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Improvement in Spatial Resolution with HSI – SR and CNN

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Abstract- Hyper spectral Super-Resolution (SR) is the method improves the spatial resolution of an image. A HIS SR is combined with the (CNN) model. It is used as a feature extractor. CNN contains various layers. These layers determine the color, edges and curves of the image. The process consists of three phases training, testing and implementing. Feature detection and its mapping are done by the convolutional layer. Pooling layer is another building block of CNN. Training is followed by testing and implementation. The algorithm is formed by using software called OpenCV using Python as a language. The hardware used for the testing phase is Raspberry pi. It is a compact size CPU.

Keywords-*Convolutional neural network, Image Super-Resolution (SR), Raspberry Pi.*

I.INTRODUCTION

Raspberry pi is a credit- card sized computer. It functions almost like a computer. There are various surveillance systems such as cameras, CCTV , etc., in these types of surveillance systems, the person who is stationary and is located in that particular area can only view what is happening in that place. Whereas, here, even if the user is moving from one place to another. The main advantage is used in security purposes and another advantage that it offers privacy on both sides since it is being viewed by only one person. Another advantage is that it is a simple circuit. The operating system used here is Raspbian OS . The proposed system is implemented on Raspberry Pi with con - trolling the device also live video streaming is implemented for quick actions and human recognition. Mobile video surveillance system has been envisioned in the literature as either classical video streaming with an extension over wire and wireless network system to control the human operator. Remote monitor has become an important main- tenancy method that is based on the network. There are two units Raspberry Pi Unit and Process unit with wireless link between them. Sensor unit will send sensor reading to Raspberry Pi Unit which will be uploaded to the server.

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II.LITERATURE SURVEY

Methods are evaluated via experiments on real-world MS image datasets, achieving excellent performance when compared to other state-of-the-art methods. The main advantage of the proposed DiCNN is that they provide explicit physical interpretations and can achieve fast convergence while achieving high pansharpening quality [1].

To make the first attempt to solving the HSI-SR problem using an unsupervised encoder- decoder architecture that carries the following uniqueness's:

a. It is composed of two encoder-decoder networks coupled through a shared decoder in order to preserve the rich spectral information from the HIS network.

b. The angular difference between representations is minimized in order to reduce the spectral distortion.

The architecture consists of two deep networks, for the representation learning of the LR HSI and HR MSI, respectively. To address the challenge of spectral distortion, the representations of two modalities are encouraged to have similar patterns by minimizing their angular difference [2].

The formulation of a noval post acquisition approach for the enhancement of low-spectral resolution multiband hyper spectral imagery. The design of an efficient coupled dictionary learning architecture relying on the alternating direction method of multipliers. The problem of hyper spectral image un mixing using the recovered high-spectral resolution data-cube, and we are able to demonstrate that the proposed scheme provides significant value in hyper spectral image understanding techniques [3].

Linear methods for HSI classification include linear principal component analysis (PCA), projection pursuit (PP), and linear band combination (fusion) These methods are simple in algorithmic structure but not necessarily of low computational cost, or of accurate enough for Classification of complex scenes. The work extends the HSI classification pipeline with a single HSI data cube to multiple HSI data cubes. To be classified of multiple classes. The main challenge is deriving the cube-wise classification from pixel-wise Classification [4].

To consider HSI classification with the so-called directed acyclic graphs (DAG) where the layers are not limited to chaining one after another. To extract robust and effective features from HSI classification, it is reasonable to explore CNN models which can simultaneously extract the spatial and spectral information from multiple HSI features. This paper proposes a novel framework that takes advantage of both CNNs and multiple feature learning to better predict the class labels for HSI pixels. We built a novel CNN architecture with various features extracted from the raw imagery as input [5].

III.SYSTEM DESIGN

A. Block Diagram

At the heart of this system is a Raspberry Pi which is provided with a camera module and a display. It also consists of a SD card which would be used to store the database of images for the purpose of comparison during resolution enhancing. First step would be done by the Raspberry Pi camera by capturing the image and the captured image is passed to the raspberry pi for processing the image and performs the image comparisons and resolution enhancement with the help of Convolutional neural network algorithm . Once the images are compared the captured image will be passed through the system and it will be super resolved to form a high resolution image from a lower one.

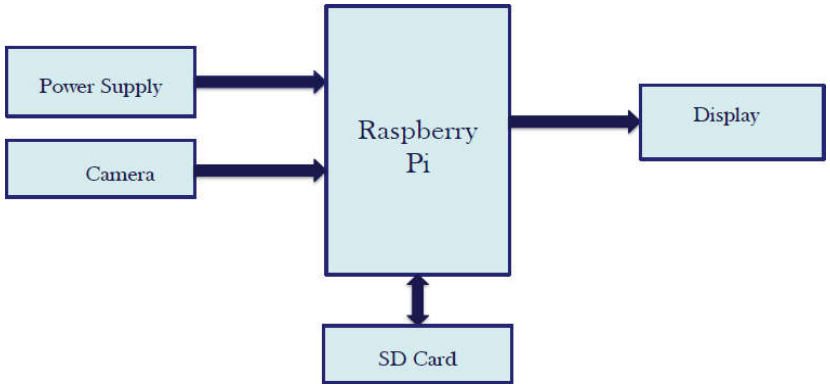

Fig.1 System Block Diagram

B. Raspberry Pi Module

This is the heart of our contrivance that will decode the input picture from the camera unit and set the characters consisting of registration numbers apart. The Raspberry Pi is a single-board computer of a size of credit card developed in the UK by the Raspberry Pi Substratum.

The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and was pristinely shipped with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, so an external drive is used for booting and long term storage. This is preferably done using a micro SD card which can be mounted on it easily.

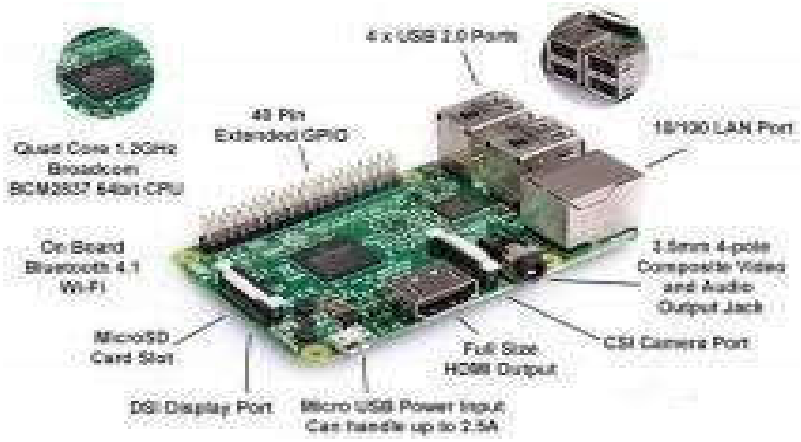

Fig.2 *Raspberry Pi Module*

C. Camera

This is an important unit that will take the frames. We will use a webcam or USB camera. It is a viewing record camera that works in true time i.e. it will get food to its image to a knowledge processing machine or knowledge processing machine network 1. It is different from an IP camera as it uses a straight to connection using Ethernet or WI - FI A USB camera is generally connected by an USB thick wire cord. The common use as a viewing record camera for the World Wide the net gave the webcam its name. USB camera is very having general approval, some of the uses cover safety over-seeing, knowledge processing machine vision, viewing record broadcasting, and for recording grouping viewing record.

Fig. 3 Camera

D. Python

Python is an interpreter, high-level, general-purpose programming language. Created by Guido van Rossum and first released in 1991, Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Python is dynamically typed and garbage-collected.

Python is a general-purpose object-oriented programming language with high-level Programming capabilities. It has become famous because of its apparent and easily understandable syntax, portability and easy to learn. Python is a programming language that includes features of C and Java. It provides the style of writing an elegant code like

C,and for object-oriented programming, it offers classes and objects like Java.

VI. WORKFLOW

A. Convolutional Neural Network(CNN)

This phase acts as interference between training and testing phase. CNN fetch the approximate data from the image using convolution layer of CNN. The approximate data is then bridged using Relu layer. The data existing in the surrounding blocks of central block is amplified. Maxpooling finds the maximum value from the amplified data . Dropout then drops 25% of unused data. Features(Weight & Bias) of input image are manipulated to match with output image using softmax. The error is compared with threshold error to measure accuracy.

B.Training

Training phase takes N images of low resolution (m, n) and high resolution (4m, 4n). Block processing is applied to all the images. Gabor filter is used to extract the textures present in an image at different angles . These extracted feature vector is applied as an input to CNN . CNN training initiates once the input is provided to it. The weight and bias of input image is updated as per the requirement. The error of weight and bias of input and output blocks must be less than threshold only then the CNN is said to be trained else the weight and bias are updated again. Training phase stops when the error obtained is less than the threshold value.

C.Testing

The testing phase is simpler than training phase. It works slightly similar as CNN. The image is captured by the camera provided in the system. Block processing is applied to the captured image. The features are extracted from the image. Once all the features are extracted CNN testing takes place with pre trained CNN module. This module provides high resolution blocks. All these high resolution blocks are combined together to form single image this image is the Super-resolved image.

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Fig.4 Training

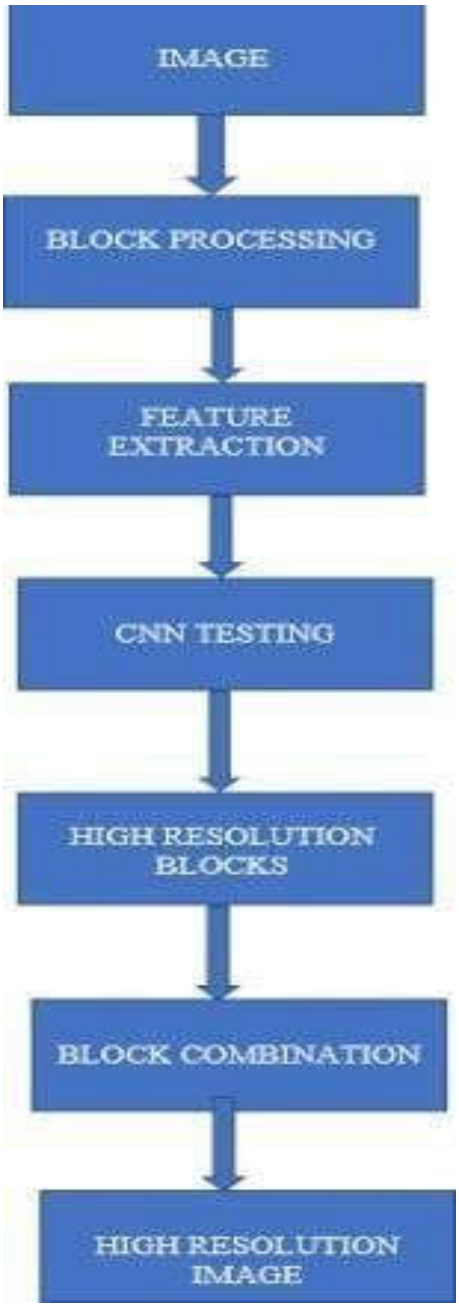

Fig.5 Testing

V. RESULTS

Fig.6 Low Resolution Image

Fig.7 Preprocess Image

Fig.8 Gabor Filter Image

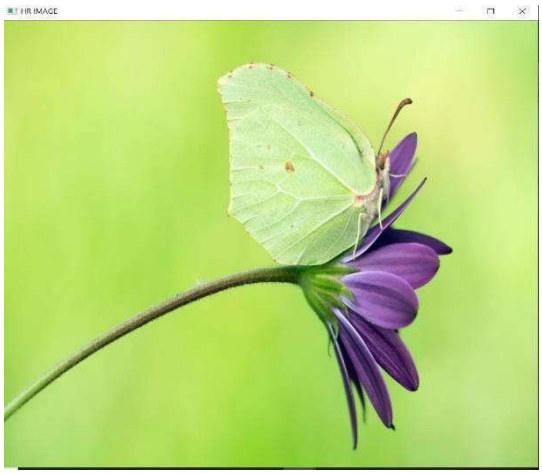

Fig.9 High Resolution Image

CONCLUSION

At the output part of the system, higher resolution image is obtained from a lower resolution image. A detailed component- wise analysis and experimental comparisons are conducted to evaluate the previous co-designed classification on HSI data.

Each component feature transformation, graph spectral method for dimension reduction, and statistical ensemble is investigated respectively, with the other fixed components, satisfying accuracy is obtained. The application is also extended to hyper spectral face recognition; while the investigation is still ongoing on reducing the size of CNN graph; all other components are proved effective on the dataset.

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