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Survey on Motion Blur Detection & Removal

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Abstract-An image which gives a visual representation and information of an object or a person. When the image of an object or person is in a motion, same time the image is captured by a camera it results in motion blur image. Also, the image gets blurred when there is shaking of camera and due to its lens adjustments. In such cases to overcome the blur at an image there is a need to detect the occurrence of blur at the image and remove the artifacts to restore the original image without any loss of information which is hidden behind the motion blur. Here our survey is to detect the motion blur at an input image and retrieve back the enhanced original image, from blurred condition.

Keywords- Motion blur, Enhanced image.

I. INTRODUCTION

As now there has been large development in the field of computer vision technologies, it plays a vital role for image recognition. The image degradation in the field of photography it is difficult to capture an image due to relative motion between the objectandacamera.When a camera capture an image, that image does not represent a single instant of time. Because of technological constraints or artistic requirements, the image may represent the scene over a period of time.

Most often this exposure time is brief enough that the image captured by the camera appears to capture an instantaneous moment, but this is not always so, and a fast-moving object or a longer exposure time may result in blurring artifacts which make this apparent. As objects in a scene move, an image of that scene must represent an integration of all positions of those objects, as well as the camera's viewpoint,overtheperiod of exposure determined by the shutter speed. In such an image, any object moving with respect to the camera will look blurred or smeared along the direction of relative motion.

This smearing may occur on an object that is moving or on a static background if the camera is moving. In a television image, this looks natural because the human eye behaves in much the same way.

Because the effect is caused by the relative motion between the camera, and the objects, motion blur occurs. Blurring an image is making the image less sharp. As a result, there is loss of information at an image. So, to restore back an original image hidden behind the blur image there is a need of detection of blur and to remove the blur occurred. As this is the survey paper on motion blur detection and removal technique.

II. RELATED WORKS

Alrik Fernandes1, Prathamesh Joshi2, Gaurav Kshirsagar3, Manav Chordia4 proposed a paper on MOTION BLUR DETECTIONANDREMOVALIN IMAGES. This paper gives a method to detect and remove artifacts from a blur image also to get back the enhanced image as an output. As made huge developments in field of technology at a area of image recognition, it approaches a method of Deep CNN and GAN method to detect and removal of motion blur from an image.

As CNN is a Convolution Neural Network mainly used in image analysis task like image recognition, object detection and segmentation. As it draws the bounding box to detect an object, this creates a problem to solve. Hence there is a need of R-CNN for masking and also to overcome segmentation problem the region to detect the motion blur is done by region proposal network. As it contains a

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homogeneous region consist of flat regions thus it classifies as blur due to same regions. In order to overcome this problem, separate blocks have made to compute an image then to plot a standard deviation of the spectral intensities of the pixels. If the standard deviation is low then region is black results in no motion blur presence. By combining the output of standard deviation mask and R-CNN mask makes the model robust to get better performance at blur detection part. Next is the removal of blur this is done by GAN Generative Adversarial Network [1].

Here the paper by Maryia M. Sada, Mahesh M. Goyani proposed model IMAGE DEBLURRING TECHNIQUES – A DETAIL REVIEW gives a reviewed details of image deblurring process. Blur occurs at an image due to atmospheric noisy disturbances, improper camera settings, affected image due to noise presence in the image. As a result, deblurring is done in order to get an enhanced image restored. As blur can be of different types Motion blur, Gaussian blur, Average blur, Defocus blur etc. As Average blur used to remove horizontal and vertical scatter blur and this affects the whole image. Motion blur is caused due to the movements happens in between object and camera. Imaging system causes defocus blur as it is present at the background of an image and "pop out" the main object using large aperture lenses [2].

Sung Hyun Cho POSTECH and Seung Yong Lee POSTECH proposed model on FAST MOTION DEBLURRING. In this paper the deblurring process is done in faster mode, at a single image of moderate size. As when the camera is exposed to light condition sensors moves, imaging sensors assemble incoming lights for some time to give an image output in blurred condition. When there is a presence of shift invariance in the motion blur image, convolution takes place with latent image and motion blur image. As the kernel describes the trace of a sensor. The removing of motion blur from an image becomes a deconvolution operation.

The non-blind deconvolution is used for getting back the latent image from the motion blur image using kernel. At the blind-deconvolution latent image recovery is risky as the kernel is unknown as it becomes more complicated. The problem of blind deconvolution with a single image to be solved at this paper, at the blurry image the latent image and kernel image are both roughly calculated. In blind deconvolution methods repeated process occurs that uses the motion blur kernel and the latent image. In this process, the blur kernel is obtained from the roughly calculateed latent image at the given blurred image. As kernel is used by applying the non- blind deconvolution to calculate the latent image from the given blurred image.

As the newly calculated latent image is used to find kernel in the next iteration. Thus, this paper presents the fast-deblurring process using fast blind deconvolution that results deblurring only in few seconds. This process speeds up both kernel and latent image calculation through iterative deblurring steps. C++ is implemented in this process such that to get a fast deblurred output of a single image, which is 20 times faster than the C-language implementation. A GPU is used at the process as it reduces the processing time to within a few seconds, which is fast enough for practical applications of deblurring. Kernel is calculated, using image derivatives rather than pixel values [3].

Shuang Zhang, Member, IEEE, Ada Zhen, Member, IEEE, and Robert L. Stevenson, Member, IEEE proposed model on DEEP MOTION BLUR REMOVAL USING NOISY/BLURRY IMAGE PAIRS. Thispaper represents the method of deblurring in a faster way such that the single input image of medium size within a time limit. Here iterative deblurring is done where latent image estimation and kernel estimation is being increased due to the reuse of image derivatives. Image processing techniques are used for projection of latent image as it is used of kernel estimation.

As Gaussian for denoising at the latent image estimation. At the process of kernel estimation image derivatives are used for processing and also strengthens the numerical calculations for less usage of Fourier transformation. As a result, in a well-conditioned output rather than use of values of pixel which gives the faster output? Here at this paper, it gives demonstration of faster deblurring process such that image quality can be comparable.

Where GPU performance makes the processing time faster. Images captured during the movement of an object it had made common the occurrence of a motion blur image hence there is a loss of an information at an image. This effect is due to the

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image sensor at a camera which is responsible for incoming light into an electrical signal such that image can be viewed, analyzed, or stored. The motion blur can be erased from the image by denoising method, such that latent image and blur kernel is used when the motion blur is made in the complex mode. Here in this paper blur kernel and latent image are calculated by the input blurred image as it is a blind deconvolution problem.

As here the blind deconvolution is being used at a single image at a very less time limit hence speeds up and strengthened the blur kernel and the latent image estimation in an iterative deblurring process [4].

VeerrajuGampalaa , M. Sunil Kumar b , C. Sushama b , E. FantinIrudaya Raj caDepartment of Computer Science and Engineering, KoneruLakshmaiah Education Foundation, Vaddeswaram, proposed model on Deep Learning-Based Image Processing Approaches For ImageDeblurring. As this paper discuss the Generative Adversarial Network (GAN). This is used for recovery of an original image, which kept hidden behind the blur at an image. This uses mobile-V3 network so that can be used on mobile devices for image recoveries. An evolution metric is used on mobile devices such that it can be made this work worthier for deblur an image.

As motion blur has made major impact in order to get an original image. By exposing the camera to capture an image of an object the relative motion occurs due to variation in position of camera or object. Hence there causes a blurry image. As there has been huge development in field of deep learning (CNN) Convolutional neural network has made utilized in many areas. In order to get a clear image, the CNN is being used. Also, it can be utilized in mobile devices to obtain a clear sharp image with low power and energy consumptions. Here at this paper image deblurring is used for mobile devices to obtain a clear image [5].

Fatma Albluwi, Vladimir A. Krylov&RozennDahyot School of Computer Science & Statistics, Trinity College Dublin, Ireland proposed model on Image Deblurring and Super-Resolution Using Deep Convolutional Neural Networks. Removing spatially variant motion blur from a blurry image is a challenging problem as blur sources are complicated and difficult to model accurately. Recent progress in deep neural networks suggests that kernel free single image deblurring can be efficiently performed, but questions about deblurring performance persist. Thus, we propose to restore a sharp image by fusing a pair of noisy/blurry images captured in a burst.

Two neural network structures, Deblur RNN and Deblur Merger, are presented to exploit the pair of images in a sequential manner or parallel manner. To boost the training, gradient loss, adversarial loss and spectral normalization are leveraged. The training dataset that consists of pairs of noisy/blurry images and the corresponding ground truth sharp image is synthesized based on the benchmark dataset GOPRO. We evaluated the trained networks on a variety of synthetic datasets and real image pairs. The results demonstrate that the proposed approach outperforms the state- of-the-art both qualitatively and quantitatively [6].

Diksha Adke, Atharva Karnik, Honey Berman, Shyamala Mathi proposed model on, Detection and Blur- Removal of Single Motion Blurred Image Using Deep Convolution NeuralNetwork. This paper gives information of detection and removal technique for motion blur using CNN algorithm and also consist of a discriminator model it also consists of second deconvolution SRN network for object recognition.

Discriminator detects only motion-blurry images from input data stream and feed to deblurring network. The discriminator contains a layer of CNN with filters. At the output of discriminator, it consists of sigmoid function which gives the better result of binary values. To enhance the model, it contains Adam optimizer with cross entropy loss function. To detect the low-level features in images like edges, points can be done by using max pooling.

As at the beginning of the experiment there is a utilization of “Average is pooling” layers to preserve the illumination of image, reduce the frequency of pixels as the layers proceed then the output is given as reduce accuracy and longer training duration of the model. As the next sub model is deconvolution scale Recurrent Network.

The model consist of an ResBlock contains LSTM architecture it has encoder-decoder network. The architecture perform transformation of output as

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that of input image gives a higher S/N(Signal-to-Noise) ratio. Recurrent Neutral nets gives an improved performance in deblurring the hidden data with better training efficiency as they carry the information from adjoining input images as sequences.

The method used for deblurring individual frames as it terminates the requirements of ground- truth-image while training the network. By evaluating the PSNR as shown in the table with random noisy images results that output image performs segmentation and pattern recognition task [7].

Ning Li, Songnan Chen, Mengxia Tang, Jiangming Kan proposed a paper on Deblurring Method for Motion Blurred Images based on GAN. In this paper generative adversarial network (GAN) model based on the mobilenet-V3 network structure as it reaches the motion blurred image recovery on mobile devices. Here it contains network structure which consists of a generator and two discriminators.

Feature pyramid structure (FPN) used at generator side. Discriminator is used for both the global and the local minimum mean square error loss is used in training. Feature extraction of target detection problems. By determining the process of feature extraction, the lower layer contains less and high - level layer contains more features of semantic information.

Hence the target location at high-level is accurate. At the single high-level feature, the target location information will be lost. The main aim at the multi-scale enhancement classic pyramid is used which contains the huge calculation. Here the goal is to construct the feature pyramid network with less calculation. As feature pyramid structure used at fuzzy restoration is composed of an FPN backbone network. Mobilenet-v3 is proposed which are Mobilenet-v3 large and Mobilenet-v3 small required in suitable situations with different requirements.

Mobilenet-v3 small gives better accuracy of ImageNet classification tasks by about 3.2 percent and Mobilenet-v2, gives better reasoning efficiency by 15 percent. Mobilenet-v3 large outputs the accuracy of ImageNet classification tasks by about 4.6 percent, and reasoning efficiency is given by 5 percent. Mobilenet-v3 Large gives the same accuracy on COCO as V2, with a 25% as increase in reasoning efficiency. At this paper mobilenet-V3-DSC network is proposed by altering mobilenet-V3 network to decrease the network size and computing power [8].

OrestKupyn, Volodymyr Budzan, Mykola Mykhailych1, Dmytro Mishkin, Jiri Matas proposed Deblur GAN: Blind Motion Deblurring Using Conditional Adversarial Networks. As this paper presents method for getting rid of motion deblurring using Deblur GAN. Deblur GAN achieves performance in structural similarity measure and visual appearance. As the deblurring model is used for object detection on blurred images.

The aim of the proposed model to recover sharp image from blur image. CNN is trained called as generator. As critic network is introduced to generate training set for both networks. The input is given as blurred image and gives the output sharp image. Critic network gives the distance between restored images and the sharp images [9].

Yuqing Zhao, Guangyuan Fu,1 Hongqiao Wang,1 Shaolei Zhang,1 and Min Yue1 proposed a paper on Infrared Image Deblurring Based on Generative Adversarial Networks. Here this paper discusses the deblurring of an infrared image given as input to the model infrared to restore a clear image as its output. This consists of two architectures of GAN, GB2S: IB⟶IS and GS2B: IS⟶IB these are the two generators used. To restore clear image GB2S is used and to generate blurred images from clear images GS2B is used. The model consists of discriminators DB and DS. DB is used to distinguish the input is a blurred image or not, while DS used to distinguish to check the input is sharp.

The clear image is sent to the generator GS2B to get a blurred output image. As deblurred image is generated when output blurred image is given as input. The discriminator DS used to recognise true and fake image by receiving generated deblurred image and the real clear image. As GB2S used to generate a deblurred image when the input real blurred image is given.

The generator GS2B used to synthesize the blurred image by the generated deblurred image. To determine the authentication, the synthesized blurred image and the real blurred image are sent to discriminator DB. By continuous iterative process

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generator generates more sensible deblurred images [10].

III. CONCLUSION

This paper presents the methods of deblurring techniques of the motion blur image, as these methods involve in removing the artifacts from an image resulted because of camera or object movement. Different Algorithms are used in the removal of the blur artifacts.

The deblurred images can be useful in image processing algorithms. Hence different architectures can be used in deblurring process can be used in real time data given as input.

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