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# Human Detection On Foggy Images

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***ABSTRACT--- This paper was discussing about the human detection using SVM combining weighted least square-filter (WLS), histograms of oriented gradients (HOG). The combination of HOG and SVM is a powerful approach for human detection, as it uses local strength gradients; it is hard to handle noisy and foggy images. For removing of noise or fog from this type of images, we used weighted least square (WLS) filter, and then HOG and SVM algorithms are used for human detection. Due to deprived weather conditions such as fog and haze, the acquired images will exhibit damaged visibility. This can be occurred because of the presence of the suspended particles and scatter of light between objects and the camera. So the image improvement and renewal methods are used to improve the quality of an image which provide strong image in poor weather condition and can extract features from the images not only when they had illumination variations but also when they are degraded with fog. At last, detected objects can be categorized into predefined groups of humans and other objects by using SVM classifier.***

***Keywords: HOG and SVM classifier, human detection, WLS filter***

## I INTRODUCTION

The aim of computer vision is identify, understand, interpret and explore the data of the image. Outside images in poor weather (i.e., foggy, hazy etc.) has low contrast and fidelity. Haze and fog are formed due to the environment effect, but they are not the same. Haze is thin and transparent effect while fog is thick and opaque. The fog is formed in the environment due to the air light and weakening process. Most of the automatic systems, depends on the classification of the input images, but are failed to work usually caused by the corrupted images. Fog removal is important in consumer or computational photography in computer vision applications. So the process of removing fog can be knowingly increase the perceptibility of scene and improve the color change caused by the air light. Majority of the computer vision algorithms, usually accept that the input image is division radiance.

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For checking presentation of the various vision algorithms, for e.g. feature recognition, riddling, and photometric analysis will certainly suffer from the unfair and low-contrast division radiance. Fog removal will provide depth information and benefit many vision algorithms in image editing. Fog is the role of distance in camera object [1, 9]. Here removal of fog requires the estimation of air light map or depth map. Hence the thickness of the fog is different from image to image and it is hard to detect, so image defogging is a challenging task.

Because of the removal of fog from the image it produces the image with clear edges, which is used to detect the humans from the image. Human detection is an essential task in computer vision, and it gives the vital information for clear understanding of the video footages. It has been an obvious extension to automotive applications due to the possibility for improving safety systems. Regardless of the challenges, still human detection is an active research area in computer vision in recent years. So here we are detecting the humans in the image by using the histogram algorithm. Human detection considers the image of the human and then extracts its features. From the given query image, the feature extraction is retained on the query image and then a search is carried out for the features of the human that is to be detected, in the transformed image. If a suitable match is found, then it can be said to the object is present in the query image. Human detection is a significant task in different transportation applications, such as human-vehicle crash analysis, human facilities planning, the multimodal performance measure and human behaviour study and any computer vision process, and it provides the fundamental information for clear understanding of the video footages.

## II. RELATED WORK

In image enhancement the single image fog amputation technique is implemented because it yields a more enriched edge preserved vision without any noise removal technique like histogram equalization etc. Here DCP principle is used at initial stage to find thickness of the fog and eliminates this fog from the image after that WLS is applied for divergence adjustment, to know the fine details in an image. WLS filter is an edge preserved filter that analyzes features in an scene and recombine them with robust adequate feature. In presence of noise a WLS filter is used to weaken effect while de-blurring images. The proposed algorithm applied for RGB images with a single color channel, gray scale images that contains fog and it consists of a fewer identified variables as compared to unknown variables. This is known as ill-posed problem.

Here, the basic information was considered as indications, so user involvement is not required for that.

This work is divided into three sections. First section, fog removal can be done through air light approximation, transmission map approximation, and refinement procedure. Second section, dissimilarity handling with preservative specifics using WLS algorithm was used. Here humans are the most important of moving objects in streets, roads, and events. Our main objective is the detection of human that can be done by using SVM algorithm. That can be prepared through object detection.

## III. PROPOSED METHOD

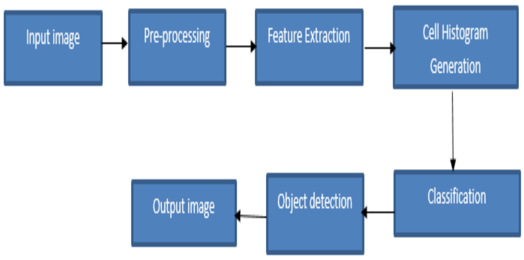



**Figure. Design Methodology Pre-processing**

The defogging algorithm for images initiates in an environment. First, we calculate grey image, chromatic blue and chromatic red image by using the equation 1

$$I(i,j) = I_{attenuate}(i,j) + A_{air-light}(i.j) \quad (1)$$

Where diminution and air light are tasks of image that are represented in eq.2 and in eq.3

$$I_{attenuate}(i,j) = I_0(i,j)e^{-\beta d(i,j)} \quad (2)$$

$$A_{airlight}(i,j) = I_\infty(1 - e^{-\beta d(i,j)}) \quad (3)$$

Where $I_{attenuate}(i,j)$ is the weakened pixel strength at pixel (i, j) in deprived environmental condition, 'Io (i, j)' is the gray level power of the de-weathered copy, 'β' is the extension of atmospheric smattering number based on the wavelength of light purpose. '$d(i,j)$' is the distance of the pixel point and 'I∞' is global atmospheric constant or sky intensity.

*Dark channel prior*

After normalization, the pixels with highest intensity are treated as sky-light. Here we assumed the shade of distinctive light is very close to the color of the sky light, it is positive value. But here shady channel takes the smallest strength across RGB channels and single color channel has little intensity value.

$$DarkChannd = \min_{c\varepsilon(RGB)}\left( \min_{(i,j)\varepsilon\Omega(z)} I_c(i,j) \right) \quad (4)$$

here $I_c(i,j)$ is tint channel of RGB image, c ϵ {r, g, b} is the smallest value of the tint channel, the 'min' operator behaves as a minimum filter across a local patch Ω(z), arranged at location z. If we take an image without fog contains a very low intensity value and looks very dark.

Finding the min value for feature extraction is the robust technique for air light estimation.

*Transmission map*

$$t(z) = 1 - \min_{c\varepsilon(RGB)}\left(\frac{I(z)}{A}\right) where 0 < t(z) < 1 \quad (5)$$

Where

$$t(z) = \begin{cases} 0, & fully\ foggy\ and\ opaque\ image \\ 1, & completely\ fog\ free\ image \end{cases} \quad (6)$$

Transmission map estimation is measure of the thickness of the haze. Broadcast map $t(z)$ is portion of the atmospheric light.

$t(z)$ is the pixel values taken from the dark channel and this value is 0 if it contains fog otherwise it gives value 1. Here we set t0 = 0.1, for improved dissimilarity gain to avoid the small value of $t(z)$. The sophisticated image reflectance is restored as:

$$I_0(z) = \frac{I(z) - A}{\max\{t^{\wedge}, t_0\}} + A \quad (7)$$

There is need to improve the quality of the image why because here Dissimilarity gain and fine particulars are quiet missing. After the eq.7, the image contains some more fog. So we need some restoration process to remove that fog for that we applied WLS filter.

*WLS filter*

In this we have to increase the fine details from the previous image and then we get the fog free image to detect the object that is human. Here, we used edge preserving operator to eliminate the haze from the image. WLS filter will find the fine and coarse details of the image, and stores the intensity values that is proportional to the atmospheric light.

After that we applied two algorithms one for feature extraction HOG (Histogram of Oriented Gradients) and another for object detection SVM (Support Vector Machines).

*Feature Extraction*

In this approach we have to extract the features of the image based on the object appearance and shape by characterizing it using Local intensity Gradients and Edge Directions. So, the image is heavily divided into small special regions called cells. This technique counts the occurrences of gradient orientation in localized portions of an image.

For each cell directions/edges is computed and later all cell data is combined to give a complete HOG descriptor of the window. The variety of colours and illumination in the surrounding makes normalization inevitable.

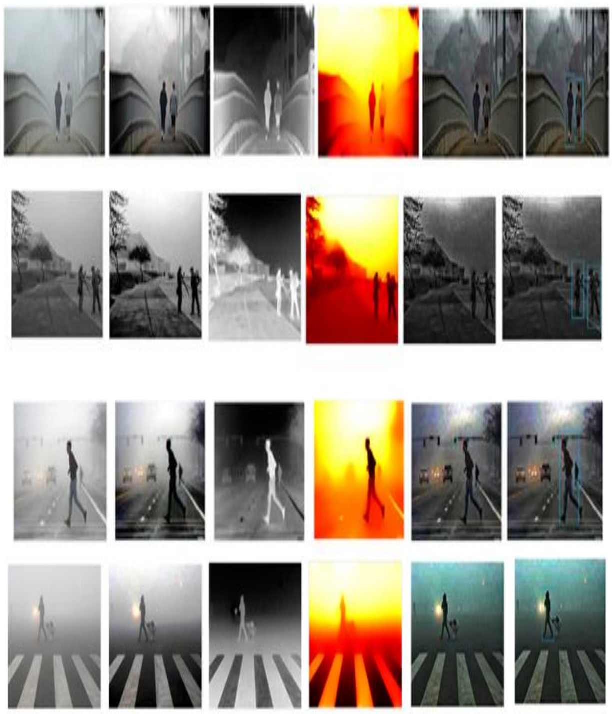
To change the illumination, contrast of the image the cells must be grouped. After that HOG descriptor is used for the vector of the components to normalize cell histograms from all of the block regions.

*Classification*

Classification is identifying the problem and divides into set of categories (sub-populations) whose class affiliation is known. An algorithm that tools arrangement, particularly in a existing implementation, is identified as a classifier. Here we applied SVM for classification. SVM is mostly used classification method in computer vision and machine learning applications. Because of its simplicity and accuracy, this classifier is popular and it can deal with high-dimensional data. Here binary classification is used by defining a hyper-plane to classify the input data into two classes. In this all data points are correctly classified. The presented work can done by using a soft-margin SVM due to its ability to deal with non-linear data linearly. Thus, separating human features for one side of hyper plane and remaining features to another side of hyper plane.

## IV. RESULTS AND OBSERVATIONS

On testing over a wide set of images collected from the dataset. The system works reasonably and robustly. Initially, the dark channel prior algorithm which is followed by transmission map. For removal of noise and fog from the image weighted least square filter is used. Here the features of human images are calculated by the HOG. They show the most prominent edge corresponding to each cell for a object image respectively. This edge information is taken from the weighted gradient orientation bin corresponding to the histogram of each cell.



**(a) (b) (c) (d) (e) (f)**

**The columns are classified as Original fog image(input) (b)Estimation of global air light (c) Constraint based Dark channel prior (d) Transmission map (e) Defogged image (output) (f) Object detection (human detected)**

Here we observed that given fog image is converted into fog free image using pre-processing techniques. In pre-processing estimation of atmospheric and air light and fog thickness and the intensity of pixels is calculated. In further step of processing the filter like weighted least square filter is applied to remove the noise from the image. After applying the WLS filter which is fog free image by using seven parameters. The seven parameters used to know the improvement in visibility of image are Peak to noise ratio, Maximum difference, Normalized cross correlation, Structural content, Average difference, Mean square error, Normalized absolute error. The output image from the weighted least square filter is given to histogram algorithm to abstract the features of human from given images. Here classification is done using the supervised method called the Support vector machine to classify the humans from the other objects or things present in the images. Therefore, the humans are represented using the bounding box.

## V. CONCLUSION AND FUTURE WORK

This paper used the DCP, Transmission map, WLS filter to get fog free image. The efficiency of the image is verified using the evaluation of variable values that is fixed or variable. Extensive human detection experiments show high detection rates with relatively low numbers of false detections. These results illustrate the high discriminate power of histogram features and the effectiveness and robustness of the hierarchical human detection approach.

In summary, the results show that the humans representation histogram features are general to different kinds of object classes, and our features election methods are efficient to extract informative class specific features for human detection. Presented work consists of basic idea and the implementations where we have been reached so far. The work can be extended by using different filters. In future, we would like to use different filters to remove the noise from the image as fog is one of the main reasons for the accidents. And we would also look forward to apply the remaining any robust algorithm for human.

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