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IMAGE DENOISING USING HSVOD WITH K++ MEANS ALGORTHIM

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ABSTRACT

With the explosion in the number of digital images taken every day, the demand for more accurate and visually pleasing images is increasing. However, the images captured by modern cameras are inevitably degraded by noise, which leads to deteriorated visual image quality. Therefore, work is required to reduce noise without losing image features (edges, corners, and other sharp structures). So far, researchers have already proposed various methods for decreasing noise. Each method has its own advantages and disadvantages. In this paper, we summarize some important research in the field of image denoising. First, we give the formulation of the image denoising problem, and then we present several image denoising techniques. In addition, we discuss the characteristics of these techniques. Finally, we provide several promising directions for future research.

Keywords: Denoising, Monochrome, Ridgelet, Speckled

I. INTRODUCTION

Restoring damaged photos takes up a significant chunk of time spent on digital image processing. The study of algorithms and the practise of processing images with a specific end in mind both fall under this category. Restoring a picture is fixing problems that occur during the process of capturing the image [9]. The blurring and noise introduced by electrical and photometric sources contribute to the deterioration. The defective picture production process, such as relative motion between the camera and the source scene or an out-of-focus optical system, may induce blurring, which reduces the image's bandwidth [10]. Atmospheric turbulence, optical aberrations, and relative camera-to-ground motion all contribute blurring factors to aerial photos used for remote sensing.. Degradation occurs at every stage of the image process, from the optics to the film to the digitizer.

An region, target, or event may be better understood via the use of remote sensing, which involves analysing data collected from a sensor placed at a distance. For the sake of accuracy, it does not physically touch the items under scrutiny. Satellite imagery has several environmental uses, including resource monitoring and mapping, crop forecasting, urban development analysis, disaster management, and more

The process of picture denoising is often used in photography and publishing to restore quality to images that have been damaged during the production process. Astronomy, where resolution limitations are particularly severe, medical imaging, where high-quality images are required for analysing rare events, and forensic science, where potentially useful photographic evidence is sometimes of extremely poor quality, are all areas where image denoising finds applications [10]. Now, let's think about how a digital picture is seen on a screen. To store the coordinates of each pixels in a digital picture, we may use a two-dimensional array notation, written as s(x,y), where x and y are the corresponding coordinates. In digital photography, each pixel represents the amount of light entering the camera at a given point (x,y). Images in binary, grayscale, and colour are some of the most common. Clean picture like the uproarious picture from an information base that comprise of picturesof a similar class and a denoising technique forimages utilizing outside picture of a similar classification withfree dataset.The proposing picture denoising plan by utilizing adjusted Principal Component Analysis has predominant execution which joins with Dual Tree Wavelet Transform and gives expanding PSNR esteem in every

II. LITERATURE SURVEY

The K-SVD technique is an iterative one, moving back and forth between a sparse encoding of the examples utilizing the ongoing word reference and an activity of refreshing the word reference iotas to all the more likely suit the information. Our implementations are low-complexity in terms of computing and enable precise reconstruction, robustness against perturbations, and simplicity of use. transformations have theoretical support that implies they can outperform wavelet techniques for several picture reconstruction tasks. Positively, the given empirical findings are consistent with the literature[1].Digital image processing using singular value decomposition (SVD) methods is of significant relevance to huge computer centres with strict imaging requirements. Both images and very broad representations of the point spread function (impulse response) may benefit from the SVD techniquesFinally, a variety of object and imaging system degradations are discussed, and analyses and techniques are offered for getting a pseudo inverse of separable space variant point spread functions (SVPSF's)[2]. As a sparse expansion for functions in continuous spaces that avoid line discontinuities, the ridgelet transform was first developed. [3]In this research, we propose the signal-scale wavelet K- SVD calculation, a remarkable half breed picture denoising approach in light of the wavelet change and the scanty and excess portrayals model (SWK-SVD). Multiscale picture qualities and scanty earlier of wavelet coefficients are achieved in a straightforward manner in the wavelet domain. As a result, we achieve cutting edge denoising execution as far as both PSNR and tasteful effects within the sight of elevated degrees of commotion.[4] In this research, we propose the signal-scale wavelet K-SVD algorithm, an unique hybrid image denoising approach based on the wavelet transform and the sparse and redundant representations model (SWK-SVD). Multiscale picture characteristics and sparse prior of wavelet coefficients are attained in a straightforward manner in the wavelet domain. It is for this reason that we will be constructing sparse representations in the wavelet domain. K-SVD is used to train on picture approximation and high-frequency wavelet coefficients, resulting in both adaptive and over- complete dictionaries. As a result, we achieve state-of-the-art denoising performance in terms of both PSNR and aesthetic impacts in the presence of high levels of noise.[5] In this research, we offer K-LLD, an adaptive denoising technique that clusters the supplied noisy picture into areas with comparable geometric structure using a patch-based approach Through the use of Stein's unbiased risk estimator, we also provide a new technique for selecting the local patch size for each cluster (SURE). We provide a number of examples to demonstrate the algorithm's effectiveness in general. These results suggest that the suggested approach compares well to some of the most cutting-edge denoising techniques that have recently been published.[6] Commonly, singular value decomposition (SVD) is used to transform a collection of 1D vectors into a higher dimension. Forming 2DSVD, In this work, we investigate the optimality features of 2DSVD as a low-rank approximation and demonstrate that it offers a foundation for bringing together two recent methods. Examples of 2DSVD's use in image processing and meteorological mapping experiments. [7]An oracle provides guidance on how to optimally adjust a spatially variable estimator to the unknown function, such as a piecewise constant or polynomial function, a variable knot spline, or a variable bandwidth kernel. [8]Here, we provide a novel approach to compactly representing extensive picture collections. Our approach involves storing tiny regions of a 2- dimensional picture as inadequate projections onto an assortment of model orthonormal bases that are advanced deduced from a preparation set, instead of utilizing the more customary vectorial portrayal.[9] The outcome is a low-mistake, profoundly conservative picture/fix portrayal with critical hypothetical benefits and good correlations with existing procedures (counting JPEG) on tests including the pressure of ORL and Yale face information bases, as well as a data set of various regular pictures. Finally, we investigate how picture noise impacts the effectiveness of our compression methods.[10]

III PROPOSED SYSTEM

The patch grouping can be made by any classification algorithms such as block matching, K- means clustering and nearest neighbor clustering. The block matching method is followed in many patches grouping process due to its simplicity. After patch grouping singular value decomposition is involved this is further followed by ridgelet transform. In this transform first we compute 2D fast Fourier transforms for the image. Then the values are substituted over the square lattice. For each angular line 1D inverse FFT is estimated and then wavelet transformation is presented to obtain ridgelet co-efficient.

A. Patch Grouping

Classification problems involving clustering similar patches have several applications in the field of image and video processing. While many other classification techniques (such as block matching, K-means clustering, nearest neighbour clustering, etc.) can be found in the literature,. In order to find the square patches that are comparable, we calculate the Euclidean distance between the transform coefficients. In our proposed system it is applicable to take a satellite images. Since we need detailed image, we have to reduce the noise in the image.

B. Singular Value Decomposition

These patches made up the entire image. A similar group of patches is taken based on Euclideandistance and SVD is applied.

$$P = U\Sigma V^T = \Sigma\sigma_i \, u_i \, v_i^{\,T}$$

U ^{and} V are unitary matrices. Σ =diagram(σ1, . . . , σn) has nonnegative diagonal elements appearing in non increasing order such that

The denoised version is obtained by aggregating patch estimates after the low-rank approximation has been applied. It completes a picture by replacing any damaged or missing pixels. It reduces background noise thanks to its low rank approximation and non- local redundancy. However, further techniques are needed to solve photos with big isolated patches.

C. Ridgelet Transform

In terms of restoring images, the ridgelet transform is on par with the more well-known wavelet transform. Discontinuities in straight lines are handled more smoothly..

1. To analyse the picture, a 2D FFT computation must be performed.
2. The Fourier transform computed using a square lattice may be recalculated using polar latticesamples instead.
3. To get the corresponding inverse Fast Fourier transform in 1 dimension along each angular line, we must do the following calculation.
4. Get the ridgelet coefficients by applying the 1D dual-tree complex wavelet transform on the resultant angular lines.

The following is a description of the complicated ridgelet picture denoising algorithm:

a. Divide the image into R×R blocks with two vertically adjacent blocks overlapping R/2×R pixels and two horizontally adjacent blocks overlapping R×R/2 pixels.

b. For each block, apply the proposed complex protrusions, threshold the complex light coefficients, and perform the inverse complex gradient transform.

c. Take the average of the image noise reduction values at the same location.

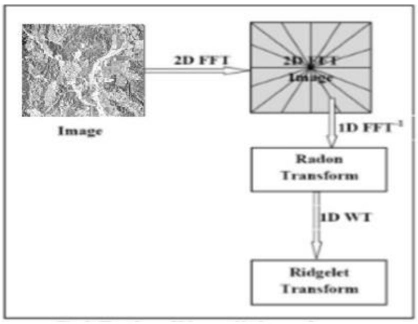


Figure 1 Ridgelet Transformation

K-means++:

The goal of the k-means problem is to identify cluster centers that minimize intrastratum variation, which is defined as the sum of the squared distances from each data point to its cluster center (the center closest to it).There are at least two significant theoretical limitations to the k-means method, although:.The k-mean++ approach overcomes the second of these challenges by defining a way to initialize cluster centers before proceeding with regular k-means optimization rounds. As long as the algorithm is given the k-means++ initialization, it will always provide a solution that is O (log k) competitive with the best possible k-means solution.

RESULT AND ANALYSIS

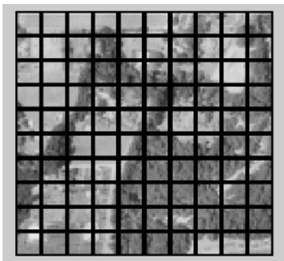
Original image

The satellite image has been taken for denoising purpose with a size of 512 x 512 pixels.

Figure 2 original image

Figure 3 Gaussian noise image

Patches image



After the noise image can be divided into patches. The image patches divided into 10 x 10 patch size. Based on the Euclidean distance the similar patches are taken.

Gary scale

Noise image

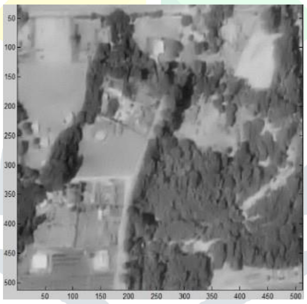
Denoised image

Next, the k-means ++ technique may be used to cluster the patches into larger units, and finally, the singular value decomposition can be used to filter the noisy picture. A technique called singular value decomposition may help you determine which features of your data display the greatest volatility, and rank them accordingly. Change the threshold and the PSNR and MSE values for the same picture will change.

T=0.1

A simple thresholding method used to calculate the PSNR of an image. If the threshold values are less than some constant T or if the threshold values are greater than that constant. The Noise Ratio has been changed.

Difference of Noisy Image and Denoised Image



The denoised images has been arrived after processing of noise removal method like decomposition with thresholding. The effectiveness of the suggested strategy may be evaluated using this method

Noise image Denoise image

Pixel Value of Satellite image:

The input satellite image has been splitting in to multiple patches.

im =

Columns 1 through 18

234	233	237	235	243	246	242	241	239	245	239	238	241	244	243	240	241	240
136	144	159	178	201	201	192	193	189	185	184	180	181	184	183	183	183	185
109	136	161	176	193	188	176	184	183	173	176	171	170	173	173	169	168	174
122	170	199	203	207	189	173	183	189	180	176	170	169	174	176	174	173	180
129	181	202	201	207	199	184	188	191	186	177	173	174	178	178	171	171	176
134	186	199	195	203	195	187	185	181	180	180	177	177	179	177	176	177	178
123	182	199	196	203	193	191	189	180	182	189	184	183	183	179	174	177	176
126	183	195	193	198	195	186	185	182	183	190	181	179	181	180	176	179	179
139	192	193	191	193	195	186	184	183	185	182	181	179	180	182	182	180	182
156	210	198	194	198	199	194	193	186	181	178	183	180	179	184	181	177	183
140	202	193	191	205	212	201	194	185	182	182	184	181	178	181	178	174	181
122	183	194	200	218	218	198	185	182	187	185	183	180	178	180	179	175	178
113	162	194	204	213	203	190	185	182	185	186	179	177	179	179	177	177	177
100	136	176	184	193	191	186	187	182	180	181	174	177	180	177	177	180	178
104	138	153	160	178	184	182	184	180	184	184	179	180	180	176	181	187	182
115	143	118	140	174	176	178	178	175	183	188	186	184	181	181	186	193	190
110	121	89	127	184	183	180	173	171	175	175	180	177	175	179	181	186	187
90	94	88	114	163	190	183	175	177	177	170	177	174	172	177	177	176	176
74	84	101	103	124	170	173	165	171	183	182	189	187	185	188	190	186	184
84	101	118	119	122	137	152	140	148	174	183	189	193	195	197	198	197	200
94	115	127	124	119	116	144	120	113	153	179	193	200	200	201	205	204	206
101	117	127	121	112	124	146	113	90	127	186	200	203	203	198	194	191	195
132	130	133	127	111	118	132	108	85	104	160	187	190	196	188	172	168	174
165	146	140	135	121	114	117	113	98	98	134	172	166	163	158	155	154	164
169	146	135	135	132	127	114	108	93	92	140	169	153	136	136	148	160	175
155	142	128	127	131	131	111	95	87	111	158	163	155	143	146	156	180	194

Columns 253 through 256

235	237	240	235
114	115	127	123
106	94	95	114
130	105	95	126
117	115	116	125
103	117	131	129
108	111	122	124
116	117	116	102
122	121	119	105
116	125	125	117
121	120	120	117
119	122	120	117
115	118	117	113
126	125	112	117
109	132	122	117
85	116	136	120
106	113	126	103
126	132	121	107
123	146	125	105
130	141	135	92
177	159	129	121
209	197	159	135
190	198	169	131
147	158	147	135
146	139	136	153
178	164	155	160
199	201	182	156

T=0.2

Noisy images Denoised images

Calculate PSNR and MSE

MSE: 0.005500

PSNR: 27.4035962 27.4036

T=0.4

Noised image Denoised image

Calculate PSNR and MSE

MSE: 0.005453

PSNR: 27.3660078 27.3660

T=0.6

```
Calculate PSNR and MSE
--------------------------------

MSE: 0.005561
PSNR: 27.4514109    27.4514
```

T=0.8

Noisy image

Denoised image

```
Calculate PSNR and MSE
--------------------------------

MSE: 0.005482
PSNR: 27.3894064    27.3894
```

T=1

Noisy image

Denoised image

MSE(Mean Square Error)

If you compare the original (speckled) picture Is with the despeckled version, Id, you will see that there is a difference between the two images, as shown by the MSE. Reducing the MSE indicates the filter is doing well. However, superior visual quality was not necessarily correlated with low MSE values [7].

Where R*C is the size of image.

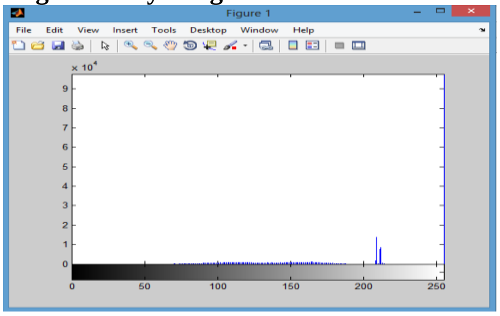
PSNR(Peak Signal-to-Noise Ratio)

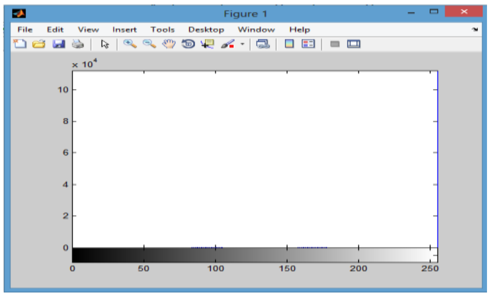
$$\text{MSE} = \frac{\sum (IS(r,c) - ID(r,c))^2}{R*C}$$

PSNR, which stands for "Peak Signal-to-noise ratio," measures how much signal there is relative to how much background noise in a given piece of data or picture. The PSNR is often believed to be on a logarithmic decibel scale. When evaluating lossy compression algorithms for images, PSNR is often employed as a metric of reconstruction quality. In this scenario, the original data serves as the signal, while compression-related errors serve as the noise.

$$\textbf{PSNR } (dB) = 10 \log 10 \left(\frac{2552^2}{MSE}\right)$$

Original image histogramNoisy image





T=0.1

3.7 CONCLUSION AND FUTURE WORK

"Singular Value Decomposition" (a concept from linear algebra) was used to invalidate the picture. SVD is a reliable and powerful tool for decomposing a system into a collection of linearly independent parts, each of which contributes its own amount of energy to the entire system. Our proposed system is designed to reduce noise, when the satellite image is affected by additive white Gaussian noise by image denoising using HOSVD which is a very simplified algorithm and focused on satellite images. Since we take satellite image there should be reduced noise and so the image gives detailed description of important particles in the image. The combination of patch grouping and HOSVD works effectively. Finally, our proposed system improves PSNR value and also reduces MSE by which our proposed systemshows improvements when compared with other state of the art methods

THRESHOLD VALUE	MSE	PSNR
0.1	0.005465	27.3759
0.2	0.005500	27.4036
0.4	0.005453	27.3660
0.6	0.005561	27.4514
0.8	0.005482	27.3894
1	0.005511	27.4122

REFERENCES

[1] H. Takeda, S. Farsiu, and P. Milanfar, “Kernel Regression for Image Processing and Reconstruction,” IEEE Trans. Image Processing, vol. 16, no. 2, pp. 349-366, Feb. 2007.

[2] C. Tomasi and R. Manduchi, “Bilateral Filtering for Gray and Color Images,” Proc. IEEE Int’l Conf. Computer Vision, pp. 839-846, 1998.

[3] D. Tschumperle´ and R. Deriche, “Vector-Valued Image Regularization with PDEs: A Common Framework for Different Applications,” IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 27, no. 4, pp. 506-517, Apr. 2005.

[4] M. Vasilescu and D. Terzopoulos, “Multilinear Analysis of Image Ensembles: Tensorfaces,” Proc. Int’l Conf. Pattern Recognition, pp. 511-514, 2002.

[5] Z. Wang, E. Simoncelli, and A. Bovik, “Multi-Scale Structural Similarity for Image Quality Assessment,” Proc. IEEE Asilomar Conf. Signals, Systems, and Computers, pp. 1398-1402, 2003.

[6] Santosh Kumar Yadav,Rohit Sinha and Prabin Kumar Bora ,”Image Denoising using Ridgelet Transform in a Collaborative Filtering Framework”(IEEE 2014)

[7] Songyuan Tang and Jian Yang, ”Image Denoising using K-SVD and Non-Local Means”,2014 IEEE Workshop on Electronics,Computer and Applications.

[8] Qiang Guo, Caiming Zhang& Hui Liu ,”An Efficient SVD Based Method for Image Denoising”, IEEE Transactions On Circuits And Systems For Video Technology 2015.

[9] Han liu,Yue Zhao,Lili Liang and Yingmin Yi, ”Research on Image denoising Using patch- based Singular Value Decomposition’’, IEEE 28th conference on Electrical and Computer Engineering,Canada may 3-6 2015.

[10] S. Naresh1, A. S. Srinivasa Rao2 ,”Performance analysis of Wavelets in Image De-noising”, International Journal of Advanced Research in Electrical,Electronics and Instrumentation Engineering(An ISO 3297: 2007 Certified Organization)Vol. 2, Issue 8, August 2013.

[11] U. M. Gokhale, Y.V.Joshi G.H.Raisoni “Noise Estimation Using Filtering and SVD for Image Tampering Detection” (International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2, Issue 1, January 2013).

[12] A.AFREEN HABIBA1, DR.B. RAGHU2 “A Hybrid Technique for Denoising in Hyperspectral Images” (International Journal of Innovative Trends and Emerging Technologies ISSN 23499842 (Online), Volume 1, Special Issue 1(NCFCSIT 15), March 2015).

[13] Jeetesh Kumar Rajak ,Achint Chugh “ Image Data Denoising using Center Pixel Weights in Non-Local Means and Smart Patch-based, Modern Machine Learning Method using Higher Order Singular Value Decomposition: A Review “(International Journal of Computer Applications (0975 – 8887) Volume 115 – No. 14, April 2015)

[14] Chandrika Saxena ‘’ Noises and Image Denoising Techniques: A Brief Survey’’, International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 3, March 2014)

[15] D.Nirmala sri and Dr.G.Rajkumar, Dr.K.Parimala “Improved Image Denoising by Merging Statistical Denoising Method and Wavelet Transform Method “https://ijaet- e.com/files/2019/99-104.

[16] Toran Lal, Mrs. Deepty Dubey2 “A Survey on Image Noises and Denoise Techniques”, International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 1, Issue 9, November 2012.