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A CONCERT ON USING CNN TECHNIQUE TO PROPERLY DEHAZE EVERY BAND OF MULTISPECTRAL IMAGES UNDER DIFFERENT SCENARIOS

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ABSTRACT

Haze frequently taints multispectral remote sensing photos, resulting in poor image quality. This study proposes a unique dehazing technique for multispectral remote sensing images based on a deep convolutional neural network (CNN) with residual structure. Before training a regression from the hazy image to the clear image, the residual structure is initially connected in parallel among several CNN individuals. The ultimate dehazing result is obtained by combining the outputs of CNN users and weight maps. The established CNN network's employees receive training using a variety of haze sample levels in order to acquire a variety of dehazing skills through the multi-scale convolutional mining of multi-scale haze features. The CNN individuals are fused together in an adaptive way, and the weight maps also adjust to the fuzzy distribution. The clear scene can be regained by adding a fuzzy image to the end-to-end network as intended. It is suggested to use a wavelength-dependent haze simulation technique to create labelled data for training the network and to create extremely accurate hazy multispectral images. The results of the trials show that, depending on the situation, the suggested strategy can effectively remove haze from each band of multispectral photos.

Keywords: Weight maps, dehazing, residual images, CNN

1. INTRODUCTION

Since it can provide a wealth of ground data, multispectral remote sensing imagery is an essential tool for studying the earth's resources and natural environment. But weather conditions like haze, fog, and clouds frequently have an impact on multispectral images. These occurrences impair image visibility and destroy texture data, which affects a variety of applications like target identification and terrain categorization. Haze removal is therefore required to raise the calibre of remote sensing photographs.

With the deterioration of photographs of the natural world brought on by low visibility weather, dust, and other factors, image dehazing is a technique that is gaining popularity. There is a rising requirement for dehazing solutions that are easy to use and very effective due to developments in autonomous systems and platforms. Due to haze and microscopic objects like dust, mist, and odours that deflect light from its intended line of propagation, outdoor images typically have low contrast and limited visibility. Haze decreases the contrast of the image while also adding a new component known as "airlight," which has two effects on the image. The scene's visibility and the airlight's colour change can both be fixed by recovering a haze-free image. D Ehazing can also benefit many computer vision algorithms that are negatively impacted by biassed, low contrast scene radiance and often employ the input image after radiometric calibration to represent the scene radiance. Finally, since haze depends on the unknown depth information, scene depth estimation is frequently a by-product of dehazing, and the depth information can be used for a variety of purposes.

2. LITERATURE SURVEY

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Images from multispectral remote sensing have been dehazed using a variety of different techniques. An individual spectral band was typically the focus of earlier techniques for dehazing multispectral data. Richter [1] eliminated the haze from Landsat TM and SPOT HRV satellite photos by comparing the histograms between patches of haze and clear areas. A homomorphic filter was used by Feng et al. [2] to eliminate thin clouds from ASTER data. In order to remove the haze that fluctuated spatially, Du et al. [3] split the image using the wavelet transform. The virtual cloud point method with background haze suppression was employed by Liu et al.

3. IMPLEMENTATION

CNN Individual

CNN individuals with the same structure as those in the proposed model are used to learn the mapping from the hazy image to the clear image. For the regression problem, a residual network can converge more quickly than a non-residual network since it can learn from reference.

The related hazy image can be considered as a rough replica of the dehazed image because they share a similar texture and colour. When learning the dehazing mapping using CNN with residual structure, Only the difference part (haze component), which is learned and represented by convolutional layers, contributes the complex texture and colour information in the dehazed image. As a result, the learning challenge is lowered.

Figure 5.2 depicts the structure of the intended CNN person. The input image is initially mapped to high dimension using a three by three convolutional layer with sixteen filters. An element-wise subtraction layer, a layer for feature fusion, and two multiscale convolutional layers make up the residual structure that follows.

In order to extract multiscale properties of the haze, each multiscale convolutional layer comprises of three paralleled convolutions with various kernel sizes (for example, 1 1, 3 3, 5 5). Paddings are set to 0, 1, and 2, whereas strides are set to 1, 1, and 1 to maintain size invariance for the three scales.

The multi-scale feature maps are fused using the feature fusion layer (see Fig. 5.3), which calculates the pixel-by-pixel average values between the individual feature maps of the three scales.

MATLAB

For technical computing, MATLAB is a high-performance language. It combines calculation, visualisation, and programming in a user-friendly interface while outlining issues and solutions using conventional mathematical notation. The acronym MATLAB, which stands for matrix laboratory, was developed to make it simple to use the matrix software created by the LINPACK and EISPACK applications. As a result, MATLAB is based on a solid foundation of sophisticated matrix software, where the fundamental building block is an array that doesn't need to be pre-dimensioned and can be used to quickly handle a variety of technical computing issues, particularly those involving matrix and vector formulations.

Toolboxes are a kind of application-specific solutions available in MATLAB. Toolboxes are crucial for the majority of MATLAB users since they enable learning and using specialised technologies. These thorough collections of MATLAB functions (M-files) allow the MATLAB environment to be enhanced to tackle certain problem kinds. There are toolboxes for a wide range of disciplines, including simulation, wavelets, fuzzy logic, neural networks, and control systems.

Some of the typical uses of MATLAB include math and computing, algorithm development, data collection, modelling, simulation, prototyping, data analysis, exploration, and visualisation, as well as scientific and engineering graphics. It is also employed for developing apps, particularly those with graphical user interfaces.

Architecture:

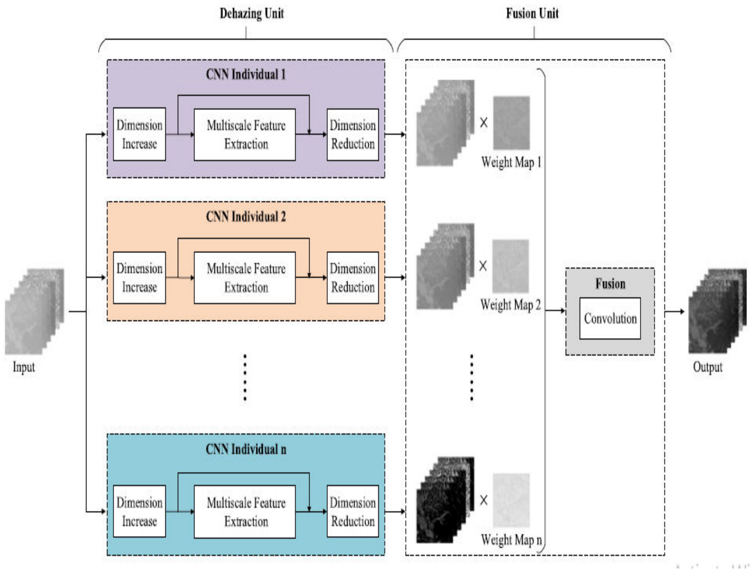

Fig 1. The designed dehazing network's architecture

The project's entire workflow is depicted in the flowchart below.

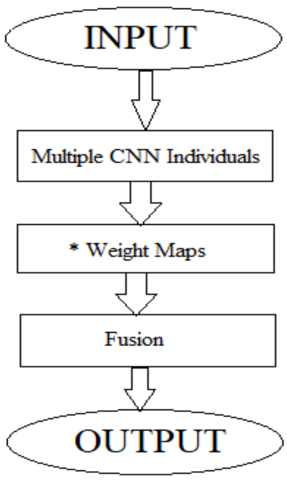

Fig. 2 : Design flow

4. RESULTS

The project scope includes analysis of these findings. Dehazed version of the supplied image will be produced.

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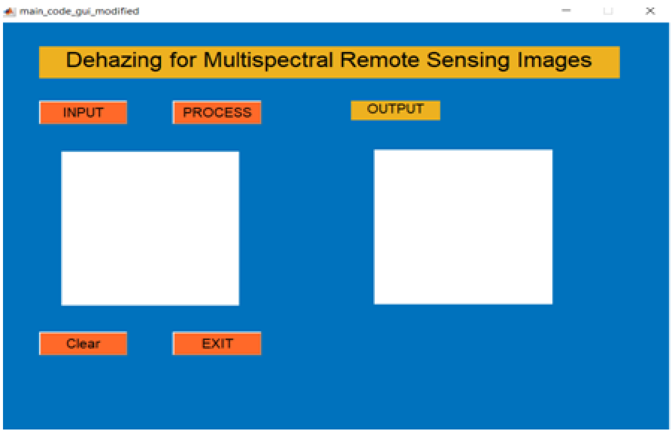

Fig 1: SAMPLE INTERFACE

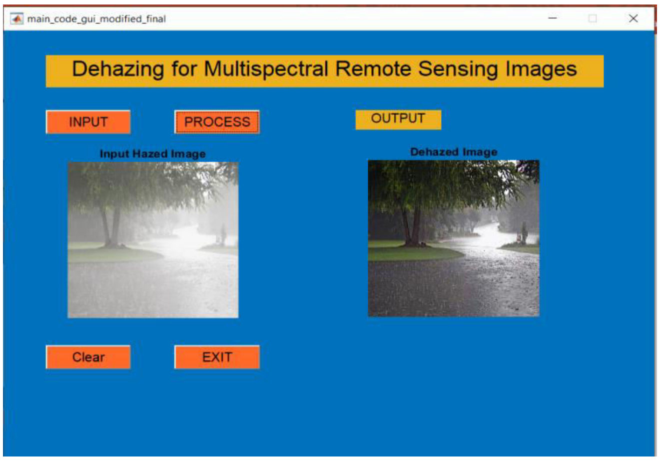

Fig 2:Image of a foggy rain

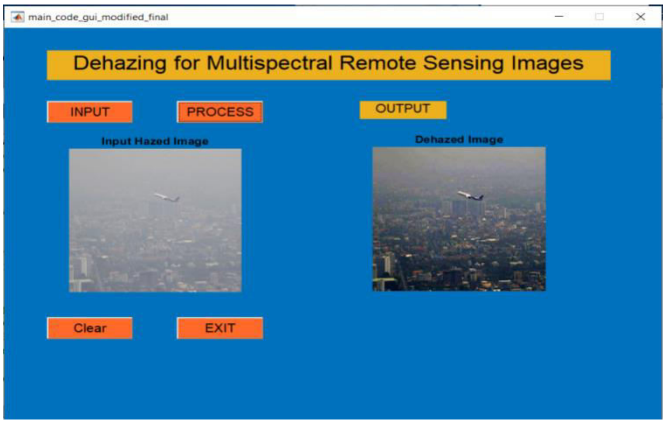

Fig 3 : EARTH TOP VIEW

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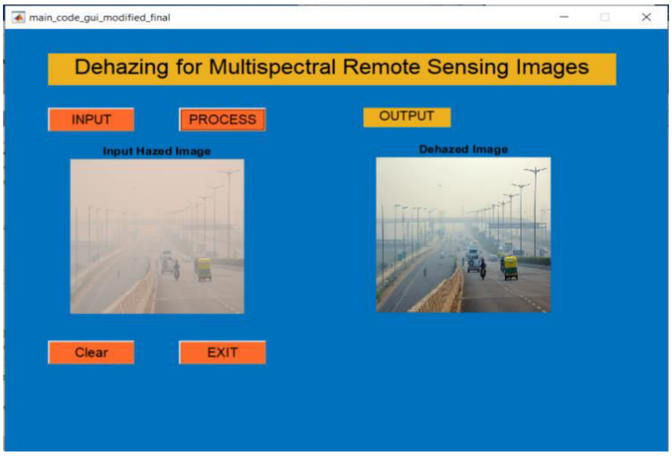

Fig 4: ROAD VIEW

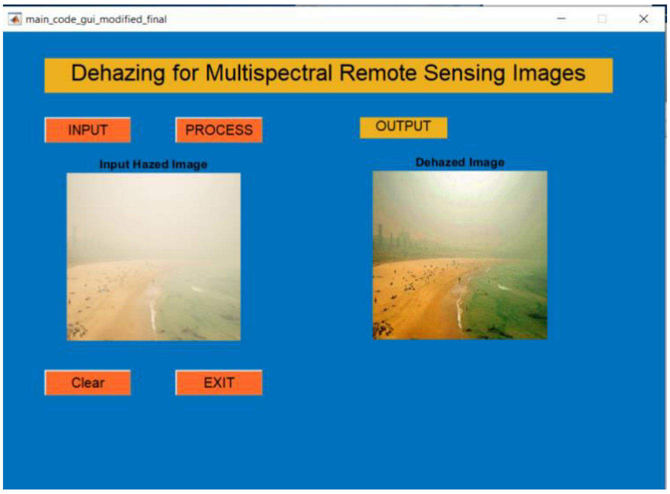

Fig 5: BEACH VIEW

CONCLUSION

Multispectral remote sensing photos frequently contain haze, which makes them more difficult to detect and increases the risk of inaccurate interpretation. This project proposes a novel deep CNN-based technique for eliminating haze from multispectral remote sensing photos. There are two parts to the network. The first involves concurrently linking several CNN users with residual structure. Each person is utilised to train a regression from the foggy image to the clear image. This regression provides a more realistic representation for haze by mining multiscale data through multiscale convolutions. In the suggested network, which adopts the residual structure, the input image can immediately provide the complex texture and colour information. Convolutional layers only learn and represent the hazy component. The learning challenge is consequently lessened. These individuals possess various degrees of haze training as well as various dehazing skills. In order to produce the final, dehazed image, several CNN personnel are combined as the second component of the proposed network.

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