A Review on Moving Target Detection based on Edge Extraction

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Abstract- Detecting and tracking moving objects in a sequence of video images is an important application in the field of computer vision. This topic has many applications in surveillance systems, human-computer interaction, robotics, etcThe main features can be extracted from the edges of an image which significantly reduce the amount of data to be processed while preserving the important structural properties of an image In this thesis which is based on the experimental result shows a new viewpoint to image processing from video footage using edge detection and morphological image processing. We have introduced a new idea of receiving processed image for detecting an inflamed with the help of canny edge detection will be more efficient. Our conclusion has shown an excellent in term of Accuracy percentage, Accuracy 97.618 %, Sensitivity specificity time in sec, Walking Speed in sec.

Keywords- moving objects, Canny Edge Detection, Motion Segmentation.

I. INTRODUCTION

First step in visual surveillance system includes motion detection. Motion detection segments the moving foreground object from the rest image. Successful segmentation of foreground object helps in the subsequent process such as object classification, personal identification, object tracking and activity recognition in the video. Motion segmentation is done mainly with background subtraction, temporal differencing, and optical flow. Out of the three methods, background subtraction is the most popular method for detecting moving regions in an image by taking the absolute difference between the current image and the reference background image.

A proper threshold is judiciously selected which segments foreground from the background. Edge detection is the concept for a set of mathematical methods whose aim is to identify the points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. In this paper, an improved canny edge detection algorithm is represented to obtain moving and robust edges. Compared with ordinary Canny method, there are four improvements to reduce computation time and ensure detection accuracy.

Firstly, 2-D Gaussian filter is decomposed into two independent 1-D filters, i.e. row filter and column filter, which allows calculate image gradient in parallel way. As a result, computation time is reduced highly. Secondly the method uses two thresholds, to detect strong and weak edges, and includes the weak edges in the output only if they are connected to strong edges.

Detection is a well developed field on its own within image processing Edges typically occur on the boundary between 2 regions [2].

Edge is defined as the boundary pixels that connect two separate regions [3] with changing image amplitude attributes such as different constant luminance and tristimulus values in an image. Edge detection is a well developed field on its own within image processing. Among the several textual properties in an image, edge-based methods focus on the 'high contrast between the text and the background'. The edges of the text boundary are identified and merged, and then several heuristics are used to filter out the non-text regions. Usually, an edge filters (e.g. canny operator) issued for the edge detection, and a smoothing operation. The Canny method finds edges by looking for local maxima of the gradient of I. The gradient is calculated using the derivative of a Gaussian filter [23].

The method uses two thresholds, to detect strong and weak edges, and includes the weak edges in the output only if they are connected to strong edges for x and y direction as shown in figure 2.2 (a), (b) [16]. This method is therefore less likely than the others to be fooled by noise, and more likely to detect true weak edges.

The canny edge detection algorithm is easy to implement, and more efficient than other algorithms. From this edge detected images, text region is identified Features can be extracted from the edges of an image which significantly reduce the amount of data to be processed while preserving the important structural properties of an image [1].

Fig 1. Edge Detection.

1. Canny Edge Detection:

John Canny introduced the canny edge detection technique [1] [5] [11] at MIT in 1983. It is the standard, powerful and usually used edge detection method. It separates the noise from the image before extracting edges. Canny is a better method for extracting the edges than other existing methods and produces the good result. The Canny operator can control a number of details of edge image and can suppress the noise efficiently.

This method follows following steps:
- For smoothing the image, the Gaussian filter is used with the identified value of sigma which reduces noise.
- At each point, the edge direction and local gradient are calculated. According to edge point, it is the point with locally maximum strength in the gradient direction.
- The edge point increases ridges in the gradient image magnitude. In this algorithm, top of these ridges are considered and gives zero value to all pixels that are not on the ridges top. Then, as output, a thin line is produced. This process is called non- maximum suppression. Then, hysteresis thresholding is used here to threshold the ridges pixel. It has two threshold values such as T1 and T2. Case1: if T1>T2, ridges pixel value is higher than threshold T2, shows strong edge pixels. Case 2 if T2>T1, if T1<T2, ridges pixel value is lesser than threshold T2, shows weak edge pixel. At last, the edge linking process executes by integrating the weak pixels that having 8-pixel connectivity to strong pixels. The canny edge detection method contains the pair of 3x3 convolution mask shown in Figure 5.

II. RELATED WORK

First step in visual surveillance system includes motion detection. Motion detection segments the moving foreground object from the rest image. Successful segmentation of foreground object helps in the subsequent process such as object classification, personal identification, object tracking and activity recognition in the video. Motion segmentation is done mainly with background subtraction, temporal differencing, and optical flow. Out of the three methods, background subtraction is the most popular method for detecting moving regions in an image by taking the absolute difference between the current image and the reference background image.

A proper threshold is judiciously selected which segments foreground from the background. Edges are a reliable feature of text regardless of colour/intensity, layout, orientations, etc. Edge strength, density and the orientation variance are three distinguishing characteristics of text embedded in images, which can be used as main features for detecting text. Edge-based text extraction algorithm is general-purpose method, which can quickly and effectively localize and extract the text from both document and indoor/ outdoor images.

Yang Liu; Zongwu Xie; Hong Liu (2020): Edge detection is one of the most fundamental operations in the field of image analysis and computer vision as a critical preprocessing step for high-level tasks. It is difficult to give a generic threshold that works well on all images as the image contents are totally different. This paper presents an adaptive, robust and effective edge detector for real-time applications. According to the 2D entropy, the images can be clarified into three groups, each attached with a reference percentage value based on the edge proportion statistics. Compared with the attached points along the gradient direction, anchor points were extracted with high probability to be edge pixels. Taking the segment direction into account, these points were then jointed into different edge segments, each of which was a clean, contiguous, 1-pixel wide chain of pixels. Experimental results indicate that the proposed edge detector outperforms the traditional edge following methods in terms of detection accuracy. Besides, the detection results can be used as the input information for post-processing applications in real-time.

Giha Yoon; Geun-Yong Kim (2020): In the last decade, deep neural network (DNN)-based object detection technologies have received significant attention as a promising solution to implement a variety of image understanding and video analysis applications on mobile edge devices. However, the execution of computationally intensive DNN-based object detection workloads in mobile edge devices is insufficient in fulfilling the object detection requirements with high accuracy and low latency, owing to the limited computation capacity. In this paper, we implement and evaluate a DNN-based object detection offloading framework to improve the object detection performance of mobile edge devices by offloading computation-intensive workloads to a remote edge server. However, preliminary experimental results have shown that offloading all object detection workloads of mobile edge devices may lead to worse performance than executing the workloads locally. This degradation is obtained from the inefficient resource utilization in the edge computing architectures, both for the edge server and mobile edge devices. To resolve the aforementioned

problem with degradation, we devise a device-aware DNN offloading decision algorithm that is aimed to maximize resource utilization in the edge computing architecture. The proposed algorithm decides whether or not to offload the object detection workloads of edge devices by considering their computing power and network bandwidth, and therefore maximizing their average object detection processing frames per second. Through various experiments conducted in a real-life wireless local area network (WLAN) environment, we verified the effectiveness of the proposed DNN-based object detection offloading framework.

Ahmed H. (2020) Genetic algorithms (GAs) are intended to look for the optimum solution by eliminating the gene strings with the worst fitness. Hence, this paper proposes an optimized edge detection technique based on a genetic algorithm. A training dataset that consists of simple images and their corresponding optimal edge features is employed to obtain the optimum filter coefficients along with the optimum thresholding algorithm. Qualitative and quantitative performance analyses are investigated based on several well-known metrics. The performance of the proposed genetic algorithm-based cost minimization technique is compared to the classical edge detection techniques, fractional-order edge detection filters, and threshold-optimized fractional-order filters. As an application for the proposed algorithm, a strategy to detect the edges of the brain tumour from a patient's MR scan image of the brain is proposed. First, Balance Contrast Enhancement Technique (BCET) is applied to improve the image features to provide better characteristics of medical images. Then the proposed GA edge detection method is employed, with the appropriate training dataset, to detect the fine edges. A comparative analysis is performed on the number of MR scan images as well. The study indicates that the proposed GA edge detection method performs well compared to both classical and fractional-order edge detection methods.

Zhen Zheng; Bingting Existing edge detection algorithms suffer from inefficient edge localization, noise sensitivity, and/or relatively poor automatic detection capability. Contemporary edge detection algorithms can be improved by targeting these problems to help bolster their performance. Grey system theory can be used to resolve the small data and poor information issues in the local information of uncertain systems. An automatic edge detection algorithm was developed in this study based on a grey prediction model to remedy these problems. Noise characteristics in grey images are used to deploy a noise-filtering algorithm based on local features. A mask with twenty-four edge direction information points (345°) was established based on edge line texture features. By compressing the amplitude of the sequence, the randomly oscillated grey prediction sequence can be converted into a smooth, new sequence. The discrete grey model (1,1) (DGM(1,1)) was established based on this

new grey prediction sequence to obtain the grey prediction maximum value. A grey prediction image with enhanced edges was obtained by replacing the pixel value in the original image with the maximum grey prediction value. A grey prediction subtraction image with edges separated from non-edge points was also obtained by subtracting the original image from the grey prediction image. The optimal separation threshold in the grey prediction subtraction image can be determined via the global adaptive threshold selection method. The neighborhood search method was then deployed to remove stray points and burrs from the image after the target was separated from the background, creating the final edge image. Experiments were performed on a computer-simulated phantom to find that both the subjective visual effects and objective evaluation criteria are better under the proposed method than several other competitive methods. The proposed edge detection algorithm shows excellent edge detection ability and is highly robust to noise,

Shurong Pang; Zhe Chen; Fuliang 2021: High precision measurement is becoming an imperative requirement in many applications. A novel sub-pixel line-edged angle detection method based on convolutional neural network is proposed in this paper. The line edges of targets are accurately estimated by their geometric slope angles with an edge point located on the line. Specifically, the pixel level line-edged images are first obtained by image preprocessing. Then, two separate convolutional neural networks are effectively constructed to boost their discriminative capabilities for the sub-pixel line-edged angle classification. The pixel level line-shaped edge images are used as input and the final network outputs are the specific sub-pixel level line-edged angles. Finally, the sub-pixel level diameter measurements are precisely performed with the estimated angles. Compared with existing methods, the proposed method can estimate the sub-pixel line-edged angle with 0.1 degree accuracy in end-to-end way, even for the noisy images. Simulation results for angle measurement and the real-world experiment for diameter measurement reveal the validity of the proposed method.

Jun Tu; Fei Gao (2021): Airport detection in synthetic aperture radar (SAR) images has attracted much concern in the field of remote sensing. Affected by other salient objects with geometrical features similar to those of airports, traditional methods often generate false detections. In order to produce the geometrical features of airports and suppress the influence of irrelevant objects, we propose a novel method for airport detection in SAR images. First, a salient line segment detector is constructed to extract salient line segments in the SAR images. Second, we obtain the airport support regions by grouping these line segments according to the commonality of these geometrical features. Finally, we design an edge-oriented region growing (EORG)

algorithm, where growing seeds are selected from the airport support regions with the help of edge information in SAR images. Using EORG, the airport region can be mapped by performing region growing with these seeds. We implement experiments on real radar images to validate the effectiveness of our method. The experimental results demonstrate that our method can acquire more accurate locations and contours of airports than several state-of-the-art airport detection algorithms.

Wannan Zhang (2022): Scale-invariant feature transform (SIFT) has been successfully used for optical image registration, but it cannot produce satisfying results when directly applied to synthetic aperture radar (SAR) images. In the present study, a novel method is proposed for registration between SAR and optical images. First, candidate keypoints are detected using SIFT algorithm. Then, canny edge detection algorithm is adopted to remove the edge points which are wrong candidate points. Next, SIFT descriptors are generated from these correct keypoints. Last, the fast library for approximate nearest neighbors (FLANNs) algorithm is applied to search matching points in high-dimensional space. Experimental results show that the proposed approach is significantly more accurate and much faster than the original SIFT algorithm.

Samee U. Khan 2021 In recent years, many large-scale information systems in the Internet of Things (IoT) can be converted into interdependent sensor networks, such as smart cities, smart medical systems, and industrial Internet systems. The successful application of edge computing in the IoT will make our algorithms faster, more convenient, lower overall costs, providing better business practices, and enhance sustainability. Facial action unit (AU) detection recognizes facial expressions by analyzing cues about the movement of certain atomic muscles in the local facial area. According to the detected facial feature points, we could calculate the values of AU, and then use classification algorithms for emotion recognition. In edge devices, using optimized and custom algorithms to directly process the raw image data from each camera, the detected emotions can be more easily transmitted to the end-user. Due to the tremendous network overhead of transferring the facial action unit feature data, it poses challenges of a real-time facial expression recognition system being deployed in a distributed manner while running in production.

Therefore, we designed a lightweight edge computing-based distributed system using Raspberry Pi tailed for this need, and we optimized the data transfer and components deployment. In the vicinity, the front-end and back-end processing modes are separated to reduce round-trip delay, thereby completing complex computing tasks and providing high-reliability, large-scale connection services. For IoT or smart city applications and services, they can

be made into smart sensing systems that can be deployed anywhere with network connections.

III. PROPOSED METHOD

The flow chart of our proposed model. It shows how the algorithm is set up. After taking frames from video footage we have done pre-processing in where we have converted the RGB image into Gray image.
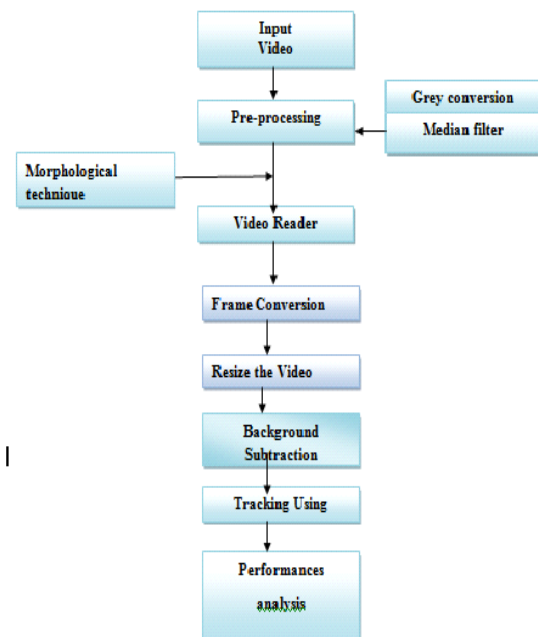

Fig 2. Proposed flow diagram.

Then we use median filtering for removing the noise and have done image binarization for edge detection. After pre processing the images we find the edges of the images by canny edge detection and we have done morphological image processing.

IV. CANNY EDGE DETECTION ALGORITHM

The algorithm runs in 5 separate steps:
1. Smoothing:
Blurring of the image to remove noise.

2. Finding gradients:
The edges should be marked where the gradients of the image has large magnitudes.

3. Non-maximum suppression:
Only local maxima should be marked as edges.

4. Double thresholding:
Potential edges are determined by thresholding

5. Edge tracking by hysteresis:

Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge. Each step is described in the following subsections.

V. IMPLEMENTATION OF CANNY EDGE

1, all video in this worksheet (except the original) are produced by our implementation. A few things should be noted with regards to this:

* The (source) image and the thresholds can be chosen arbitrarily.
* Only a smoothing filter with a standard deviation of σ = 1.4 is supported (the one shown in Equation 1).
* The implementation uses the "correct" Euclidean measure for the edge strengths, described
* The different filters cannot be applied to edge pixels.

This causes the output image to be 8 pixels smaller in each direction. However, our implementation uses the iterative approach. First all weak edges are scanned for neighbour edges and joined into groups. At the same time it is marked which groups are adjacent. Then all of these markings are examined to determine which groups of weak edges are 6 connected to strong edges (directly or indirectly). All weak edges that are connected to strong edges are marked as strong edges themselves. The rest of the weak edges are suppressed.

VI. CONCLUSIONS

In this paper, various edge detection techniques are studied and compared. After the experimental analysis, it is found that the second order derivatives (Canny and Log) are working well in comparison to first order derivatives (Sobel, Prewitt and Roberts). The Log and Canny edge detection method producing good results for image quality and visual perception. Since, Log edge detection technique is vulnerable to noise. So, it is not providing the better results than canny edge detection technique in presence of noise.

Hence, it is experimentally proved that the canny edge detector is a better edge detector technique of forming the edges for inner as well as outer lines of the object. It has more good resistance to noise than Roberts, Prewitt, Sobel and Log edge detection technique. Here, Sobel edge detection technique proves better for discovering better outer lines (continuous boundary) only of an object. As the future work, we can design the new filter over the limitation to get better image quality so that the image can be enhanced by reducing the noise.

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