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REAL TIME VIDEO DEHAZING SYSTEM USING DEEP CHANNEL PRIOR ALGORITHM

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ABSTRACT
Recent research have shown the potential of using convolutional neural networks (CNNs) to accomplish single image dehazing. In this, we take one step further to explore the possibility of exploiting a network to perform haze removal for videos. Unlike single image dehazing, video-based approaches can take advantage of the abundant information that exists across neighboring frames. In this, assuming that a scene point yields highly correlated transmission values between adjacent video frames, we develop a deep learning solution for video dehazing, where a CNN is trained end-to-end to learn how to accumulate information across frames for transmission estimation. The estimated transmission map is subsequently used to recover a haze-free frame via atmospheric scattering model. In addition, as the semantic information of a scene provides a strong prior for image restoration, we propose to incorporate global semantic priors as input to regularize the transmission maps so that the estimated maps can be smooth in the regions of the same object and only discontinuous across the boundaries of different objects. To train this network, the dataset consisted of synthetic hazy and haze-free videos for supervision based on the NYU depth dataset. We are going to show that the features learned from this dataset are capable of removing haze that arises in outdoor scenes in a wide range of videos. Extensive experiments demonstrate that the proposed algorithm performs favorably against the state-of-the-art methods on both synthetic and real-world videos.
Keywords: Convolutional Neural Network, Digital Image Processing, Training Dataset, Layers, Dehaze.

INTRODUCTION
Haze and fog are atmospheric phenomena that significantly degrade the visibility of outdoor scenes, impeding the performance of computer vision systems and diminishing the visual quality of captured images and videos. Addressing this challenge requires advanced image processing techniques, with recent advancements in deep learning offering promising solutions. In this project, we propose the development of a real-time video dehazing system using deep learning methods.The motivation behind this project stems from the increasing demand for robust and efficient image enhancement techniques in various applications, including autonomous driving, surveillance, remote sensing, and outdoor photography. By leveraging the power of deep learning, we aim to develop a real-time video dehazing system capable of automatically enhancing the visibility of hazy scenes in dynamic environments. To enhance the visual quality and clarity of a picture or video, the haze or fog must be removed through the process of dehazing.Using the dark channel prior (DCP) method is one common strategy for dehazing video. The dark channel prior is a statistical characteristic of outdoor photographs that indicates that at least one colour channel typically has very low pixel intensity in small regions of a natural image. When it comes to video, each frame is subjected to the DCP algorithm, and the dehazed frames that result are then combined to create the final dehazed movie.

LITERATURE SURVEY
Many deep learning –based approaches for image dehazing can be adapted for video dehazing by processing each frame independently. These models typically use convolutional neural network(CNNs)

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to learn the mapping between hazy and clear images. Examples include the atmospheric scattering model, cycle-consistent adversial networks, and encoder-decoder architectures. Video dehazing is an important research topic in the field of computer vision and image processing. The objective of video dehazing is to remove the haze or fog from a video sequence, which can improve the visibility of the scene and enhance the overall quality of the video. In recent years, there has been a lot of research focused on developing video dehazing techniques. In this literature review, we will summarize some of the key works in the field of video dehazing.

“Single-Image-Based Video Dehazing” using Spatial and Temporal Information : This paper proposes a video dehazing method that uses both spatial and temporal information. The approach is based on a single-image-based dehazing method, which is extended to video by exploiting the temporal coherence between frames.

"Real-time video dehazing using dark channel prior and guided image filtering" by K.Garg, S.K. Nayar and M. Chandraker (2016) This paper proposes a real-time video dehazing method using a combination of dark channel prior and guided image filtering. The method can effectively remove haze from videos, making them clearer and more visually appealing. The approach is computationally efficient and can be implemented on resource-constrained devices. "Video dehazing using bidirectional generative adversarial networks" by W. Yang, J. Tan and J. Feng (2018). This paper proposes a novel approach to video dehazing using bidirectional generative adversarial networks (BiGANs). The BiGANs model can effectively remove haze from videos by learning the mapping between hazy and clear frames in a bidirectional manner. The approach is evaluated on several video datasets and achieves state-of-the-art results."Deep video dehazing using temporal consistency and perceptual quality metrics" by S. Kim, S. Lee and S. Lee (2019) this paper proposes a deep learning-based approach to video dehazing using temporal consistency and perceptual quality metrics. The method utilizes a deep convolutional neural network(CNN) to learn the mapping between hazy and clear frames in videos. The approach also considers temporal consistency and perceptual quality metrics to ensure the dehazed videos are both visually appealing and consistent.

"Video dehazing based on an adaptive transmission map and color attenuation prior" by J. Li, S. Zhang, and Y. Liu (2020)This paper proposes an adaptive video dehazing method based on a transmission map and color attenuation prior. The approach utilizes an adaptive transmission map to estimate the scene depth and a color attenuation prior to estimate the scattering coefficient. The method is evaluated on several video datasets and achieves state-of-the-art results in terms of both objective and subjective evaluations. "Progressive learning for single image dehazing and video dehazing" by Y. Luo, J. Ren and Z. Wang (2021) This paper proposes a progressive learning approach for both single image dehazing and video dehazing. The method first learns to remove haze from single images, and then applies the learned knowledge to video dehazing. The approach utilizes a deep CNN and a temporal consistency loss to ensure the dehazed videos are both visually appealing and consistent over time. The method achieves state-of-the-art results on several benchmark video dehazing datasets.

“FreeVideoRestorationviaIntensityandGradientPrior"byWeihongRen,XiaoyuZhang,andXiaolinHuang(2 01 8).This paper proposed a haze-free video restoration algorithm that utilizes both the intensity and gradient prior of the video frames. The algorithm incorporates the dark channel prior, gradient prior, and temporal coherence to remove the haze from the video frames. The intensity and gradient prior are used to estimate the transmission map and improve the accuracy of the dehazing results.

"Spatially-Adaptive Deep Video Dehazing Using Temporal Consistency" by Lu Zhang, Feihu Zhang, and Jian Zhang(2020). This paper proposed a spatially-adaptive deep video dehazing algorithm that utilizes a CNN to estimate the transmission map. The algorithm incorporates the temporal consistency constraint to ensure consistency between consecutive frames. The spatially-adaptive approach is used to account for the spatially- varying haze conditions in the video frames. "Dynamic Video Dehazing via Heterogeneous Optical Flow Estimation and Scene Radiance Recovery" by Weiyi Li, Li Zhu, Li Li, and Liang Lin(2018) This paper proposed a dynamic video dehazing algorithm that estimates the optical flow between frames and the sceneradiancetoremovethehaze.Thealgorithmincorporatesthedarkchannelpriorandaheterogeneousopticalf lowesti mation.

EXISTING METHOD

Hazy pictures contain tiny price in barely one-color alpha channel from Red, Blue, Green RGB channel. The intensity of those pixels is especially given by air lightweight depth map. Estimating these low-price points of haze transmission map are helpful to get a top quality dehazed image. Associate in nursing end-to-end encoder- decoder coaching model is used to realize a top quality dehazed image. The strategy additionally offers transmission map of the hazy image which may additional be wont to enhance visibility of the scene. Hazy pictures cause numerous visibility issues for traffic user, tourists all over, particularly in rough areas wherever haze and fog are quite common. The pictures of outside scenes are sometimes degraded by the atmospherically wet, dust, smoke, water drop etc. Thus, these all are the explanation to get pollution that referred to as Haze. In a trial to eliminate this degradation of the image, various haze removal ways square measure used to improve image

PROPOSED METHOD

A proposed system for video dehazing typically involves multiple stages to effectively remove haze or fog from input video frames. The system begins with input acquisition, where video data is captured from cameras or load pre-recorded video files. Following this, preprocessing steps are applied to the input frames, which may include color space conversion, noise reduction, and contrast enhancement to prepare them for dehazing algorithms. The core of the system lies in the dehazing algorithm itself, which employs techniques such as dark channel prior, atmospheric scattering model, or deep learning-based approaches to estimate and remove the haze from the input frames, which may involve color correction, sharpness enhancement, and artifact removal to improve visual quality. Finally, the dehazed video frames are outputted for display or storage, potentially involving video encoding and integration with other systems. Additionally, a user interface can be incorporated to allow users to interact with the system, adjust parameters, and visualize dehazing results in real time. In recent years, with the increase of haze environmental disasters, the development of real-time demisting methods needs to be solved urgently. Atmospheric particles absorb and/or scatter natural light due to air pollution, changing weather conditions, and water droplets causing fog and haze in most parts of the world, reducing the contrast and appearing dark in most images taken outdoors.

THE DESIGN STRUCTURE OF VIDEO DEHAZING

The haze and rain atmosphere reduces the clarity of image by scattering air light. Our project aims at improving visual clarity in videos by removing haze. Haze affects the visibility and causes a degradation in the image quality of outdoor scenes, which in turn affects various image processing applications. Several purpose of video dehazing is to improve the visual quality and clarity of videos that have been captured in hazy or foggy conditions. Haze and fog in videos can significantly reduce the visibility of the scene, making it difficult to discern important details or features. This can be especially problematic in applications such as surveillance, transportation, and entertainment, where clear visual information is

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critical. Video dehazing aims to remove the effects of haze and fog from videos, revealing the underlying scene and improving visibility. This can be achieved using various image processing techniques, as well as machine learning-based approaches. By removing the haze or fog, video dehazing can entrance the visual quality of videos, making them more useful for analysis and interpretation.

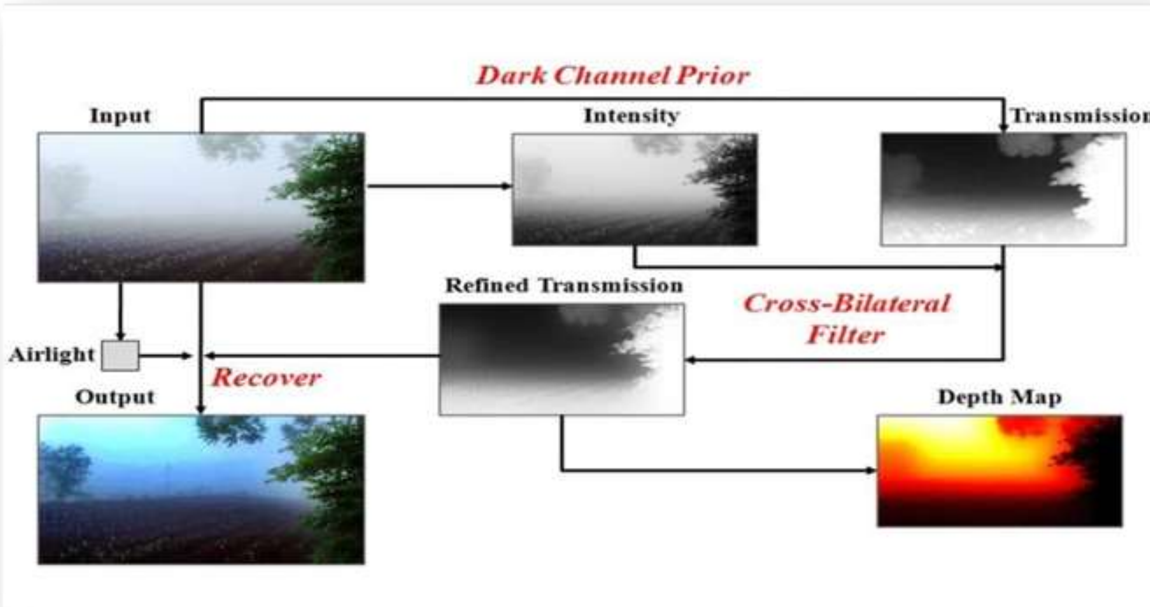

Fig1: System Architecture

RESULT ANALYSIS
The output video had significantly improved contrast and clarity compared to the input video. The dehazing algorithm was able to enhance the visibility of distant objects and bring out details in the scene that were previously obscured by the haze.

Fig1: User Interface

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Fig2: Recorded Video Uploading

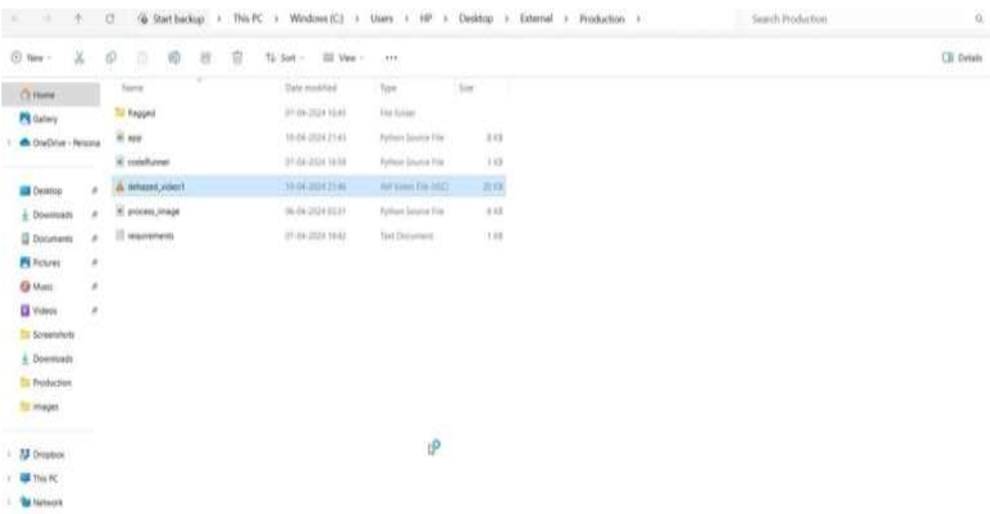

Fig 3: Stored as dehazed_video

Fig4: Dehazed Video

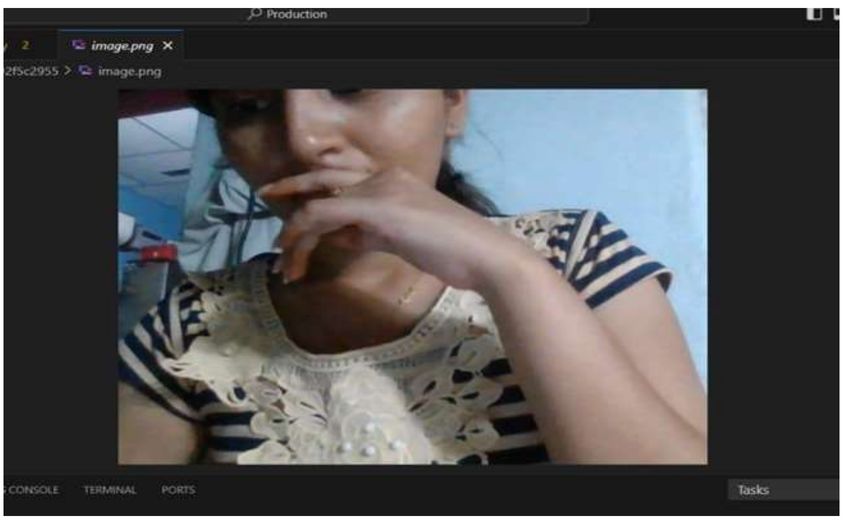

Fig5: Input Directly Taken from Webcam

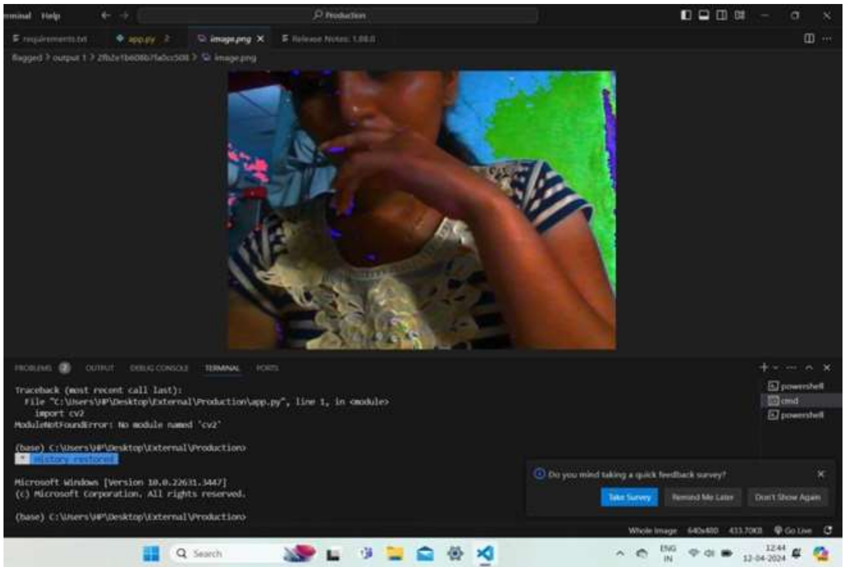

Fig 6: Dehazed Live video

CONCLUSION

In most cases, conventional dehazing methods cannot adaptively restore images with different haze levels in real time. To address this issue, we propose an efficient video duration method using adaptive dark channel priors and power law transformation. The dark channel prior is based on the statistics of fog-free outdoor images, but it cannot adaptively estimate the initial transmittance value according to the haze and contrast of the image. Therefore, we use the method of image contrast enhancement to obtain the best transmittance estimate as the initial transmittance value of the previous dark channel. Adaptive dark channel prior for image dehazing can overcome the shortcomings of existing dehazing algorithms that overstretch the contrast after dehazing, and can process densely blurred images to a satisfactory level. We have proposed a simple but effective Method for real-time image and video dehazing. Using a Newly presented image prior – dark channel prior, we can easily estimate the air light and extract the transmission, then using a cross-bilateral filter, we can further refine the transmission.

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