Synopsis Images From Foggy Images Also Under Difficult Lighting Conditions

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Abstract: In this paper, we propose to generate quality images from an input of foggy images ,or an image which is disturbed by various lighting conditions. In this approach, we use a web cam or a surveillance camera for obtaining an input image .Using this quality images, we can generate a synopsis, video, which is the summary of the input video. A synopsis video is having many applications. Here we propose one such application using video synopsis in road maintenance. In road maintenance, a synopsis images of the road can be used for analyzing the present condition of the road. Here a camera will be fixed into a route bus that is plying through that road. By selecting a route bus, we are able to conserve the fuel that was wasted for a separate site inspection. Back ground extraction; Object Segmentation and Stitching are the various steps in shaping the synopsis video from the original. Surface defects are the most common abnormalities for roads and rails and they should be carefully inspected. Fog fades the color and reduces the contrast of the scene, so various camera-based advanced systems can be used to improve the scene. Here we are going to reformulate the problem using image enhancement with Open Source Computer Vision Library (OPENCV) and this new algorithm produces better result with homogeneous fog and also deals better with the presence of heterogeneous fog. To compare the proposed algorithm to previously presented algorithms, we propose an evaluation scheme and we build up a set of synthetic and camera images with and without homogeneous and heterogeneous fog. The algorithms are applied on foggy images and results are compared with the images without fog.

[Abraham Mathew, R. Radhakrishnan. **Synopsis Images From Foggy Images Also Under Difficult Lighting Conditions**. *Life Sci J* 2013; 10(3): 1222-1225]. (ISSN: 1097-8135). http://www.lifesciencesite.com 183

Keywords: Web cam; surveillance; Segmentation; Stitching; Open Source

1. Introduction

Synopsis Video, as the name implies, is a short summary or an abstract of the content of a longer video document [1-3]. Specifically, a video abstract is a sequence of still or moving images representing the content of a video in such a way that the target party is rapidly provided with concise information about the content while the essential message of the original video is well preserved. Video synopsis can make the surveillance cameras and webcams more useful by giving the viewer the ability to view summaries of the endless videos captured, in addition to the live video stream. A synopsis server can analyze the live video feed for interesting events and record an object based description of the video. In electrical engineering and computer science, image processing is a form of signal processing for which the input is an image and usually the image processing is referred as digital image processing but optical and analog image processing are not possible, in order to get an enhanced image or to extract some useful information from it [4-6]. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them. It is among rapidly growing technologies today, with its applications in various aspects of a business. Image Processing forms core research area within engineering and computer science disciplines too. An image defined in the ―real world‖ is considered to be a function of two real variables, for example, a(x,y) with a as the amplitude (e.g. brightness) of the image at the real coordinate position (x,y) [7-10].In a sophisticated image processing system it should be possible to apply specific image processing operations to selected regions. Thus one part of an image (region) might be processed to suppress motion blur while another part might be processed to improve color rendition. The most requirements for image processing of images is that the images be available in digitized form, that is, arrays of finite length binary words. For digitization, the given Image is sampled on a discrete grid and each sample or pixel is quantized using a finite number of bits. The digitized image is processed by a computer. To display a digital image, it is first converted into analog signal, which is scanned onto a display [11-15]

2. Process involved

A considerable number of vehicle accidents are caused by poor maintenance of roads and thus the importance of road maintenance is a primary issue in any country. Maintenance of a particular road will be effective, only if the existing condition of that road is analyzed [16,17]. For systematically analyzing the existing condition of a road, we can use a web-cam or a video camera which is fixed on a moving bus that is plying through that route and finally make a synopsis of this input video image. But the quality of this video will be affected if fog is present, also due to the presence of the considerable number of atmospheric particles with significant size and distributions in the participating media. Because of these particles, light from the environment and light reflected from an object are absorbed and scattered, making the visibility not as clear. Some techniques have been introduced to tackle the problem caused by bad weather, particularly fog and haze. To avoid the problem, automatic methods have been proposed to enhance visibility in bad weather. Methods that work on visible wavelengths, based on the type of their input, can be categorized into two approaches: those using polarizing filters, and those using images taken from different fog densities [18,19]. Both of the approaches require that the images are multiple and taken from exactly the same point of view. While they can produce reasonably good results, their requirement makes them impractical, particularly in real time applications, such as vehicle systems. Considering their drawbacks, our goal is to develop a method that requires solely a single image taken from ordinary digital cameras, without any additional hardware. The method principally uses color and intensity information. It enhances the visibility after estimating the color of skylight and the values of air light. The experimental results on real images show the effectiveness of the approach.

3. Hue and saturation analysis

In bad weather, especially in daylight, the environmental light can be assumed globally constant, since we can ignore the sunlight that directly illuminates objects appearing in the observation. This environmental light is produced by the scattering effects of the particles in the medium, which yield certain chromatic color (that is identical to the light chromaticity. In our method, to be able to enhance the visibility, we first have to estimate and then remove the light chromaticity. The simplest way to estimate the value of the light chromaticity is by finding a patch in the input image that only has the air light (i.e., when the distance of an object is infinite), and computing the chromaticity. However, to find the air light-only patches is not trivial, and in some cases they are simply not present.

Based on the hue and saturation definition, if we have two input images of an identical scene with different fog/haze density, their hue values will be exactly the same; since, the air light will be canceled out. However, their saturation values will be different, since the air light cannot be excluded. If we analyze the saturation values further, they will be larger if the air light is larger, and will be smaller if the air light is smaller. This fact leads to a conclusion that a scene with fog/haze differs to that without fog/haze only in their saturation values. Therefore, if we intend to enhance the visibility, particularly if we want to remove the air light, we have to keep the hue values and to make the saturation values smaller. The problem then, is how small we should make them. This problem is not trivial and, in fact for a single input image, it is ill-posed. input image. This method is based on two basic observations: first, images with enhanced visibility (or clear-day images) have more contrast than images plagued by bad weather; second, air light whose variation mainly depends on the distance of objects to the viewer, tends to be smooth. Relying on these two observations, we develop a cost function in the framework of Markov random fields, which can be efficiently optimized by various techniques, such as graph-cuts or belief propagation. The method does not require the geometrical information of the input image, and is applicable for both color and gray images [20,21].

Figure1. Input image, when the environmental light is bluish.

Bad weather, such as fog and haze, can significantly degrade the visibility of a scene. Optically, this is due to the substantial presence of particles in the atmosphere that absorb and scatter light. In computer vision, the absorption and scattering processes are commonly modeled by a linear combination of the direct attenuation and the airlight.

Based on this model, a few methods have been proposed, and most of them require multiple input images of a scene, which have either different degrees of polarization or different atmospheric conditions. This requirement is the main drawback of these methods, since in many situations; it is difficult to be fulfilled. To resolve the problem, we introduce an automated method.

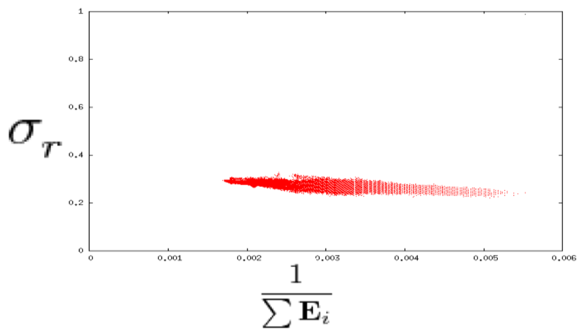

Figure2. All pixels of the image into the inverse intensity chromaticity space of the red channel.

Figure3. The Result of the normalizing environmental light of Figure1.

4. Estimating the atmospheric light

In most of the previous single image methods, the atmospheric light **A** is estimated from the most haze-opaque pixel. For example, the pixel with highest intensity is used as the atmospheric light and is furthered refined but in real images, the brightest pixel could be on a white car or a white building. As we discussed the dark channel of a haze image approximates the haze denseness well. We can use the dark channel to improve the atmospheric light estimation. We first pick the top 0.1% brightest pixels in the dark channel. These pixels are most haze opaque. Among these pixels, the pixels with highest intensity in the input image **I** is selected as the atmospheric light. This simple method based on the dark channel prior is more robust than the brightest pixel‖ method. We use it to automatically estimate the atmospheric lights for all images.

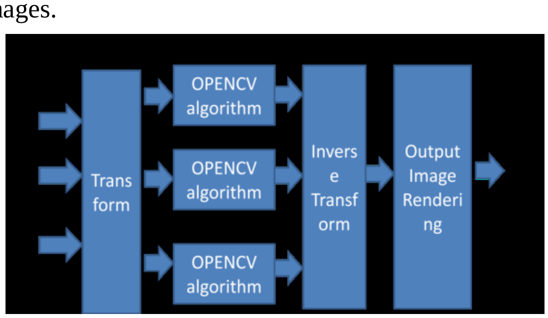

Figure 4.Architectureof Enhanced defoggy image process.

The attenuation of luminance through the atmosphere was studied by Koschmieder derived an equation relating the apparent luminance or radiance *L* of an object that is located at distance *d* to the luminance *L*0 measured close to this object, i.e., L = L0 e-βd + L∞ (1- e-βd) (4.1),On the basis of this equation, Duntley developed a contrast attenuation law, stating that a nearby object exhibiting contrast with the background will be perceived at distance d with the following contrast: C = [(L0 - L∞)/ L∞] e-βd = C0 e-βd (4.2) This expression serves to base the definition of a standard dimension that is called ―meteorological visibility distance‖. To compare the proposed algorithm to previously presented algorithms, we propose an evaluation scheme and we build up a set of synthetic and camera images with and without homogeneous and heterogeneous fog. The algorithms are applied on foggy images and results are compared with the images without fog. It's true that we can see in various light levels, over a fairly large range—your eyes work well in bright sunlight, but also in fairly dimly lit rooms. In each case, though, the eye must first adapt to the average light level of the environment before you can really see well.

5. Result and Conclusion

In this work, we have proposed a method that is solely based on single images and can be used in real time operations, without any user interferences. To our knowledge, no current method has these useful features. Hence, we believe that many applications, such as synopsis video, driver assistance system, remote sensing, panoramic images, a feature of commercial digital cameras, etc, can be improved by utilizing our proposed method. We have studied the local OPENCV algorithm in terms of two constraints on the inference of the atmospheric veil, we introduce a third constraint to take into account the fact that road images contain a large part of planar roadway, assuming a minimum meteorological visibility distance. The obtained visibility using opencv algorithm performs better than the original algorithm on road images as demonstrated on a set of several synthetic images and on a set of camera images, where a uniform fog is added following Koschmieder‘s law. We have generated three different types of heterogeneous fog, a situation never considered previously in our domain.

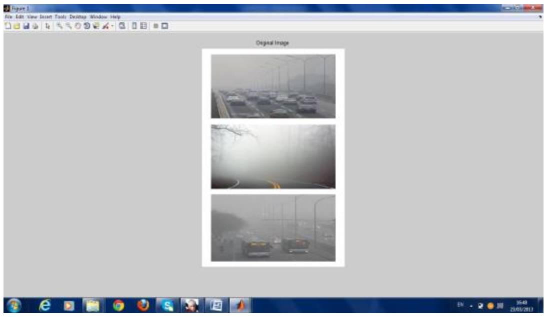

Figure5. Original image.

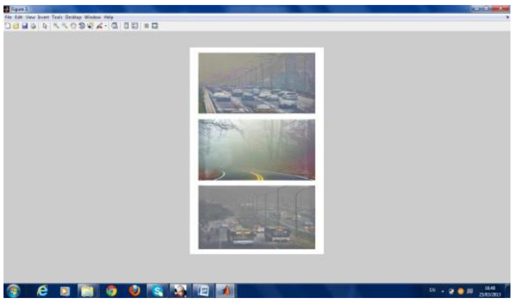

Figure6. The de-foggy image.

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