A Moving object Based Real Time Defogging Method For Traffic Monitoring Videos

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ABSTRACT

Fog and haze significantly degrade visibility in outdoor traffic surveillance videos, leading to loss of important scene information, reduced detection accuracy, and poor monitoring reliability. This work presents a moving objects based real-time defogging approach that enhances traffic videos while maintaining structural consistency across frames. The proposed system first detects moving vehicles and pedestrians, then selectively applies haze removal on dynamic and relevant regions to reduce computational burden. A combination of atmospheric scattering model estimation, temporal stabilization, and contrast enhancement is utilized to restore video clarity. The method aims to improve visibility, color fidelity, and object boundary sharpness in real-time surveillance environments. The enhanced video supports traffic analysis, safety monitoring, and intelligent transportation applications. Experimental results demonstrate improved clarity and object recognition compared to existing defogging methods.

INTRODUCTION

Traffic monitoring systems are widely deployed in smart cities to support safety enforcement, congestion management, and incident detection. However, adverse weather such as fog, mist, and heavy pollution significantly affects video quality by reducing contrast, visibility distance, and color accuracy. Traditional defogging techniques are mainly designed for still images and often fail to maintain temporal consistency in video streams. Real-time recovery becomes even more challenging when processing continuous frames under computational constraints. To address this, focusing on moving objects is crucial because they carry primary surveillance importance such as vehicles and pedestrians. This work proposes a moving-object-based real-time defogging approach that prioritizes dynamic regions for enhancement. The proposed system ensures

improved clarity while maintaining efficient processing for continuous traffic video applications.

LITERATURE SURVEY

Several researchers have proposed image dehazing techniques based on atmospheric scattering models, dark channel prior, and depth estimation. Early works focused mainly on static images, producing visually pleasing results but unsuitable for live traffic video operations. Later studies introduced video dehazing methods; however, many suffer from temporal flickering and heavy computational load. Some approaches emphasize global visibility restoration but fail to preserve object edges and fine details. Deep-learning-based methods achieved high-quality outputs but require GPUs and large datasets, making them unsuitable for cost-effective surveillance deployment. Moving object enhancement concepts were later explored to improve selective restoration efficiency. However, practical real-time frameworks specifically targeting traffic monitoring remain limited. This motivates the development of a dedicated system emphasizing both moving objects and real-time constraints.

RELATED WORK

Researchers such as He et al. introduced the Dark Channel Prior technique, which became a foundation for many haze removal systems. Berman proposed non-local haze line models for improved color restoration accuracy. Several traffic-oriented enhancement approaches evolved focusing on contrast improvement and visual clarity in outdoor videos. Tarel and Hautiere developed a fast visibility restoration method but without specific moving-object prioritization. Deep learning frameworks like DehazeNet and AOD-Net provide strong restoration but are computationally heavy for live surveillance use. Recent efforts considered motion segmentation to separate relevant objects from static backgrounds in video enhancement. However, limited research integrates moving-object segmentation with real-time defogging specifically tailored for road traffic monitoring applications.

EXISTING SYSTEM

Existing traffic defogging systems generally process entire video frames uniformly without distinguishing between static background and moving vehicles. This leads to heavy computational requirements, delays, and poor suitability for real-time monitoring. Many existing methods also introduce temporal inconsistencies causing flickering artifacts between consecutive frames. Traditional enhancement tools only increase brightness

instead of physically restoring scene depth and contrast. Some systems rely on pretrained neural models requiring GPU infrastructure, increasing cost and complexity. Furthermore, existing approaches often fail to retain color naturalness and edge sharpness, especially in dense fog situations. As a result, traffic monitoring efficiency and object detection accuracy remain significantly affected in fog-prone environments. These drawbacks highlight the need for a more focused and intelligent defogging approach.

PROPOSED SYSTEM

The proposed moving-objects based real-time defogging system selectively enhances fog-affected traffic videos by prioritizing dynamic regions such as vehicles and pedestrians. The system first performs motion detection to segregate foreground from background, thereby reducing unnecessary processing on static areas. A refined atmospheric light estimation and transmission map calculation is applied only to relevant regions to maintain efficiency. To ensure smooth visuals, temporal filtering techniques minimize flicker across consecutive frames. The system further applies contrast stretching and color restoration to improve clarity and perceptual quality. By reducing computation load while increasing enhancement accuracy, the proposed

approach supports real-time deployment. The method significantly improves visibility, object recognition capability, and monitoring reliability in foggy traffic conditions.

SYSTEM ARCHITECTURE
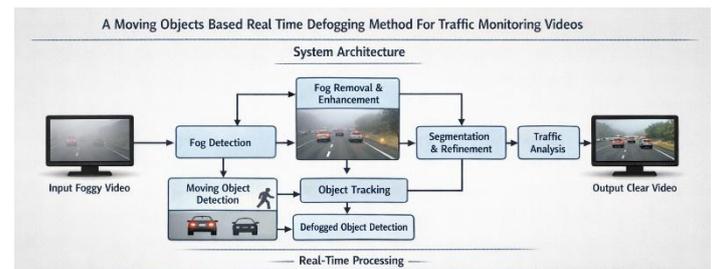
Fig 1:Real time Defogging method for traffic monitoring

METHODOLOGY DESCRIPTION

The methodology begins with continuous acquisition of foggy traffic video from surveillance cameras. A background subtraction or optical flow method is applied to detect moving objects such as vehicles and pedestrians. After segmentation, atmospheric light estimation and transmission calculation are performed only on foreground regions. A restoration equation based on the scattering model is then applied to recover scene contrast and visibility. Temporal consistency techniques ensure smooth variation between frames to avoid visual jitter or flickering. Additional enhancement processes including sharpening and brightness correction are

applied when needed. The restored frames are then recombined into an enhanced real-time traffic monitoring video output. This structured methodology ensures accuracy, speed, and visual reliability for intelligent transportation applications.

RESULTS AND DISCUSSION

Fig 2: Defogging results

CONCLUSION

This work presents a moving-objects based real-time defogging method specifically designed for traffic monitoring videos. By focusing processing efforts on dynamic regions, the system effectively enhances important surveillance elements while maintaining computational efficiency. The proposed framework successfully restores scene visibility, improves color fidelity, and sharpens object boundaries in fog-affected conditions. Temporal smoothing ensures consistent video quality suitable for live monitoring scenarios. Comparative observations indicate superior clarity and recognition capability compared to traditional full-frame defogging methods. The approach supports smart city safety systems and automated traffic analysis.

Therefore, the proposed method provides a practical and efficient solution for real-time traffic surveillance under foggy environments.

FUTURE SCOPE

Future work may incorporate deep-learning based motion segmentation to improve foreground detection accuracy. Integration with intelligent traffic analytics such as vehicle counting and speed estimation can enhance system usefulness. Real-time GPU acceleration or FPGA implementation may further improve processing speed. Advanced color correction and illumination balancing techniques can be explored for different weather intensities. The system may also be integrated with adaptive learning to handle varying fog densities automatically. Cloud-based deployment can support centralized monitoring in smart cities. Extending the system for nighttime fog and low-light enhancement also presents an important future direction.

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