

Web-Based Image Processing and Enhancement Using Flask

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ABSTRACT: With the increasing demand for digital image processing applications, real-time image enhancement and transformation have become essential in various domains, including photography, medical imaging, and computer vision. This project presents a web-based image processing application built using Flask, enabling users to perform various image transformations and enhancements through an interactive interface. The system supports multiple functionalities such as grayscale conversion, zooming, panning, brightness adjustment, histogram equalization, edge detection, blurring, sharpening, and thresholding. A key feature of the application is its ability to process images dynamically while ensuring a no-cache mechanism for real-time updates. The backend leverages Python libraries like NumPy and PIL, while the frontend utilizes HTML templates to facilitate seamless user interactions. The application employs a modular approach, integrating an `image_processing` module that handles different image transformation operations.

I. INTRODUCTION

The primary objective of this is to create a web application that provides us various features such as histogram equalization, greyscale and so on for image enhancement. With the rapid growth of digital technology and internet-based applications, digital image processing has become one of the most important areas in computer science and information technology. Images are widely used in many domains such as photography, medical diagnosis, satellite imaging, computer vision, education, and scientific research. In these areas, image enhancement and transformation techniques are essential for improving image quality, extracting meaningful information, and supporting accurate analysis. As the demand for fast and efficient image processing continues to increase, there is a growing need for platforms that can deliver real-time image enhancement in a simple and accessible manner.

Traditional image processing software often presents several limitations. Most desktop-based applications require installation on a specific system, consume significant storage and processing power, and may involve complex interfaces that are difficult for beginners to use. In addition, such software generally requires manual intervention and may not be easily accessible across different devices. These limitations reduce flexibility and make image processing less convenient, especially for students, researchers, and users who need quick image transformations without depending on heavy standalone tools. In today's digital environment, web-based solutions provide a practical alternative by enabling users to access services anytime and from anywhere through a browser..

II. LITERATURE REVIEW

Y. Title: "Trends and prospects of techniques for haze removal from degraded images. Author: G. Sahu, A. Seal, D. Bhattacharjee, M. Nasipuri, P. Brida, and O. Krejcar. Year: 2022.

Description: For the last two decades, image processing techniques have been used frequently in computer vision applications. The most challenging task in image processing is restoring images that are degraded due to various weather conditions. Mainly, the visibility of outdoor images is corrupted due to adverse atmospheric effects. The visibility of acquired images is reduced in these circumstances. Haze is an atmospheric phenomenon that reduces the clarity of an image. Due to the presence of particles such as dust, dirt, soot, or smoke, there is significant decay in the color and contrast of captured images. Haze present in acquired images causes issues in a variety of computer vision applications. Therefore, enhancing the contrast of a hazy image and restoring the visibility of the scene is essential. Since clear images are required in every application, image dehazing is an important step. Hence, many researchers are working on it. Different methods have been presented in the literature for image dehazing. This study describes various traditional and deep learning techniques of image dehazing from an analytical perspective. The main intention behind this work is to provide an intuitive understanding of the major techniques that have made a relevant contribution to haze removal. In this paper, we have covered different types of contributions toward dehazing based on the traditional method as well as deep learning approaches. With a considerable amount of instinctive simplifications,

the reader is expected to have an improved ability to visualize the internal dynamics of these processes.

Title: Object classification based on enhanced evidence theory: Radar-vision fusion approach for roadside application.

Author: P. Liu, G. Yu, Z. Wang, B. Zhou, and P. Chen.

Year: 2022.

Description: Roadside object detection and classification provide a good understanding of driving scenarios in regard to over-the-horizon perception. However, typical roadside sensors are insufficient when used separately. The fusion of the millimeter-wave (MMW) radar and monovision camera serves as an efficient approach. Unfortunately, the uncertain and conflicting data in extreme light conditions pose challenges to the fusion process. To this end, this study proposed an evidential framework to fuse the radar and camera data. A novel modeling approach for basic belief assignments (BBAs) was proposed, which took the uncertainty of convolutional neural network (CNN) model into consideration. Moreover, the single-scan and multiscan fusion methods were developed based on the enhanced evidence theory, which utilized different weighted coefficients by referring to the reinforced belief (RB) divergence measure and belief entropy (BE). Both numerical and empirical experiments were conducted to investigate the method performance. Specifically, in numerical experiments, the belief value of actual classification increased to 99.01%. For empirical experiments, based on the real datasets collected by roadside devices, the proposed method was demonstrated to outperform the state-of-the-art ones in terms of 71.06% and 87.23% precisions for bright light and low illumination conditions, respectively. The results verify that the proposed method is effective in fusing the conflicting and uncertain data.

III. METHODOLOGY

Modules Name:

- Image Collection
- CNN + Pyramid Model
- Image Segmentation
- Histogram Analysis
- Image Processing
- Image Filtering
- Image Enhancement

Existing System

The existing system mainly relies on traditional image processing techniques such as basic filtering and thresholding methods for image enhancement and segmentation. These techniques are commonly used because they are simple to implement and require less computational effort. However, while they provide basic image improvement, they often fail to deliver high-quality results when dealing with complex or low-quality images. Their limited ability to preserve image details and adapt to different conditions makes them less effective for modern image processing requirements.

One of the primary techniques used in the existing system is Mean filtering and Gaussian filtering for noise reduction and image smoothing.

PROPOSED SYSTEM:

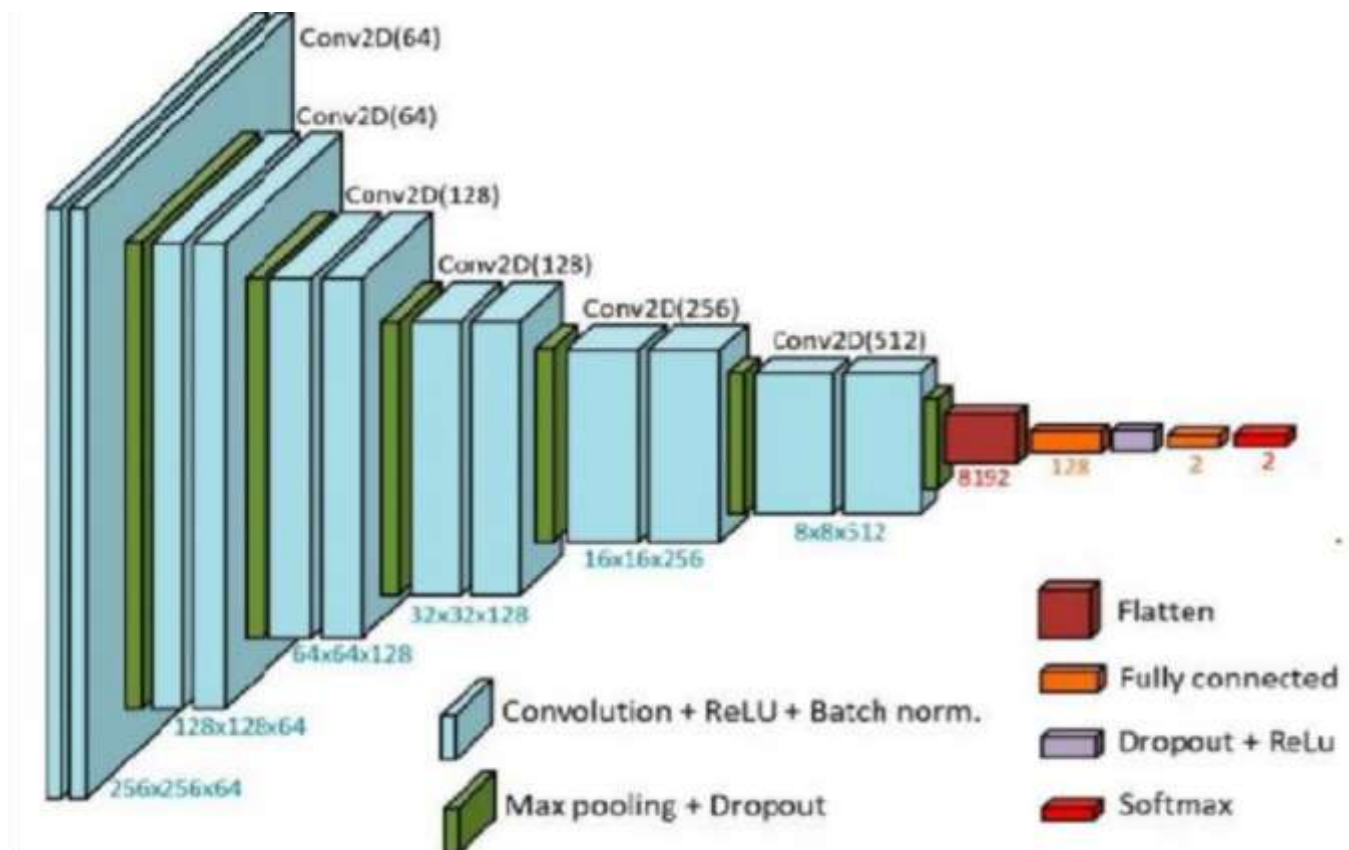
The proposed protocol showed how centralized SDN controller nodes logically assumed the role of network management and control. Therefore, we present a Lightweight Authentication and Key Agreement Protocol (LAKP) for SDN-enabled WSNs to protect entity communication. Additionally, we demonstrate that the suggested system prevents known security flaws by conducting both informal and formal security studies using the Scyther tool and Burrows-Abadi- Needham (BAN) logic. Further, the performance study demonstrates that the suggested scheme performs better in computing and communication burdens than related protocols with 1.6% to 5.4% and 1.3% to 5.8%, respectively.

Proposed System Advantages

The proposed system introduces a modern and efficient web-based solution for digital image processing by overcoming the limitations found in traditional standalone applications. Existing image processing approaches usually depend on desktop software that requires manual installation, frequent updates, and direct user intervention for every operation. These methods often become inconvenient because users are restricted to a specific device and need sufficient system resources to perform image enhancement tasks. In addition, traditional software may not provide instant accessibility, making it difficult for users to process images quickly whenever required. To solve these issues, the proposed system provides an online platform that allows users to perform image processing operations directly through a web browser in a simple and convenient manner.

The system is developed using Flask, a lightweight and flexible Python web framework that enables efficient communication between the frontend and backend. Flask provides a structured and reliable environment for handling user requests and delivering processed image results in real time. Because Flask is lightweight, the application can run smoothly without requiring heavy infrastructure.

SYSTEM ARCHITECTURE



This architecture shows a Convolutional Neural Network (CNN) used for image classification or image enhancement. The input image first passes through several Conv2D layers with ReLU activation and Batch Normalization, which

extract important features like edges, textures, and patterns. After each convolution block, Max Pooling with Dropout reduces the image size and removes unnecessary details while preventing overfitting. As the layers go deeper, the network learns more complex features, increasing filters from 64 to 512. The extracted feature maps are then converted into a 1D vector using the Flatten layer. Finally, Fully Connected layers process this data, and the Softmax output layer gives the final classification probabilities for the two output classes.

MODULES:

1) Image Collection:

Image collection is the process of gathering a diverse array of visual content for various purposes, ranging from personal enjoyment to professional use. It involves sourcing, organizing, and curating images from different sources such as photography websites, stock photo libraries, social media platforms, and personal photography. The collected images may be used for artistic projects, marketing materials, educational resources, research endeavors, or simply for personal documentation.

2) CNN + Pyramid Model:

The CNN + Pyramid model, also known as Convolutional Neural Network with Pyramid architecture, is a deep learning architecture designed for tasks such as image recognition and object detection. It combines the strengths of convolutional neural networks (CNNs) with the multi-scale feature representation provided by pyramid structures. In this model, the CNN component processes input images hierarchically, extracting features at multiple levels of abstraction through convolutional layers.

3) Image Segmentation:

Image segmentation is a fundamental task in computer vision that involves partitioning an image into multiple segments or regions based on certain characteristics, such as color, texture, or

intensity, with the goal of simplifying the representation of an image and extracting meaningful information. The main objective of image segmentation is to divide an image into semantically meaningful parts, enabling more efficient analysis, understanding, and manipulation of visual content.

4) Histogram Analysis:

Histogram analysis is a fundamental technique in image processing and computer vision that involves analyzing the distribution of pixel intensities within an image. A histogram is a graphical representation of the frequency of occurrence of each intensity value in the image, with darker pixels represented on the left and brighter pixels on the right. By examining the shape and characteristics of the histogram, valuable insights can be gained about the overall brightness, contrast, and distribution of tones within the image

5) Image Processing:

Image processing refers to the manipulation and analysis of digital images to extract useful information, enhance visual quality, or perform specific tasks for various applications. It encompasses a wide range of techniques and algorithms aimed at modifying images to achieve desired objectives. Basic image processing operations include resizing, cropping, and rotating images, which are commonly used for tasks such as preparing images for display or fitting them into specific dimensions. More advanced image processing techniques involve filtering, which modifies pixel values based on local neighborhoods to remove noise, enhance details, or highlight specific features.

6) Image Enhancement:

Image enhancement is a fundamental process in image processing that aims to improve the visual quality of digital images by emphasizing certain features, reducing noise, enhancing contrast, or adjusting brightness and color balance. It encompasses a variety of techniques and algorithms designed to enhance specific aspects of an image while preserving its overall integrity and fidelity. Common image enhancement methods include histogram equalization,

filtering, sharpening, contrast stretching, grayscale conversion, and brightness adjustment. In low-light and nighttime conditions, image enhancement plays a crucial role in improving visibility and reducing the effects of poor illumination.

IV. IMPLEMENTATION

We can see from the results that on each database, the error rates are very low due to the discriminatory power of features and the regression capabilities of classifiers. Comparing the highest accuracies (corresponding to the lowest error rates) to those of previous works, our results are very competitive.

V. EXPERIMENTAL RESULTS



Fig: Home Page

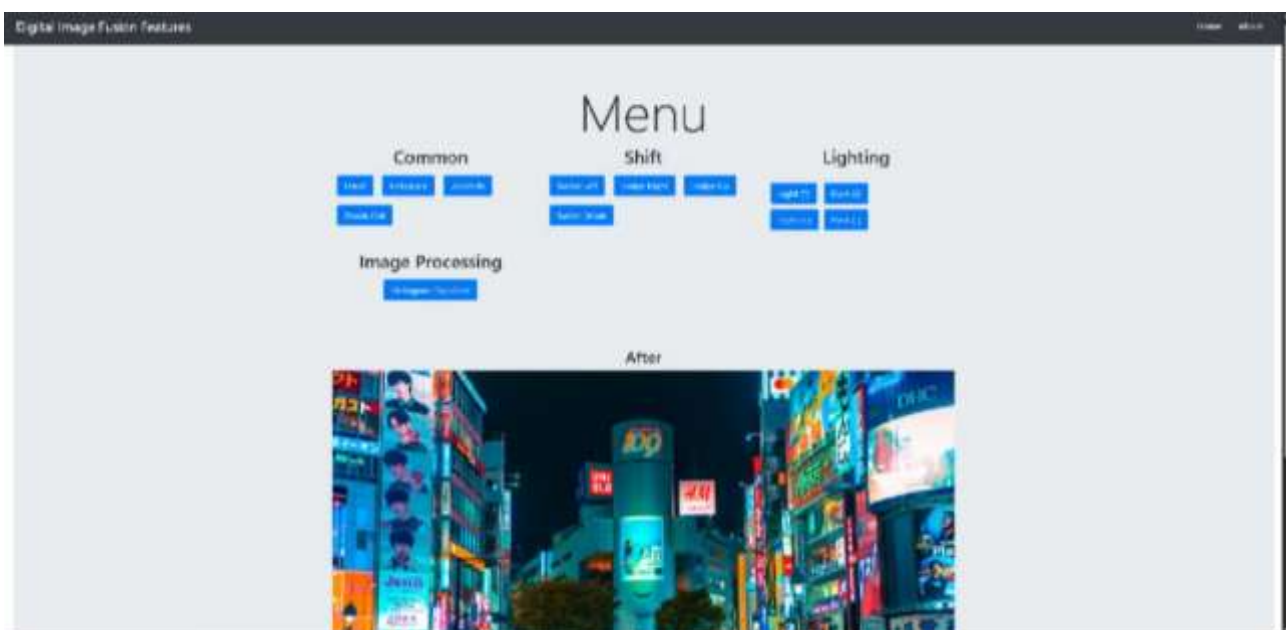


Fig: Menu Page

VI. CONCLUSION

To facilitate multi-object detection and recognition tasks on the Intelligent Roadside Surveillance System, we propose an efficient flowchart for night image enhancement by employing multi-source data fusion. Using a fixed field of view and easy multi-sensor fusion, we present a complete set of multi-sensor fusion schemes suitable for the intelligent roadside system. The two key fusions are the decision-level fusion of camera and radar and the pixel-level fusion of day and night images.

VII. FUTURE ENHANCEMENT

To facilitate multi-object detection and recognition tasks on the Intelligent Roadside Surveillance System, we propose an efficient flowchart for night image enhancement by employing multi-source data fusion. Using a fixed field of view and easy multi-sensor fusion, we present a complete set of multi-sensor fusion schemes suitable for the intelligent roadside system. The two key fusions are the decision-level fusion of camera and radar and the pixel-level fusion of day and night images.

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