inversely proportional to their storage capacity.

The Typical television images produce data rates exceeding 10 million bytes per second. There are other image sources that produce even higher data rates. Storage and/or transmission of such data require large capacity and/or bandwidth, which could be very expensive. Currently image Compression & restoration is recognized as an “enabling technology”. Image Compression & restoration is the natural technique for handling the increased spatial resolution of today’s imaging sensors and evolving broadcast television standards. Furthermore the image Compression & restoration plays a vital role in many important and diverse applications , including tele video-conferencing ,remote sensing (the use of satellite images for weather and the other earth –resource applications), document and medical imaging, facsimile transmission, and the control of remotely controlled vehicles in military , space and hazardous waste management applications.

The Image Compression & restoration represents the problem of reducing the amount of data required to address the digital image. The primary aim of any image Compression & restoration algorithm is to reduce the number of bits required to store or transmit images without any severe loss of information.

Based on this the Image Compression & restoration can be either lossless or lossy. In the lossless image Compression & restoration algorithm, the original data can be regenerated exactly from the compressed data. And the LossyCompression&restoration techniques refer to the loss of information when data is compressed. As a result of this distortion, higher Compression & restoration ratios are possible as compared to the lossless Compression & restoration method in the reconstruction of the image. However this high level of Compression & restoration is accompanied by loss of data and the exact image can’t be reconstructed. There have been a number of techniques which are being used for image Compression & restoration . JPEG and its advances are most commonly used image Compression & restoration techniques. Researchers have suggested a number of techniques like entropy based techniques, transform based techniques, Predictive coding, run length coding etc.

All these methods although focus around reducing the amount of data redundancy in the image file. The data redundancy with respect to an image data can be classified as coding redundancy(less amount of coding), inter pixel redundancy (finding and eliminating correlated pixels) and psycho-visual redundancy (eliminating no visual information).

Among all the techniques the transform based techniques i.e. based on Discrete Cosine Transform and Discrete wavelet Transform have shown the best results over time both in achieving higher Compression & restoration bandwidth and speed of data transmission. In this paper we present a technique which is a combination of DCT technique and enhanced by Fuzzy logic function. The aim is to give a better Compression & restoration ratio along with increasing the visual perception quality of the image.

Fuzzy logic techniques have been used in various areas involving clustering, data aggregation pattern deduction etc. We are using fuzzy logic in this technique to improve the quality of the compressed image resulting from DCT image Compression & restoration technique. In the later part of this paper the literature review of various papers has been presented followed by a description of the proposed algorithm and the results of the output image.

# 2. LITERATURE REVIEW

**2.1 IMAGE COMPLETION WITH GLOBAL STRUCTURE AND WEIGHTED NUCLEAR NORM REGULARIZATION**

**MingliZhanget al**., has proposed in this paper Structure and nonlocal patch similarity have been used successfully to enhance the performance of image restoration. However, these techniques can often remove textures and edges, or introduce artifacts. In this paper, we propose a novel image completion method that leverages the redundancy of nonlocal image patches via the low-rank regularization of similar patch groups. The textures and edges in these patches are preserved using an adaptive regularization technique based on the weighted nuclear norm. Furthermore, a new global structure regularization strategy, imposing l1-norm sparsity on the image’s high-frequency residual component, is presented to recover missing pixels while preserving structural information in the image. An efficient optimization technique, based on the Alternating Direction Method of Multipliers (ADMM) algorithm, is used to solve the proposed model. Experimental results show our method to outperform state-of-the-art image completion approaches, for various text-corrupted images and different ratios of missing pixels.

We presented a novel image completion method that exploits the similarity of nonlocal patches in the image, and applies an innovative global structure regularization technique to guide the reconstruction process. The nonlocal self-similarity (NSS) prior uses weighted nuclear norm to regularize groups of similar patches, while retaining the texture and edge information of these patches. Moreover, the global structure regularization technique proposed in this paper preserves the structural information of the image by imposing sparsity on the image’s high-frequency residual component. An efficient optimization strategy, based on the ADMM algorithm, was proposed to recover the image from a corrupted observation. Experiments on several benchmark images have shown our method to outperform state-of-the-art image completion approaches, for various ratios of missing pixels and text corruptions. In future work, the proposed method could be extended to other image reconstruction problems, such as image super-resolution.

**2.2 MEDICAL IMAGE SUPER-RESOLUTION WITH NON-LOCAL EMBEDDING SPARSE REPRESENTATION AND IMPROVED IBP**

**Christian Desrosiers et al**., has proposed in this paper This paper proposes a novel super-resolution method that exploits the sparse representation and non-local similarity of patches for the effective reconstruction of images. High Resolution images are reconstructed from low resolution observations with an efficient technique based on the alternating direction method of multipliers (ADMM). A robust iterative back-projection approach is used in a post-processing step to remove residual noise and artifacts in the reconstructed image. Experiments on benchmark medical images illustrate the advantage of our method, in terms of PSNR and SSIM, compared to state of the art approaches.

We presented a novel method1 for the image super-resolution problem. Our method combines sparse representation and non-local patch embedding in a single model, and uses an efficient optimization algorithm based on ADMM to recover the high-resolution image. A post-processing step, using a robust iterative back-projection technique, is proposed to remove residual artifacts in the reconstructed image. Experiments on benchmark medical images show the advantage of our method compared to several state of the art approaches.

**2.3 A WEIGHTED TOTAL VARIATION APPROACH FOR THE ATLAS-BASED RECONSTRUCTION OF BRAIN MR DATA**

**KuldeepKumaret al**., has proposed in this paper Compressed sensing is a powerful approach to reconstruct high-quality images using a small number of samples. This paper presents a novel compressed sensing method that uses a probabilistic atlas to impose spatial constraints on the reconstruction of brain magnetic resonance imaging (MRI) data. A weighted total variation (TV) model is proposed to characterize the spatial distribution of gradients in the brain, and incorporate this information in the reconstruction process. Experiments on T1-weighted MR images from the ABIDE dataset show our proposed method to outperform the standard uniform TV model, as well as state-of-the-art approaches, for low sampling rates and high noise levels.

This paper presented a novel compressed sensing method that uses a probabilistic atlas to impose spatial constraints on the reconstruction. The atlas uses a Laplace distribution to model the heavy-tailed characteristic of image gradients. Reconstruction accuracy in terms of SNR (db) obtained by TV and WTV for increasing noise levels, with a sampling ratio of 10%. (b) SNR values for different brain slices, using a sampling ratio of 10% and noise level of σ = 0.01. Values in both figures correspond to the average computed over the slices of 10 different subjects. (c) Convergence plot of the proposed WTV method. An efficient optimization approach, based on the alternating direction method of multipliers (ADMM), was proposed to compute the reconstruction. Experiments on 184 T1- weighted MR images from the ABIDE dataset show our proposed method to outperform the standard uniform TV model, as well as state-of-the-art approaches, for low sampling rates and high noise levels. As future work, we will extend this method by incorporating a regularization term based on wavelet sparsity.

**2.4 TENSOR COMPLETION USING TOTAL VARIATION AND LOW-RANK MATRIX FACTORIZATION**

**Gang Liuet al**., has proposed in this paper In this paper, we study the problem of recovering a tensor with missing data. We propose a new model combining the total variation regularization and low-rank matrix factorization. A block coordinate descent (BCD) algorithm is developed to efficiently solve the proposed optimization model. We theoretically show that under some mild conditions, the algorithm converges to the coordinatewise minimizers. Experimental results are reported to demonstrate the effectiveness of the proposed model and the efficiency of the numerical scheme.We propose a new model combining the total variation regularization and low-rank matrix factorization. Block coordinate descent (BCD) algorithm is developed to efficiently solve the proposed  
optimization model. We theoretically show that under some mild conditions, the algorithm converges to the coordinatewise minimizers. Experimental results are reported to demonstrate the effectiveness of the proposed model and the efficiency of the numerical.

**2.5 STRUCTURE-GUIDED IMAGE COMPLETION VIA REGULARITY STATISTICS**

**Shuai Yang et al**., has proposed in this paper we propose a novel hierarchical image completion approach using regularity statistics, considering structure features. Guided by dominant structures, the target image is used to generate reference images in a self-reproductive way by image data enhancement. The structure-guided image data enhancement allows us to expand the search space for samples. A Markov Random Field model is used to guide the enhanced image data combination to globally reconstruct the target image. For lower computational complexity and more accurate structure estimation, a hierarchical process is implemented. Experiments demonstrate the effectiveness of our method compared to several state-of-the-art image completion techniques.

Given a target image with missing regions, the dominant structure lines of it are detected and used to guide the image data enhancement to obtain several transformed versions of the target image in a self-reproductive way. These enhanced images are combined to reconstruct the target image using the proposed regularity-statistics-based approach. The hierarchical implementation accelerates the algorithm and works for more robust structure feature detection. We validate the effectiveness of our method by comparisons with state-of-the-art image completion methods.

**2.6 STRUCTURE-AWARE IMAGE INPAINTING USING PATCH SCALE OPTIMIZATION**

**ZhihuaChenet al**., has proposed in this paper Image inpainting is widely used in many image processing applications such as image stitching, image editing and object removal. The main challenge stems from producing visually plausible results after reconstruction. Most of the image inpainting algorithms cannot maintain structure continuity and texture consistency precisely. To address this problem, we propose a robust exemplar-based inpainting algorithm. Firstly, we present a local structure multiplier to contain sufficient structure information in the priority function which ensures the structure continuity. Secondly, we combine color features and space distance between two patches to search for the optimized patch to avoid texture inconsistency. At last, we calculate the average pixel difference between two patches under each candidate scale, we select the scale which the minimal average pixel difference is to be the optimized scale. We copy the target patch with the optimized patch. Extensive experiments show the effectiveness of the proposed method.

In this paper, a new patch priority model and optimized patch searching model are proposed in order to improve the performance of image restoration. Based on the observation that the visual plausibility highly relies on the performance of structure continuity, the local structure multiplier is proposed in our patch priority function to make the priority of the patch on the fill-front larger than the others. In this way, the inpainting process starts from the patch with the largest priority value to achieve better structure continuity. We also propose the patch with geometric distance and optimized scale to conduct a more accurate inpainting process. In a certain iteration of the inpainting process, when searching the optimized patch, the factor of Euclidean distance is taken into account. To overcome the lack of samples, we conduct a global searching instead of using a searching window. The patch with the minimal average difference is the final inpainting patch. Compared with other previous image inpainting algorithms, our method is comprehensive and our results are more visually plausible.[6]

**2.7 AN EFFICIENT SVD-BASED METHOD FOR IMAGE DENOISING**

**YunfengZhanget al**., has proposed in this paper Nonlocal self-similarity of images has attracted considerable interest in the field of image processing and has led to several state-of-the-art image denoising algorithms, such as block matching and 3-D, principal component analysis with local pixel grouping, patch-based locally optimal wiener, and spatially adaptive iterative singular-value thresholding. In this paper, we propose a computationally simple denoising algorithm using the nonlocal self-similarity and the low-rank approximation (LRA). The proposed method consists of three basic steps. First, our method classifies similar image patches by the block-matching technique to form the similar patch groups, which results in the similar patch groups to be low rank. Next, each group of similar patches is factorized by singular value decomposition (SVD) and estimated by taking only a few largest singular values and corresponding singular vectors. Finally, an initial denoised image is generated by aggregating all processed patches. For low-rank matrices, SVD can provide the optimal energy compaction in the least square sense. The proposed method exploits the optimal energy compaction property of SVD to lead an LRA of similar patch groups. Unlike other SVDbased methods, the LRA in SVD domain avoids learning the local basis for representing image patches, which usually is computationally expensive. The experimental results demonstrate that the proposed method can effectively reduce noise and be competitive with the current state-of-the-art denoising algorithms in terms of both quantitative metrics and subjective visual quality.

We have presented a simple and efficient method for image denoising, which takes advantage of the nonlocal redundancy and the LRA to attenuate noise. The nonlocal redundancy is implicitly used by the block-matching technique to construct low-rank group matrices. After factoring by SVD, each group matrix is efficiently approximated by preserving only a few largest singular values and corresponding singular vectors. This is due to the optimal energy compaction property of SVD. In fact, the small singular values have little effect on the approximation of the group matrix when it has a low-rank structure. The experimental results demonstrate the advantages of the proposed method in comparison with current state-of-the-art denoising methods. The computational complexity of the proposed algorithm is lower than that of most of the existing state-of-the-art denoising algorithms, but higher than BM3D. The fixed transform used by BM3D is less complex than SVD, whereas it is less adapted to edges and textures. The main computational cost of our algorithm is the calculation of SVD for each patch group matrix. As each group matrix could potentially be processed independently in parallel, our method is suitable for parallel processing. Therefore, in practice, we can use a parallel implementation to speed it up, which will make it feasible for real-time or near real-time image denoising. In addition, while developed for grayscale images, our method can be extended to shape-adaptive color image and video denoising by taking into account the shape-adaptive patches and the temporal redundancy across color components and frames. This further work will be studied in the future.

**2.8 LOW-RANK DECOMPOSITION-BASED RESTORATION OF COMPRESSED IMAGES VIA ADAPTIVE NOISE ESTIMATION**

**Xinfeng Zhang et al**., has proposed in this paper Images coded at low bit rates in real-world applications usually suffer from significant compression noise, which significantly degrades the visual quality. Traditional denoising methods are not suitable for the content-dependent compression noise, which usually assumes that noise is independent and with identical distribution. In this paper, we propose a unified framework of content-adaptive estimation and reduction for compression noise via low-rank decomposition of similar image patches. We first formulate the framework of compression noise reduction based upon low-rank decomposition. Compression noises are removed by soft thresholding the singular values in singular value decomposition of every group of similar image patches. For each group of similar patches, the thresholds are adaptively determined according to compression noise levels and singular values. We analyze the relationship of image statistical characteristics in spatial and transform domains, and estimate compression noise level for every group of similar patches from statistics in both domains jointly with quantization steps. Finally, quantization constraint is applied to estimated images to avoid over-smoothing. Extensive experimental results show that the proposed method not only improves the quality of compressed images obviously for post-processing, but are also helpful for computer vision tasks as a pre-processing method.

We have proposed a content-dependent compression noise level estimation and reduction framework via similar patch clustering and low-rank constraint. The compression noise is estimated based on quantization steps, and image prior models, i.e., a transform coefficient prior model and an image spatial correlation model. The compression noise is removed by soft-thresholding the singular values of similar image patch matrices adaptively according to their noise levels instead of a global noise level. Extensive experimental results have verified that the proposed method not only significantly improves the quality of compressed images against the relevant existing works, but also benefits computer vision tasks by removing compression noise.

**2.9 MULTIVIEW IMAGE COMPLETION WITH SPACE STRUCTURE PROPAGATION**

**Seung-Hwan**Baek **et al**., has proposed in this paper We present a multiview image completion method that provides geometric consistency among different views by propagating space structures. Since a user specifies the region to be completed in one of multiview photographs casually taken in a scene, the proposed method enables us to complete the set of photographs with geometric consistency by creating or removing structures on the specified region. The proposed method incorporates photographs to estimate dense depth maps. We initially complete color as well as depth from a view, and then facilitate two stages of structure propagation and structure-guided completion. Structure propagation optimizes space topology in the scene across photographs, while structure-guide completion enhances, and completes local image structure of both depth and color in multiple photographs with structural coherence by searching nearest neighbor fields in relevant views. We demonstrate the effectiveness of the proposed method in completing multiview images.

Propagated depth maps could be unstable due to the errors originated from SfM (see Figure 6b). To solve this problem, we account for color and depth coherency in an image. The propagated space structure is simultaneously updated through iteration with consideration of spatial frequency. Nevertheless, the quality of depth maps could be degraded in case of dynamic or feature-less scenes, which potentially cause the failure of our method. Note that initial completion of the target image can be conducted by any other state-of-the-art single image completion methods We have presented a novel multiple image completion method that preserves the geometric consistency among different views. The proposed method consists of structure propagation and structure-guided completion. Our structure-guided completion, which is designed as a single optimization framework, exhibits superior results in terms of coherency and consistency. Our versatile algorithm enables us to complete not only multiple images, but also stereoscopic images. In addition it allows to fill the empty region with foreground as well as background objects, which has been challenging so far in the previous stereo completion methods.

**2.10 A COMPARATIVE STUDY FOR THE NUCLEAR NORMS MINIMIZATION METHODS**

**Jianchao Zhang et al**., has proposed in this paper The nuclear norm minimization (NNM) is commonly used to approximate the matrix rank by shrinking all singular values equally. However, the singular values have clear physical meanings in many practical problems, and NNM may not be able to faithfully approximate the matrix rank. To alleviate the above-mentioned limitation of NNM, recent studies have suggested that the weighted nuclear norm minimization (WNNM) can achieve a better rank estimation than NNM, which heuristically sets the weight being inverse to the singular values. However, it still lacks a rigorous explanation why WNNM is more effective than NMM in various applications. In this paper, we analyze NNM and WNNM from the perspective of group sparse representation (GSR). Concretely, an adaptive dictionary learning method is devised to connect the rank minimization and GSR models. Based on the proposed dictionary, we prove that NNM and WNNM are equivalent to `1-norm minimization and the weighted `1-norm minimization in GSR, respectively. Inspired by enhancing sparsity of the weighted `1-norm minimization in comparison with `1- norm minimization in sparse representation, we thus explain that WNNM is more effective than NMM. By integrating the image nonlocal self-similarity (NSS) prior with the WNNM model, we then apply it to solve the image denoising problem. Experimental results demonstrate that WNNM is more effective than NNM and outperforms several state-of-the-art methods in both objective and perceptual quality. Index Terms— Low-rank matrix approximation, NNM, WNNM, GSR, image denoising.

This paper proposed a comparative study for the nuclear norms minimization methods. We have devised an adaptive dictionary learning method to connect the rank minimization and GSR models. Based on the proposed adaptive dictionary, we have proved that NNM and WNNM are equivalent to `1-norm minimization and the weighted `1-norm minimization in GSR, respectively. Following this, inspired by the correctness of enhancing sparsity of the weighted `1-norm in comparison with `1-norm in sparse representation, we have explained that WNNM is more effective than NNM. We have applied the GSR-WNNM model with image NSS prior to image denoising. Experimental results have demonstrated that WNNM is more effective than NNM and outperforms many state-of-the-art methods both quantitatively and qualitatively.

**2.11 FAST AND FLEXIBLE CONVOLUTIONAL SPARSE CODING**

**Wolfgang Heidrichet al**., has proposed in this paper Convolutional sparse coding (CSC) has become an increasingly important tool in machine learning and computer vision. Image features can be learned and subsequently used for classification and reconstruction tasks. As opposed to patch-based methods, convolutional sparse coding operates on whole images, thereby seamlessly capturing the correlation between local neighborhoods. In this paper, we propose a new approach to solving CSC problems and show that our method converges significantly faster and also finds better solutions than the state of the art. In addition, the proposed method is the first efficient approach to allow for proper boundary conditions to be imposed and it also supports feature learning from incomplete data as well as general reconstruction problems..Convolutional sparse coding is a powerful framework that has the potential to replace or supplement popular patch-based learning and reconstruction methods. These are applicable to a wide range of computer vision problems, such as feature learning, denoising, inpainting, and demosaicking. With the proposed method, we hope to contribute a practical approach to solving general CSC problems efficiently and in the most flexible manner.

**2.12 AN ADVANCED TOTAL VARIATION MODEL IN H-1 SPACE FOR IMAGE INPAINTING**

**DamingShiet al**., has proposed in this paper Image inpainting is to restore a damaged image with missing information – a fundamental problem and a hot research area in image processing. Many approaches, both geometry oriented and texture oriented, have been proposed on inpainting such as total variation (TV), Criminisi algorithm, etc. However, these approaches suffer from either limitations such as only suitable for small areas (cracks,), staircase effect (discontinuity), or inefficient (time-consuming) to search the best matched patch (for filling-in). In this paper we propose a novel approach based on partial differential equation (PDE) and isophotes direction, named Isophotes-TV-H-1. A corrupted image is first decomposed into two parts: the cartoon (smooth parts and edges of the image) and the texture. The cartoon part is inpainted through IsophotesTV-H-1 while the texture part is done by an enhanced Criminisi algorithm which reduces the searching time for match and gives more reasonable match patches. The results of experiments on several images have demonstrated that, compared to existing methods, the proposed solution can recover the texture (of the damaged region) better, suppress error propagation and solve the problem of intensity discontinuity.

In this paper, we propose a novel approach on image inpainting. Firstly, the image is decomposed into two parts, the cartoon (smooth with lower frequency) and the texture (details with higher frequency). Then the Isophotes-TV-H-1 model and an improved Criminisi algorithm are proposed to inpaint cartoon and texture respectively based on geometry structure and the texture synthesis. The final unpainted (restored) image is achieved through superposition of the unpainted cartoon and texture. The experimental results on a number of images have shown that the proposed approach is more effective in inpainting the texture of the defected region than that of the classical TV model. The model staircase problem which happens in [17] and the TV model is solved by the proposed model, thus the inpainting results are better than that of these two models. In the future, We would attempt to use sparse representation and nonlocal variational image restoration model in wavelet domain for image inpainting.

**2.13 CONVOLUTIONAL SPARSE CODING FOR IMAGE SUPER-RESOLUTION**

**ShuhangGuet al**., has proposed in this paper Most of the previous sparse coding (SC) based super resolution (SR) methods partition the image into overlapped patches, and process each patch separately. These methods, however, ignore the consistency of pixels in overlapped patches, which is a strong constraint for image reconstruction. In this paper, we propose a convolutional sparse coding (CSC) based SR (CSC-SR) method to address the consistency issue. Our CSC-SR involves three groups of parameters to be learned: (i) a set of filters to decompose the low resolution (LR) image into LR sparse feature maps; (ii) a mapping function to predict the high resolution (HR) feature maps from the LR ones; and (iii) a set of filters to reconstruct the HR images from the predicted HR feature maps via simple convolution operations. By working directly on the whole image, the proposed CSC-SR algorithm does not need to divide the image into overlapped patches, and can exploit the image global correlation to produce more robust reconstruction of image local structures. Experimental results clearly validate the advantages of CSC over patch based SC in SR application. Compared with state-of-the-art SR methods, the proposed CSC-SR method achieves highly competitive PSNR results, while demonstrating better edge and texture preservation performance.

In this paper, we proposed a convolutional sparse coding based super resolution (CSC-SR) method. CSC directly decomposes the whole image by filtering, which naturally takes the consistency of pixels in overlapped patches into consideration. We introduced a mapping function between the LR and HR sparse coding feature maps for SR. Different from previous patch based sparse coding methods, the convolutional decomposition mechanism of CSC can keep the spatial information of input signal in the feature maps, and exploit the consistency of neighboring patches for better image reconstruction. Compared with other state-of-the-art SR methods, our algorithm achieves not only very competitive PSNR index, but also more pleasant visual quality of image texture and edge structures.

**2.14 SINGLE IMAGE SUPER-RESOLUTION FROM TRANSFORMED SELF-EXEMPLARS**

**Jia-Bin Huang et al**., has proposed in this paper Self-similarity based super-resolution (SR) algorithms are able to produce visually pleasing results without extensive training on external databases. Such algorithms exploit the statistical prior that patches in a natural image tend to recur within and across scales of the same image. However, the internal dictionary obtained from the given image may not always be sufficiently expressive to cover the textural appearance variations in the scene. In this paper, we extend self-similarity based SR to overcome this drawback. We expand the internal patch search space by allowing geometric variations. We do so by explicitly localizing planes in the scene and using the detected perspective geometry to guide the patch search process. We also incorporate additional affine transformations to accommodate local shape variations. We propose a compositional model to simultaneously handle both types of transformations. We extensively evaluate the performance in both urban and natural scenes. Even without using any external training databases, we achieve significantly superior results on urban scenes, while maintaining comparable performance on natural scenes as other state-of-the-art SR algorithms.

We have presented a self-similarity based image SR algorithm that uses transformed self-exemplars. Our algorithm uses a factored patch transformation representation for simultaneously accounting for both planar perspective distortion and affine shape deformation of image patches. We exploit the 3D scene geometry and patch search space expansion for improving the self-exemplar search. In the absence of regular structures, our algorithm reverts to searching affine transformed patches. We have demonstrated that even without using external training samples, our method outperforms state-of-the-art SR algorithms on a variety of man-made scenes while maintaining comparable performance on natural scenes.

**2.15 GENERALIZED TENSOR TOTAL VARIATION MINIMIZATION FOR VISUAL DATA RECOVERY**

**XiaojieGuoet al**., has proposed in this paper, we propose a definition of Generalized Tensor Total Variation norm (GTV) that considers both the inhomogeneity and the multi-directionality of responses to derivative-like filters. More specifically, the inhomogeneity simultaneously preserves high-frequency signals and suppresses noises, while the multi-directionality ensures that, for an entry in a tensor, more information from its neighbors is taken into account. To effectively and efficiently seek the solution of the GTV minimization problem, we design a novel Augmented Lagrange Multiplier based algorithm, the convergence of which is theoretically guaranteed. Experiments are conducted to demonstrate the superior performance of our method over the state of the art alternatives on classic visual data recovery applications including completion and denoising.

Visual data recovery is an important, yet highly ill-posed problem. The piecewise smooth nature of visual data makes the problem well-posed. This paper has proposed a novel generalized tensor total variation norm (GTV) definition to exploit the underlying structure of visual data. We have formulated a class of GTV minimization problems in a unified optimization framework, and designed an effective algorithm to seek the optimal solution with the theoretical guarantee. The experimental results on visual data completion, denoising and inpainting have demonstrated the clear advantages of our method over the state-of-the-art alternatives. It is positive that our proposed GTV can be widely applied to many other visual data restoration tasks, such as deblurring, colorization and super resolution.

**2.16 COLOR-DIRECTION PATCH-SPARSITY-BASED IMAGE INPAINTING USING MULTI DIRECTIONAL FEATURES**

**Hongjie Hu et al**., has proposed in this paper possesses a color-direction patch sparsity-based image inpainting method to better maintain structure coherence, texture clarity, and neighborhood consistency of the inpainted region of an image. The method uses super-wavelet transform to estimate the multi-direction features of a degraded image, and combines with color information to construct the weighted color-direction distance (WCDD) to measure the difference between two patches. Based on the WCDD, the color-direction structure sparsity is defined to obtain a more robust filling order and more suitable multiple candidate patches are searched. Then, the target patches are sparsely represented by the multiple candidate patches under neighborhood consistency constraints in both the color and the multi-direction spaces. Experimental results are presented to demonstrate the effectiveness of the proposed approach on tasks such as scratch removal, text removal, block removal, and object removal. The effects of super-wavelet transforms and direction features are also investigated.In this paper we have presented an image inpainting algorithm which utilizes color and multi-direction features in the inpainting procedure to maintain structure coherence and neighborhood consistency for block, scratch, text, and object removal. In the proposed inpainting method, we introduce multi-direction features into the image inpainting algorithm, and apply a new distance measure WCDD to search candidate patches and a new sparsity function CDSS to obtain robust filling order and maintain structure coherence. Moreover, the color and multi-direction constraints are incorporated into the optimization criterion to obtain sharp inpainting results. Experimental results have demonstrated that the proposed method improves the structure coherence over the existing inpainting techniques for the degraded images with relatively regular directional structure features. However, for the degraded images with many irregular directional features, the proposed may fail to maintain the neighborhood consistency. In addition, we have empirically investigated the effect of weight coefficients via different super-wavelet transforms and different direction numbers. Improved performance of the proposed approach is mainly attributed to the extracted multi-direction features. Inaccurate multi-direction features inferred by the preliminary inpainted image may result in relatively inferior inpainting results. Hence, we are currently investigating the means to accurately extract the multi-direction features.

**2.17 A NON-LOCAL STRUCTURE TENSOR BASED APPROACH FOR MULTICOMPONENT IMAGE RECOVERY PROBLEMS**

**Giovanni Chierchiaet al**., has proposed in this paper Non-local total variation (NLTV) has emerged as a useful tool in variational methods for image recovery problems. In this paper, we extend the NLTV-based regularization to multicomponent images by taking advantage of the structure tensor (ST) resulting from the gradient of a multicomponent image. The proposed approach allows us to penalize the non-local variations, jointly for the different components, through various `1,p-matrix-norms with p ≥ 1. To facilitate the choice of the hyper-parameters, we adopt a constrained convex optimization approach in which we minimize the data fidelity term subject to a constraint involving the ST-NLTV regularization. The resulting convex optimization problem is solved with a novel epigraphical projection method. This formulation can be efficiently implemented thanks to the flexibility offered by recent primal-dual proximal algorithms. Experiments are carried out for color, multispectral and hyperspectral images. The results demonstrate the interest of introducing a non-local structure tensor regularization and show that the proposed approach leads to significant improvements in terms of convergence speed over current state-of-the-art methods, such as the Alternating Direction Method of Multipliers.

We have proposed a new regularization for multicomponent images that is a combination of non-local total variation and structure tensor. The resulting image recovery problem has been formulated as a constrained convex optimization problem and solved through a novel epigraphical projection method using primal-dual proximal algorithms. The obtained results demonstrate the better performance of structure tensor and non-local gradients over a number of multispectral and hyperspectral images, although it would be interesting to consider other applications, such as the recovery of video signals or volumetric images. Our results also show that the nuclear norm has to be preferred over the Frobenius norm for hyperspectral image recovery problems. Furthermore, the experimental part indicates that the epigraphical method converges faster than the approach based on the direct computation of the projections via standard iterative solutions. In both cases, the proposed algorithm turns out to be faster than solutions based on the Alternating Direction Method of Multipliers, suggesting that primal-dual proximal algorithms constitute a good choice in practice to deal with multicomponent image recovery problems.

**2.18 NOVEL METHODS FOR MULTILINEAR DATA COMPLETION AND DE-NOISING BASED ON TENSOR-SVD**

**ShuchinAeronet al**., has proposed in this paper we propose novel methods for completion (from limited samples) and de-noising of multilinear (tensor) data and as an application consider 3-D and 4- D (color) video data completion and de-noising. We exploit the recently proposed tensor-Singular Value Decomposition (t-SVD)[11]. Based on t-SVD, the notion of multilinear rank and a related tensor nuclear norm was proposed in [11] to characterize informational and structural complexity of multilinear data. We first show that videos with linear camera motion can be represented more efficiently using t-SVD compared to the approaches based on vectorizing or flattening of the tensors. Since efficiency in representation implies efficiency in recovery, we outline a tensor nuclear norm penalized algorithm for video completion from missing entries. Application of the proposed algorithm for video recovery from missing entries is shown to yield a superior performance over existing methods. We also consider the problem of tensor robust Principal Component Analysis (PCA) for de-noising 3-D video data from sparse random corruptions. We show superior performance of our method compared to the matrix robust PCA adapted to this setting as proposed.

We presented novel methods for completion and de-noising (tensor robust PCA) of multilinear data using the recently proposed notion of tensor-SVD (t-SVD). As an application we considered the problem of video completion and de-noising from random sparse corruptions, and showed significant performance gains compared to the existing methods. The t-SVD based tensor analysis and methods can handle more general multilinear data as long as the data is shown to be compressible in the t-SVD based representation, as has been recently shown for pre-stack seismic data completion in [5]. Finding the necessary and sufficient conditions for recovery of low (multi)rank tensors using TNN from incomplete tensor data is an important theoretical problem and is an important area of future research.

**2.19 ITERATIVE SUPPORT DETECTION-BASED SPLIT BREGMAN METHOD FOR WAVELET FRAME-BASED IMAGE INPAINTING**

**LiangtianHeet al**., has proposed in this paper The wavelet frame systems have been extensively studied due to their capability of sparsely approximating piecewise smooth functions, such as images, and the corresponding wavelet frame-based image restoration models are mostly based on the penalization of the 1 norm of wavelet frame coefficients for sparsity enforcement. In this paper, we focus on the image inpainting problem based on the wavelet frame, propose a weighted sparse restoration model, and develop a corresponding efficient algorithm. The new algorithm combines the idea of iterative support detection method, first proposed by Wang and Yin for sparse signal reconstruction, and the split Bregman method for wavelet frame 1 model of image inpainting, and more important, naturally makes use of the specific multilevel structure of the wavelet frame coefficients to enhance the recovery quality. This new algorithm can be considered as the incorporation of prior structural information of the wavelet frame coefficients into the traditional 1 model. Our numerical experiments show that the proposed method is superior to the original split Bregman method for wavelet frame-based 1 norm image inpainting model as well as some typical p(0 ≤ p < 1) norm-based nonconvex algorithms such as mean doubly augmented Lagrangian method, in terms of better preservation of sharp edges, due to their failing to make use of the structure of the wavelet frame coefficients.

In this paper, we propose the ISD-SB method and especially the JLISD-SB method for wavelet frame based image inpainting problems. The final result is obtained from a multistage process consisting of solving a series of weighted ASBA models, where threshold-ISD strategy is applied to the rough intermediate results to determine the adaptive binary weights. ISD-SB method and especially JLIST-SB method can bring significant enhancements at the sharp edges of the recovered images compared to SB method and MODAL method, because the large wavelet frame coefficients reflect the singularities of the underlying true solution, and the threshold-ISD strategy sharpens the edges of the approximate solution by not thresholding the large coefficients and thus encouraging the edges to form in the recovery. More importantly, JLISD makes use of the joint sparsity property of the wavelet frame coefficients [63], [64] to further improve the recovery quality. Therefore future research includes studying specific image classes (including color images) and developing more effective corresponding support detection methods.

**2.20 IMAGE RESTORATION USING JOINT STATISTICAL MODELING IN SPACE-TRANSFORM DOMAIN**

**WenGer et al**., has proposed in this paper presents a novel strategy for high-fidelity image restoration by characterizing both local smoothness and nonlocal self-similarity of natural images in a unified statistical manner. The main contributions are three-folds. First, from the perspective of image statistics, a joint statistical modeling (JSM) in an adaptive hybrid space-transform domain is established, which offers a powerful mechanism of combining local smoothness and nonlocal self-similarity simultaneously to ensure a more reliable and robust estimation. Second, a new form of minimization functional for solving image inverse problems is formulated using JSM under a regularization-based framework. Finally, in order to make JSM tractable and robust, a new Split-Bregman based algorithm is developed to efficiently solve the above severely underdetermined inverse problem associated with theoretical proof of convergence.

Extensive experiments on image inpainting, image deblurring and mixed Gaussian plus salt-and-pepper noise removal applications verify the effectiveness of the proposed algorithm a novel algorithm for high-quality image restoration using joint statistical modeling in space-transform domain is proposed, which efficiently characterizes the intrinsic properties of local smoothness and nonlocal self-similarity of natural images from the perspective of statistics at the same time. Experimental results on three applications: image inpainting, image deblurring and mixed Gaussian and salt-and-pepper noise removal have shown that the proposed algorithm achieves significant performance improvements over the current state-of-the-art schemes and exhibits nice convergence properties. Future work includes the investigation of the statistics for natural images at multiple scales and orientations and the extensions on a variety of applications, such as image deblurring with mixed Gaussian and impulse noise and video restoration tasks.

**3.SYSTEM SPECIFICATION**

**HARDWARE REQUIREMENTS**

1. Processor Type : Pentium i3
2. Speed : 3.40GHZ
3. RAM : 4GB DD2 RAM
4. Hard disk : 500 GB
5. Keyboard : 101/102 Standard Keys
6. Mouse : Optical Mouse

**SOFTWARE REQUIREMENTS**

* Operating System : Windows 10 / Linux
* Front end : NetBeans IDE / jdk
* Coding Language : Java

**FRONT END : JAVA**

The software requirement specification is created at the end of the analysis task. The function and performance allocated to software as part of system engineering are developed by establishing a complete information report as functional representation, a representation of system behavior, an indication of performance requirements and design constraints, and appropriate validation criteria.

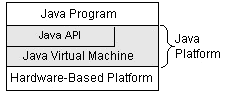
**FEATURES OF JAVA**

Java platform has two components:

* The *Java Virtual Machine* (Java VM)
* The *Java Application Programming Interface* (Java API)

The Java API is a large collection of ready-made software components that provide many useful capabilities, such as graphical user interface (GUI) widgets. The Java API is grouped into libraries (*packages*) of related components.

The following figure depicts a Java program, such as an application or applet, that's running on the Java platform. As the figure shows, the Java API and Virtual Machine insulates the Java program from hardware dependencies.



As a platform-independent environment, Java can be a bit slower than native code. However, smart compilers, well-tuned interpreters, and just-in-time bytecode compilers can bring Java's performance close to that of native code without threatening portability.

**SOCKET OVERVIEW:**

A network socket is a lot like an electrical socket. Various plugs around the network have a standard way of delivering their payload. Anything that understands the standard protocol can “plug in” to the socket and communicate.

Internet protocol (IP) is a low-level routing protocol that breaks data into small packets and sends them to an address across a network, which does not guarantee to deliver said packets to the destination.

Transmission Control Protocol (TCP) is a higher-level protocol that manages to reliably transmit data. A third protocol, User DatagramProtocol (UDP), sits next to TCP and can be used directly to support fast, connectionless, unreliable transport of packets.

**CLIENT/SERVER:**

A server is anything that has some resource that can be shared. There are computer servers, which provide computing power; print servers, which manage a collection of printers; disk servers, which provide networked disk space; and web servers, which store web pages. A client is simply any other entity that wants to gain access to a particular server.

A server process is said to “listen” to a port until a client connects to it. A server is allowed to accept multiple clients connected to the same port number, although each session is unique. To manage multiple client connections, a server process must be multithreaded or have some other means of multiplexing the simultaneous I/O.

**RESERVED SOCKETS:**

Once connected, a higher-level protocol ensues, which is dependent on which port users are using. TCP/IP reserves the lower, 1,024 ports for specific protocols. Port number 21 is for FTP, 23 is for Telnet, 25 is for e-mail, 79 is for finger, 80 is for HTTP, 119 is for Netnews-and the list goes on. It is up to each protocol to determine how a client should interact with the port.

**JAVA AND THE NET:**

Java supports TCP/IP both by extending the already established stream I/O interface. Java supports both the TCP and UDP protocol families. TCP is used for reliable stream-based I/O across the network. UDP supports a simpler, hence faster, point-to-point datagram-oriented model.

**INETADDRESS:**

The InetAddress class is used to encapsulate both the numerical IP address and the domain name for that address. User interacts with this class by using the name of an IP host, which is more convenient and understandable than its IP address. The InetAddress class hides the number inside. As of Java 2, version 1.4, InetAddress can handle both IPv4 and IPv6 addresses.

**FACTORY METHODS:**

The InetAddress class has no visible constructors. To create an InetAddressobject, users use one of the available factory methods. Factory methods are merely a convention whereby static methods in a class return an instance of that class. This is done in lieu of overloading a constructor with various parameter lists when having unique method names makes the results much clearer.

Three commonly used InetAddressfactory methods are:

1. Static InetAddressgetLocalHost ( ) throws UnknownHostException

2. Static InetAddressgetByName (String hostName) throwsUnknowsHostException

3. Static InetAddress [ ] getAllByName (String hostName) throwsUnknownHostException

**INSTANCE METHODS:**

The InetAddress class also has several other methods, which can be used on the objects returned by the methods just discussed. Here are some of the most commonly used.

Boolean equals (Object other)- Returns true if this object has the same Internet address as others.

1. byte [ ] get Address ( )- Returns a byte array that represents the object’s Internet address in network byte order.

2. String getHostAddress ( ) - Returns a string that represents the host address associated with the InetAddress object.

3. String get Hostname ( ) - Returns a string that represents the host name associated with the InetAddressobject.

4. booleanisMulticastAddress ( )- Returns true if this Internet address is a multicast address. Otherwise, it returns false.

5. String toString ( ) - Returns a string that lists the host name and the IP address for convenience.

**TCP/IP CLIENT SOCKETS:**

TCP/IP sockets are used to implement reliable, bidirectional, persistent, point-to-point and stream-based connections between hosts on the Internet. A socket can be used to connect Java’s I/O system to other programs that may reside either on the local machine or on any other machine on the Internet.

There are two kinds of TCP sockets in Java. One is for servers, and the other is for clients. The Server Socket class is designed to be a “listener,” which waits for clients to connect before doing anything. The Socket class is designed to connect to server sockets and initiate protocol exchanges.

The creation of a Socket object implicitly establishes a connection between the client and server. There are no methods or constructors that explicitly expose the details of establishing that connection. Here are two constructors used to create client sockets

Socket (String hostName, intport) - Creates a socket connecting the local host to the named host and port; can throw an UnknownHostException or anIOException.

Socket (InetAddressipAddress, intport) - Creates a socket using a preexistingInetAddressobject and a port; can throw an IOException.

A socket can be examined at any time for the address and port information associated with it, by use of the following methods:

* InetAddressgetInetAddress ( ) - Returns the InetAddress associated with the Socket object.
* IntgetPort ( ) - Returns the remote port to which this Socket object is connected.
* IntgetLocalPort ( ) - Returns the local port to which this Socket object is connected.

Once the Socket object has been created, it can also be examined to gain access to the input and output streams associated with it. Each of these methods can throw an IO Exception if the sockets have been invalidated by a loss of connection on the Net.

Inputstream Get Input Stream ( ) - Returns the InputStream associated with the invoking socket.

Outputstream Stream Get Output Stream ( ) - Returns the OutputStream associated with the invoking socket.

**TCP/IP SERVER SOCKETS:**

Java has a different socket class that must be used for creating server applications. The ServerSocket class is used to create servers that listen for either local or remote client programs to connect to them on published ports. ServerSockets are quite different from normal Sockets.

When the user creates a ServerSocket, it will register itself with the system as having an interest in client connections.

* ServerSocket(int port) - Creates server socket on the specified port with a queue length of 50.
* Serversocket(int port, int maxQueue) - Creates a server socket on the specified port with a maximum queue length of maxQueue.
* ServerSocket(int port, int maxQueue, InetAddress localAddress)-Creates a server socket on the specified port with a maximum queue length of maxQueue. On a multihomed host, localAddress specifies the IP address to which this socket binds.
* ServerSocket has a method called accept( ) - which is a blocking call that will wait for a client to initiate communications, and then return with a normal Socket that is then used for communication with the client.

**URL:**

The Web is a loose collection of higher-level protocols and file formats, all unified in a web browser. One of the most important aspects of the Web is that Tim Berners-Lee devised a saleable way to locate all of the resources of the Net. The Uniform Resource Locator (URL) is used to name anything and everything reliably.

The URLprovides a reasonably intelligible form to uniquely identify or address information on the Internet. URLs are ubiquitous; every browser uses them to identify information on the Web.

**4.TESTING AND IMPLEMENTATION**

**SYSTEM TESTING**

Testing is a process of executing a program with the intent of finding the error. Testing provides the last option from which quality can be assessed and more pragmatically, errors can be uncovered. Testing is an individualistic process, and the number of different types of tests varies as much as the different development approaches. System testing is actually a series of different tests whose primary purpose is to fully exercise the computer-based system. Although each test has a different purpose, all work to verify that all system elements have been properly integrated and perform allocated functions.

* Unit Testing
* Integration Testing
* Validation Testing

**UNIT TESTING**

The procedure level testing is made first. By giving improper inputs, the errors occurred are noted and eliminated. Then the web form level testing is made. For example storage of data to the table in the correct manner

In the organization as well as student information form, the zero length name and id are given and checked. Also the duplicate username is given and checked. The dates are entered in the wrong manner and checked.

**INTEGRATION TESTING**

Testing is done for each module. After testing all the modules, the modules are integrated and testing of the final system is done with the test data, specially designed to show that the system will operate successfully in all its aspects conditions. Thus the system testing is a confirmation that all is correct and an opportunity to show the user that the system works.

**VALIDATION TESTING**

The final step involves Validation testing, which determines whether the software functions as the user expected. The end-user rather than the system developer conducts this test for most software developers as a process called “Alpha and Beta Testing” to uncover that only the end user seems able to find. The compilation of the entire project is based on the full satisfaction of the end users. In the project, validation testing is made in various forms.

**IMPLEMENTATION**

After proper testing and validation, the question arises whether the system can be implemented or not. Implementation includes all those activities that place the conversion from the old system to new. The new system may be totally new replacing an existing or automated system, or it may be a major modification to an existing system. In other cases, proper implementation is essential to provide a reliable system to meet organization requirements. Implementation is the stage where the theoretical design is turned into a working system. The most crucial stage is to achieve a new successful system and to make users confident that the new system will work efficiently and effectively. All information given by the user is successfully stored in a database for future reference. After having the user acceptance of the new system developed, the implementation phase begins. Implementation is the stage of a project during which theory is turned into practice. During this phase, all the programs of the system are loaded onto the user's computer. After loading the system, training of the users starts. Main topics of such type of training are:

* How to execute the package
* How to enter the data
* How to process the data (processing details)
* How to take out the reports
* After the users are trained about the computerized system, manual working has to shift from manual to computerized working.

**5. MATERIALS & METHODS**

**EXISTING SYSTEM**

Implementing remote sensing is one of the key enabling technologies to fulfill the potential for precision urbanization . Compared to traditional urban approaches, remote sensing approaches for urban has the advantages of considering the within-field variability for site-specific management instead of uniform management for the sites/sensing applications in the hyper spectral sensing is much complicated than other methods can utilize various data sources including hyper spectral and multispectral data. Markov random field (MRF) is utilized to enforce class label smoothness to further boost the classification performance. the other state-of-the-art traditional and deep learning-based (hyper spectral image) HSI classification methods.

**DISADVANTAGES**

* Classification model is low
* Not very hyper spectral method is used
* Time taken is high when compared to proposed models

**PROPOSED SYSTEM**

Selecting the image from the trained sample is given as the input After selection of the pixel information the processed image is utilized. Then the image is classified by using the algorithm ELM (extreme learning model). The image classification through the existing system is drastically improved. Pixel information for every hyper spectral image contains the relevant image classification details.2D-DWT 2 dimensional – discrete wavelet transform is used as the proposed algorithm.



A hyper spectral image is selected as the input. The spectral sensing is done with the algorithm ELM (extreme learning model)Pixel value information is done. Extreme Learning machines are feedforward neural networks for classification, regression, clustering, sparse approximation, compression and feature learning with a single layer or multiple layers of hidden nodes, where the parameters of hidden nodes (not just the weights connecting inputs to hidden nodes) need not be tuned. These hidden nodes can be randomly assigned and never updated (i.e. they are random projections but with nonlinear transforms), or can be inherited from their ancestors without being changed. In most cases, the output weights of hidden nodes are usually learned in a single step, which essentially amounts to learning a linear model.

**ADVANTAGES**

* High level of the hyper spectral classification
* Expected outcome is accurate in our proposed model
* Analyzing time is low
* Better accuracy

**MODULE**

* Image selection
* Pixel information
* Image classification

1. **IMAGE SELECTION**

* Spectral imaging is imaging that uses multiple bands across the image spectrum.
* The trained sample images are given as the input images
* So the further pixel image processing along with the pixel classification can be done.

1. **PIXEL INFORMATION**

* The processing through the pixel information the process of the values for multiple processing.
* Spectral imaging is imaging that uses multiple bands across the electromagnetic spectrum.
* Spectral imaging encompasses a wide variety of techniques that go beyond RGB. Spectral imaging may use the infrared, the visible spectrum.

1. **IMAGE CLASSIFICATION**

* The performance can be analyzed through the image classification.
* Similar images can be classified through the hyper spectral classification.
* The values can be generated through the console.

**EXPECTED RESULTS**

The highly efficient spectral sensing through the image. And the similar images from the extreme learning model is made possible.The algorithm was tested on a number of test images and was found to give good results both in terms of image Compression & restoration ratio and the quality of image. 2W-DWT overcomes this disadvantage since it needs less processing power, but it gives less Compression & restoration ratio. 2WDWT uses blocks of image, but there are still correlation issues across blocks. Hybrid transform provides higher Compression & restoration ratio but for getting that clearness of the image is partially a tradeoff. By applying fuzzy logic the image quality has been enhanced so it will increase the PSNR value of the compressed image. And also reduce Errors. Fuzzy based Hybrid image Compression & restoration used in JPEG Standard images. The was also found to be lower which is an important performance parameter and the lower value means there is little difference between original and compressed images. The method can be extended further with other image types like true-color images and video files.

**6. CONCLUSION**

Fine-tuned with the new training set constructed by incorporating the newly labeled pixels. This step together with the previous step is iteratively conducted. Image Compression & restoration is an important aspect in multimedia communication. We have presented a hybrid technique using DWT for Compression & restoration of image files.  An important aspect is data Compression & restoration and for that matter Image Compression & restoration , as images form a larger part of data being exchanged over the internet through social networking and messaging sites and apps all over the world. Among all the various kinds of data images and videos constitute the bulkiest data.

Thus, the need for compressing the image and video files is an important aspect in data communication. In this research work we present a technique for image Compression & restoration , using Discrete Cosine Transform and Fuzzy Logic Techniques. The algorithm used in this paper is tested along with several images and the results are compared with other techniques. Our method shows an improved performance both in Compression & restoration ratio as well as image perceptibility.

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