Multi-Class Weather Classification Method using Multiple Weather Features and Supervised Learning

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Abstract

Traffic accidents are particularly serious on a rainy day, a dark night, an overcast and/or rainy night, a foggy day, and many other times with low visibility conditions. Present vision driver assistance systems are designed to perform under good-natured weather conditions.Classification is a methodology to identify the type of optical characteristics for vision enhancement algorithms to make them more efficient. To improve machine vision in bad weather situations, a multi-class weather classification method is presented based on multiple weather features and supervised learning. First, underlying visual features are extracted from multi-traffic scene images, and then the feature was expressed as an eight-dimensions feature matrix. Second, five supervised learning algorithms are used to train classifiers. The analysis shows that extracted features can accurately describe the image semantics, and the classifiers have high recognition accuracy rate and adaptive ability. The proposed method provides the basis for further enhancing the detection of anterior vehicle detection during nighttime illumination changes, as well as enhancing the driver’s field of vision on a foggy day

Keywords: Supervised learning models, traffic scene perception, image enhancement, image denoising, histogram

1. Introduction

Highway traffic accidents bring huge losses to people's lives and property. The advanced driver assistance systems (ADAS) play a significant role in reducing traffic accidents. Multi-traffic scene perception of complex weather condition is a piece of valuable information for assistance systems. Based on different weather category, specialized approaches can be used to improve visibility. This will contribute to expand the application of ADAS. Little work has been done on weather related issues for in-vehicle camera systems so far. Payne et al. propose classifying indoor and outdoor images by edge intensity [1].

Lu et al. propose a sunny and cloudy weather classification method for single outdoor image[2]. Lee and Kim propose intensity curves arranged to classify four fog levels by a neural network [3]. Zheng et al. present a novel framework for recognizing different weather conditions[4]. Milford et al. present vision-based simultaneous localization and mapping in changing outdoor environments [5]. Detecting critical change of environments while driving is an important task in driver assistance systems[6]. Liu et al. propose a vision-based skyline detection algorithm under image brightness variations[7]. Fu et al. propose automatic traffic data collection under varying lighting conditions [8]. Fritsch et al. use classifiers for detecting road area under multi-traffic scene [9]. Wang et al. propose a multi-vehicle detection and tracking system and it is evaluated by roadway video captured in a variety of illumination and weather conditions[10]. Satzoda et al. propose a vehicle detection method on seven different datasets that captured varying road, traffic, and weather conditions[11].

Below are the key problems for implementing this article:

1.1. Impact of complex weather on driver

Low visibility conditions will bring the driver a sense of tension. Due to variations of human physiological and psychological, driver's reaction time is different with the different driver's ages and individuals. The statistics show that driver's reaction time in complex low visibility weather conditions is significantly longer than on a clear day. In general, the driver's reaction time is about 0.2s ~ 1s. If the driver needs to make a choice in complex cases, driver's reaction time is 1s ~ 3s. If the driver needs to make complex judgment, the average reaction time is 3s~ 5s.

1.2. Enhancing the driver's field of vision in foggy day and night

Weather understanding plays a vital role in many real-world applications such as environment perception in self-driving cars. Automatic understanding weather conditions can enhance traffic safety. For instance, Xu et al. summary image defogging algorithms and related studies on image restoration and enhancement [13]. Gallen et al. propose a nighttime visibility estimation method in the presence of dense fog[14]. Gangodkar et al. propose a vehicles detection method under complex outdoor conditions[15]. Chen et al. propose night image enhancement method in order to improve nighttime driving and reduce rear-end accident [12]. Kuang et al. present an effective nighttime vehicle detection system based on image enhancement [16]. Yoo et al. present an image enhancement algorithm for low-light scenes in an environment with insufficient illumination [17]. Jung proposed and image fusion technique to improve imaging quality in low light shooting [18]. Zhou et al. present global and local contrast measurements method for single-image defogging [19]. Liu et al. present single image dehazing by using of dark channel model[20]. Pouliand and Reinhard present a novel histogram reshaping technique to make color image more intuitive [21]. Arbelot et al. present a framework that uses the textural content of the images to guide the color transfer and colorization[22]. In order to improve visibility, Xiang et al. propose an improved EM method to transfer selective colors from a set of source images to a target image [23].

Disadvantages

- Not cleared detect the weather conditions for in this process.
- Traffic analysis is not accurate the predict the final report for weather conditions.
- Weather report is not cleared so accident is increased.

2. Proposed system

Image feature extraction is the premise step of supervised learning. It is divided into global feature extraction and local feature extraction. In the work, we are interested in the entire image, the global feature descriptions are suitable and conducive to understand complex image. Therefore, multi-traffic scene perception more concerned about global features, such as color distribution, texture features outdoor conditions. Propose night image enhancement method in order to improve nighttime driving and reduce rear-end accident. Present an effective nighttime vehicle detection system based on image enhancement. Present an image enhancement algorithm for low-light scenes in an environment with insufficient illumination. Propose an image fusion technique to improve imaging quality in low light shooting. Present global and local contrast measurements method for single-image defogging. Present single image dehazing by using of dark channel model. Present a novel histogram reshaping technique to make color image more intuitive. Present a framework that uses the textural content of the images to guide the color transfer and colorization. In order to improve visibility. Propose an improved EM method to transfer selective colors from a set of source images to a target image propose a multi-vehicle detection and tracking system and it is evaluated by roadway video captured in a variety of illumination and weather conditions. Propose a vehicle detection method on seven different weather images that captured varying road, traffic, and weather conditions. So, reduce the traffic and accident issues.

Advantages

- Predict the accurate weather conditions for this process.
- Reduce the traffic issues and another one is accident issues it is major one of problems for nowadays.
- Using digital image processing so time consume is save.

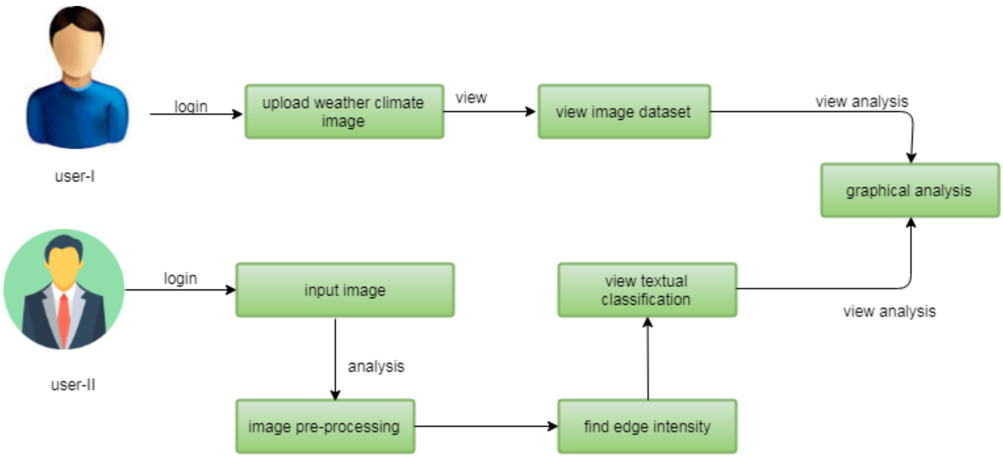


Figure 1. Architecture of proposed multi-traffic scene classification algorithm.

Following are the modules involved in proposed multi-traffic scene classification:

Weather Reports: Admin upload the training image weather data set and maintaining the perfect dataset for admin.Any details is upload and delete the date in report model. Data set for weather conditions and traffic positions and area finding the location. IN the model admin maintaining the training data set.

Find Weather: User login the page and upload the weather conditions image and next process image is analysis the admin training data set and lost finding the weather conditions. It is output for digital image processing. They will algorithms using for digital image processing and support vector machine.

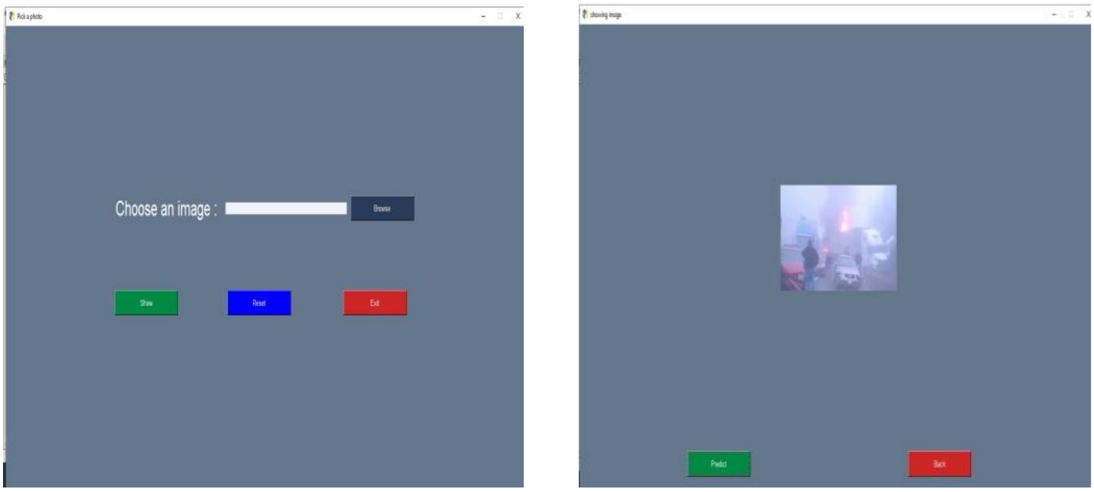
Analysis Reports: They will finally report for weather conditions and which area affect for traffic issues finding the final data report. And using support vector machine algorithm split the weather conditions for separate process. And user view the all the data in finding the data process in data set.

Graphical Representations: The analyses of proposed systems are calculated based on the traffic issues. This can be measured with the help of graphical notations such as pie chart, bar chart and line chart. The data can be given in a dynamical data.

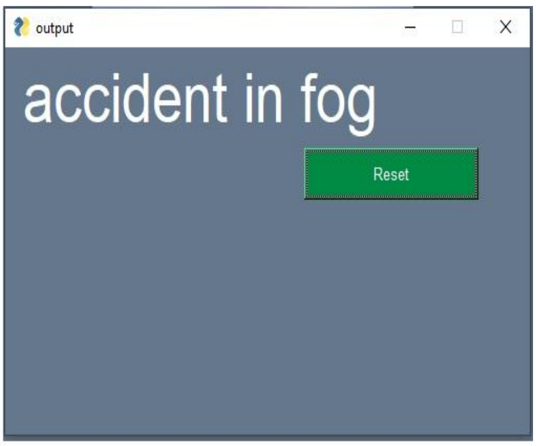
3. Experiment results

In the following section, we will first introduce the traffic scene dataset, and then the experimental set up will be briefly outlined including performance comparison, followed by the details of experiments on the database for traffic scene recognition. Our dataset contains 2000 images assigned to 10 categories of traffic scenes with 200 images belonging to each category (Figure 2): bridges, gas station, highway, indoor parking, outdoor parking, roundabout, toll station, traffic jams, train station and tunnel. The average size of each image is approximately 450*500 pixels. The images of the 10 categories were obtained by us from both the Google image search engine as well as personal photographs. Each category of scenes was split randomly into two separate sets of images, 135 for training and the rest for testing.

Figure2 Sub-sample of 10 categories traffic road scene (from left to right, from top to bottom, the labels are 1-10)



(a) Upload test image. (b) Detection of traffic.



(c) Classification.

Figure 3.Proposed traffic detection.

4. Conclusion

Road signals based on road images are a new and challenging subject, which is widely needed in many sectors. Therefore, the study of weather authorization based on images is an urgent request, which helps detect weather conditions for many visual systems. Classification is a method to classify optical properties for more efficient vision development protocols. In this sheet, eight global basic features are extracted, and 5-tracking learning algorithms are used to understand the multi-traffic road view used to evaluate color features, protocol features, and range features. Thus, the extracted features are more detailed. The proposed eight features have demonstrated that the image attributes cannot accurately describe but have strong weakness and stability in a complex climate environment. In the future, the proposed instructions should be checked with a larger image package. Integrated learning is a new paradigm in the field of machine learning. It is worth to learn about the generalization of a machine learning system. Visual image expansion mechanisms used in the public film are desirable to further investigate.

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