SATELLITE IMAGE ENHANCEMENT USING DISCRETE AND LIFTING WAVELET TRANSFORMS WITH BICUBIC INTERPOLATION ALGORITHM

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ABSTRACT

In a wide range of scientific disciplines, satellite imagery is crucial. However, the low resolution of satellite images is a common issue. In this particular study, we offer a ground-breaking technique for enhancing image quality. Our approach is based on the discrete wavelet transform, or DWT, and interpolation of a high-frequency subbands derived from the initial low-resolution input image.

The suggested method for increasing resolution starts by using DWT to split the input image into many sub-bands. The low-resolution images is interpolated into the a high-frequency sub-band images at this point. These interpolated images are then added together using the inverse DWT to produce a new image with better resolution. To further increase the sharpness of the image, we take an additional step. a preliminary estimate of a high-frequency sub-band.To test the effectiveness of the method, we used reference satellite images. These images were chosen with care to serve as exemplary representations of what can be observed frequently when viewing satellite imagery. These benchmark images were improved in resolution, and the resolution-enhanced image were then assessed for improvements in clarity and detail.

KEY WORDS: GPS, an Android app, SOS, and an alert

INRODUCTION

By integrating the discrete and lifting wavelets transformations with the bicubic interpolation technique, the primary objective of this study is to increase the quality of satellite images.In order to put these techniques into practise we use matlabThe first step in the procedure is to use DWT to build a low-resolution image by downsampling the high-resolution data. Then, a high-resolution image that has been four times enlarged is produced using the bi-cubic interpolation technique. The WZP & CS techniques are also used to improve the image. Finally, using the same expansion factor, we propose a fresh method for enhancing resolution.To evaluate the effectiveness of the offered remedies, we compare their performance to an original, high-resolution image. This graphic serves as a comparison point for the results of the various improving methods. By objectively evaluating the quality, clarity, and level of information in the updated images, we can assess the effectiveness of each method and determine the viability of our suggested strategy.

LITERATURE SURVEY

Many techniques have been created by researchers and put into use to improve the clarity & perception of satellite photos. The next part, which is an overview of the literature, describes a number of pertinent works on this subject. In their study, Bongulwar [3] presented an innovative method that boosts the contrast of satellite pictures by combining the discrete wavelet transform, or DWT, and the singular value decomposition (SVD). The first frequency subbands are known as , high- low (HL), low-high (LH), and high-high (HH).utilising the DWT technique, isolated from the initial low-contrast satellite image.A coding scheme for satellite images that incorporates entropy encodes the scalar quantization, and quick Fourier transform was published by Sahnoun [6]. Utilising both the known Lena image and satellite images, the proposed strategy was evaluated. . The results showed precise image reconstruction after decompression, and also the amount of memory required for storage was reduced by more than 80%.Xue Mei et al. [7] published a novel method for image enhancement based on the fractional Fourier transform. Instead of using the standard Fourier domain to filter the image, this method uses the fractional Fourier domain.

The fractional Fourier transformation introduces a rotation angle that changes the image attributes across several transform domains. The ideal low-pass filter may smooth the image by constructing suitable filter in the fractional Fourier domain, whereas the ideal high-pass filter can retain more information comparing to the traditional Fourier domain. By using filter design as a different approach to improve images.

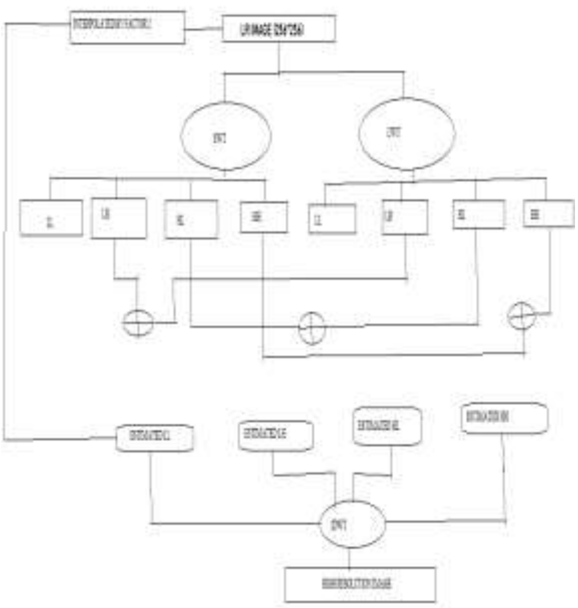
P. Suganya, N. Mohanapriya, and coworkers suggested a method for enhancing satellite images using interpolating, multi-wavelet transform, and inversely multi-wavelet converted to smaller images. The multi-wavelet transform and interpolation methods are employed to lessen artefacts. However, this method does not effectively address the issue of noise reduction.

These several techniques detailed in the literature review show the range of algorithms and methods used to enhance satellite images. Since each method has unique benefits and drawbacks, there is still potential for research and development in the field of satellite image augmentation.

OBJECTIVE

Increasing the image quality is the main objective of improving satellite imagery utilising discrete and wavelets, and bi-cubic interpolation. First, photographs with low resolution that have been downsized to 256x256 pixels are input.After being scaled, the image goes through a decomposition process using (SWT), (the), and (DWT). The several frequency components found in the It is possible to extract the image thanks to this decomposition. A two-factor interpolation procedure is applied to the image after the decomposition stage. The goal of this interpolation approach is to enlarge the image and maintain critical details while doing so.The IDWT algorithm is then applied to the interpolated image to produce a high-resolution image. The enhanced image produced by this IDWT technology has greater resolution and finer details because to the combination of all interpolated image and frequency components.This discrete and wavelet transform combined with bi-cubic interpolation technique significantly enhanced the original image's poor quality, giving a clearer and more accurate representation of the scene that was captured.

BLOCK DIAGRAM



PROPOSED METHOD

The technique suggested for satellite image enhancement divides an input image into various sub-bands using a discrete wavelet transformation (DWT). The main focus is on the interpolated a high-frequency sub-band pictures.

The high-frequency sub-bands are obtained from the input image's stationary wavelet transformation (SWT), which are then utilised to modify HF sub-band coefficient to ensure accurate interpolation. The revising process helps hone the

interpolated coefficients for high-frequency sub-bands.

While interpolating the original image, only half of the interpolation factor used for the high-frequency sub-bands is applied. The method ensures that entire image remained coherent by doing this.

The interpolated original image, the corrected high-frequency sub-bands, and all of the interpolated images are then combined using an inverse discrete wavelet transform (IDWT). The IDWT combines data from various sub-bands to produce a picture with a better resolution and finer details.

In the suggested strategy to increase satellite image resolution, this method is used to decompose the images using DWT, integrate the resulting images using IDWT, interpolate high-frequency sub-bands, correct the images using sub-bands created from SWT, and so on. With this method, the basic satellite image is attempted to be represented more precisely and comprehensively.

WORKING

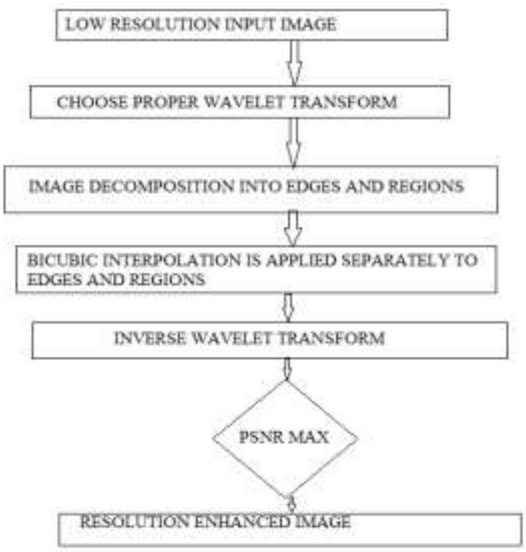
The resolution of a picture is a crucial factor in many image and video processing applications. One application that depends on a resolution increase is processing satellite photos. Interpolation, a technique for raising the overall amount of pixels in a digital image, is significantly used in picture processing activities like feature extraction, facial reconstruction, and image resolution enhancement.The bilinear, bicubic, and closest neighbour interpolation algorithms are the most often used ones. Bicubic interpolation is supposed to be more advanced and to yield edges that are smoother than the other methods. Wavelets are also necessary for image processing, particularly for 2-dimensional wavelet decomposition. . The 1D discrete wavelet transformation (DWT) along an image's rows is used to create the (LL), (LH), (HL), and (HH) pictures, which are then decomposed along the image's columns.

Researchers have created a range of techniques for enhancing image resolution using wavelets. Carey et al. focused on forecasting the unidentified characteristics of wavelet coefficients in order to improve the clarity of the reconstructed images.

They used edge detection techniques to find edges in smaller frequency sub-bands and examine the appearance of wavelet transformation extremes within the same sort of sub-bands in order to construct a model for predicting edges in higher frequency sub-bands.

Only significant coefficients were used to assess the evolution of the wavelet coefficients.In this paper, a novel technique for increasing image resolution is presented using the discrete wavelet transform, or as DWT, interpolated high-frequency sub-band images, and an original low-resolution image. In order to create a final image with higher resolution, these images are combined applying the inverse DWT (IDWT). The estimation of the high-frequency sub-bands is included as a middle stage, which sharpens the output even further. The difference picture is produced by subtracting the input image from it's interpolated LL sub-band in order to provide this estimation. By include this intermediate layer, the suggested technique aims to produce a picture that is clearer and more accurate while boosting resolution. Utilising just coefficients with significant values allowed for an efficient evaluation of the approach and the evolution of the wavelet coefficients. The proposed strategy is compared to advanced techniques like cyclic spinning & CWT-based resolution augmentation as well as more conventional interpolation techniques like wavelet zero padding. Compared to current methods, our approach enhances image resolution more effectively. The section on results and discussions includes both the numeric and visual outcomes.

FLOW CHART



RESULT

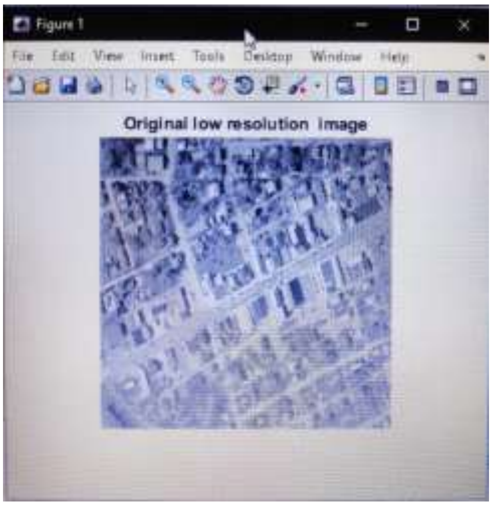


FIG.1: ORIGINAL LOW RESOLUTION IMAGE

FIG.2: BILINEAR INTERPOLATED IMAGE

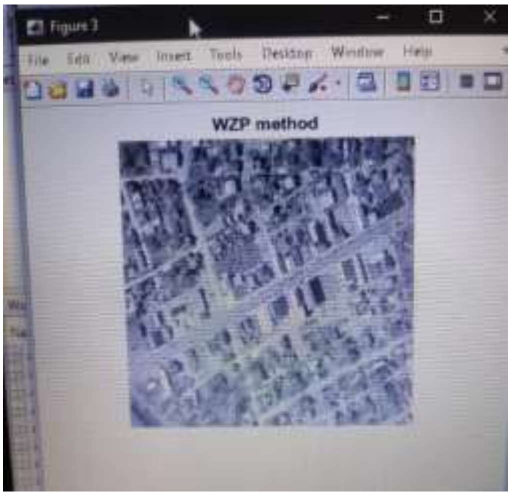


FIG.3:WZP METHOD

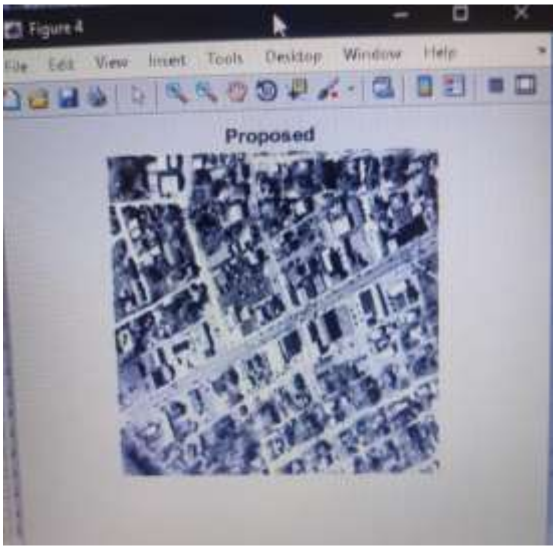


FIG.4:PROPOSED METHOD(FINAL OUTPUT)

CONCLUSIONS

In this paper, we present a novel technique for generating super-resolution images from low resolution inputs. Our suggested solution performs better than past methods in terms of efficacy and quality. We evaluated the final images both objectively and subjectively to assess the success of our approach.

There are various steps in the suggested process. We first identify the sub-bands using the discrete wavelet transform (DWT). We apply interpolation techniques to double the size of an high-frequency sub-bands. However, information loss could occur as a result of the DWT interpolation process. To address this issue, we employ the stationary wavelet transformation, which allows us to account for any loss in the high-frequency interpolated components.

Following that, we combine the original image with the high-frequency elements to produce the super-resolution image using an inverse discrete wavelet transformation (IDWT). We thoroughly assess and compare the performance of our proposed strategy with state-of-the-art techniques. the ratio of signal to noise (PSNR) data are shown in a table to demonstrate the effectiveness of our method and to validate our conclusions.Through our extensive analysis and comparison, we definitively demonstrate the efficacy of our proposed method for generating super-resolution photographs. The combined subjective and objective analyses support the superior performance and quality of our technique.

FUTURE SCOPE

Traditional descriptions of imaging now encompass a larger range of operations. Modern imaging techniques are capturing more information than just visual appearances. Interior elements, mechanical-biological traits, and fluorescent tags are covered. Additionally, the development and characterization of previously undiscovered materials are now included in imaging. Furthermore, imaging has been pushed down onto the nanoscale range, providing highly accurate observations.It is anticipated that imaging technologies will become more accessible and economical in the future. There are numerous kinds of imaging systems that serve various industries, including chemical, optical, thermal, medicinal, and molecular imaging. Image analysis relies heavily on scanning methods and statistical analysis to extract useful information from images.Future satellite applications will mainly rely on in-depth imaging studies. Satellites in Earth orbit will be fitted with a variety of sensors, allowing the collection of data that is useful for science. It will be necessary to develop new strategies for organisation and classification in order to efficiently manage and categorise the enormous amount of data that these satellites have collected. The use of sensors that can capture images from various angles will become more and more important for remote sensing. Graphics data will play a crucial role in applications for image processing.Military and planetary exploration scenarios will benefit from satellite-based imaging. Future advances in imaging are also expected to be made in the fields of astronomy, biomedical applications, and analysis of scenes for robotic vehicles. The discipline of imaging is constantly developing, opening up a wide range of opportunities for both theoretical research and real-world use.

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redundancy discrete wavelets transform when there is additive noise.[3] In their article delivered at the 2001 International Conference on Image Processing, C.B. Atkins, C.A. Bouman, and J.P. Allebach offer a method for ideal image scaling utilising pixel categorization.[4] The study "Satellite Image Resolution Enhancing Using Complex Wavelet Transform" by H. Demirel and G. Anbarjafari (2010) suggests a technique for upgrading satellite photos by using the complex wavelet transform.[5] The study "Image Quality Enhancement using Inter-Subband Correlations in Wavelet Domain" (2007) by P. Yinji, S. Il-hong, and P. HyunWook offers a method to improve picture resolution by utilising inter-subband correlations in the wavelet domain.[6] H. Demirel, G. Anbarjafari, and S. Izadpanahi submitted a paper at the 17th European Signal Processing Conference in 2009 outlining an enhanced motion-based localised super-resolution method using individual wavelet transforms for low-resolution video augmentation.