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HUMAN ACTIVITY RECOGNITION UNDER PCA AND IMAGE FUSION TECHNIQUES

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Abstract: Image enhancement is a challenging task especially in image analysis; is more challenging when performing image fusion. Image fusion is the process of combining multiple images to produce a quality output without any changes in contrast, blur and noise. Recently, deep learning models that focus on automatically extracting low-level to high-level features of the input data instead of using complicated conventional feature extraction methods have achieved significant improvements in the classification of large amounts of data, especially vision-based datasets. To overcome the above problems, this paper proposed a new image fusion method that improves image contrast and also provides suitable image details. Our method is based on a set of conventional techniques such as amalgamated histogram equalization and fast grayscale clustering to handle the mentioned problems, and we improve the overall fusion strategies by proposing a new principal component analysis technique to convert RGB images to high gray scale the contrast image as the final output image. Better results can be obtained using the PCA fusion method, but the fused image still suffers from limited directional information and cannot capture smooth edges and contours.

Keywords:*fast gray scale, PCA fusion, fused image still*

I. INTRODUCTION

Image fusion is a method of combining multiple input images to produce a single output image that is of high quality and more informative for human vision perception, robot and other processing tasks compared to any of the input images. In recent years, image fusion techniques have become a promising area of research and have gained great interest in many applications such as computer vision; facial detection and recognition, medical diagnosis, surveillance and so on. Image fusion is performed by three distinct levels of processing named as pixel level, feature level and decision level. Pixel-level fusion is used by many researchers in various applications. It merges the pixels of the input images directly to get the final output image.

Some researchers have also paid attention to feature-level image fusion, which deals with high-level processing tasks. It extracts features from an image and then fuses them using some advanced fusion schemes such as region-based. The purpose of feature-level fusion is to extract the desired features from the input images instead of all the features. The decision level is the highest level of processing of the three levels mentioned above. It extracts all the information from the images and then decides to merge the extracted information according to specific criteria. This type of processing is widely used in biometrics, fingerprint authentication and facial recognition. The main key goal of any image fusion algorithm is to increase the contrast of the source images so that most of the useful information can be preserved without creating artifacts and to apply a proper fusion strategy that should be robust against inappropriate conditions. Although many image fusion algorithms have been proposed so far, the fused image suffers from changes in background contrast, uneven illumination, blur effect, and the presence of noise. To overcome the shortcomings of the above problems, this paper presents an improved image fusion algorithm that solves these problems and achieves better results than the existing state-of-the-art image fusion techniques.

In this regard, in order to perform data classification and detection, most vision-based methods use traditional pattern recognition and machine learning methods. Because traditional methods for extracting features from video frames or images use complicated manual methods, vision-based human activity recognition is a complex method. Additionally, the use of manual methods by some local descriptors such as Histogram of Gradient (HOG) and Scale-Invariant Feature Transform (SIFT) to achieve low-level features may be acceptable for some fixed datasets. However, since hand-crafted features are limited to a certain dataset, achieving efficient features from a new dataset and adapting the hand-picked low-level features to the new dataset and state is a challenging task. Nevertheless, there are significant studies that use traditional pattern recognition and conventional machine learning methods to recognize human actions on video datasets.

They proposed an SVM classifier using Meta classifier (MC) and Naive Bayesian classifier (NBC) to classify the same human activity data set. The results showed that their proposed MC method (by 77.19% accuracy) outperformed the NBC method (by 56.32% accuracy) in the classification of the DML Smart Actions dataset. However, the proposed MC method achieved a significant degree of accuracy in the classification of other data sets as well. Additionally, in other work, to recognize human activity, this group used Speed up Robust Features (SURF) and STIP to extract features from DML Smart Actions dataset images. In addition, the NNSC algorithm was used to construct visual words. A kernel function was used to measure the similarity between images or videos. In this regard, they compared their proposed methods with their previous works. As a result, their proposed kernel method combined with SVM and NNSC achieved the highest accuracy rate (79.9%). Moreover, their proposed kernel function combined with SVM achieved the second highest accuracy rate compared to previous same works with an accuracy rate of 62.6%.

II. LITERATURE REVIEW

Literature research is the most important step in the software development process. Before creating a tool, it is necessary to determine the time factor, the economy and the strength of the company. Once these things are secured, the next ten steps are to determine which operating system and language can be used to develop the tool. Once programmers start building a tool, they need a lot of external support. This support can be obtained from experienced programmers, from a book or from a website. Before building the system, the above assessment is taken into consideration in the development of the proposed system.

M. Sharma, "A review: image fusion techniques and applications," Int J Comput Sci Inf Technol, vol. 7, pp. 1082-1085, 2016.

The PCA is applied in, which reduces the dimensions of data and produces energy information in final fused output image. Nevertheless, this method suffers from spectral degradation, and due to that, it cannot capture the smooth edges, textures and contours in the image.

Y. Yang, "Multimodal medical image fusion through a new DWT based technique," pp. 1-4.

Discrete wavelet transform (DWT) was proposed by yon et al., which preserves high-frequency information with fast computation but it has lack of shift-invariance property that introduce artifacts and noise. Moreover, it has limited directional information and cannot capture the essential features like contours and edges.

S. Mane and S. D. Sawant, "Image fusion of CT/MRI using DWT, PCA methods and analog DSP processor, " Int. Journal of Engineering Research and Applications, vol. 4, pp. 557-563, 2014.

Mane et al. [13] introduced hybrid DWT and PCA so that it can achieve spatial as well as

spectral information. The input images are decomposed by DWT and then PCA is applied to decomposed images. Though this method produces better fused results than individual DWT and PCA techniques but the output image still has limited directional information. Moreover, this combined technique is shift variant that introduces artifacts in the fused image and it also cannot capture the smooth contours and edges.

J. Adu, J. Gan, Y. Wang, and J. Huang, "Image fusion based on nonsubsampled contourlet transform for infrared and visible light image," Infrared Physics & Technology, vol. 61, pp. 94-100, 2013.

The NSCT is discussed, which is fully shiftinvariant and has flexible frequency selectivity with fast implementation that addresses the above issues. However, the poor illumination and blurring effect degrades the fused image so it cannot preserve the detailed information from input images.

Z. Qu, Y. Xing, and Y. Song, "An Image Enhancement Method Based on Non-Subsampled Shearlet Transform and Directional Information Measurement," Information, vol. 9, p. 308, 2018.

The NSST is used to decompose both images and SF-PCNN is applied to sub-band coefficients for source images. This algorithm addresses the issues of shift variance and it has better frequency selectivity. However, the decomposed lowfrequency image is affected by poor contrast and sharpness, so the image loses some part of energy information, which affects the overall performance of the output image.

Bayat et al. (2017) developed acceleration data by using user's smartphone to identify few types of human physical activities. The author proposed a new digital low-pass filter recognition system, in order to isolate the component of gravity acceleration and tested the proposed solution in several cases of real-time examples which was having various statistical features like high frequency and low frequency components. From this experiment, the author achieved an overall accuracy rate of 91.15 % using fusion methods.

Cabero et al. (2018) highlighted the experimental parameters to be taken into considered for capturing proximity traces among peoples when, the bluetooth is used as a radio technology. Granularity and reliability parameter of Bluetooth limits the analysis based on trace acquisition. As a remedy to these limitations optimal configuration has been implemented for the acquisition of proximity traces and also a fine-tuned bluetooth system has been used for the movement information on custom hardware. Using the proposed solution, the author achieved an experimental result with minimum granularity.

Guiry et al. (2017) introduced the method of detecting human activity by using both the chest sensor and smartphone accelerometer. In this article, offline analysis was focused in order to compare this approach with de-facto machine learning algorithms under various use-cases. The feasibility of the proposed system was determined by carried out the experiments in two different countries involving 6 and 24 peoples respectively. Analysis of 1165 min of recorded recognizing activities like sitting, standing, and running, lying, walking and cycling indicates that by using this protocol 98 % accuracy was achieved.

Bhattacharya et al. (2017) and Khan et al. (2018) studied human activity recognition using the accelerometer sensor with different position of front and back pant pocket, (jacket breast pocket). The various activities such as standing, walking running, hopping staircase ascent and descent are classified by Artificial Neural Networks (ANN). The measurement of motion mode recognition was done by using inertial sensors with the help of user's smartphone positions either on the body or on belt and following certain walking activities (swinging, texting, phoning, and bag) which are classified by a decision tree classification algorithm

such as walking has been published by Susi et al. (2017).

Incel et al. (2017) recently discussed about the human Position recognition using linear acceleration, gravity, gyroscope and magnetic field in smartphone sensors with the following user's activity such as walking, jogging, running, biking, going up/down stairs and on a bus which are classified by K-Nearest Neighbour, Multi-Layer Perceptron (MLP) and j48 are performed. Physical movement recognition was obtained by using inertial measurement unit as reported by Anguita et al. (2016). For this, the user's smartphone was placed in a position of belt at the waist and certain Support Vector Machine (SVM) algorithm classified activities like standing, walking, sitting, lying, staircase ascent and descent are followed.

Abbate et al. (2018) studied about the fall detection system that has main applications in hospitals. For this the patient movement has been monitored regularly and when it senses a fall it sends an emergency request to caregivers with the help of smartphone based sensors. This paper also gives information about the false alarms. For an example, detection mechanism senses some of the incidents like sitting on a sofa or lying on a bed as a fall and alerts caregivers. To overcome this problem, the author has implemented some novel techniques like detecting the daily activities of humans so as to reduce/avoid the mistakenly mis-detected false alarms. The major contribution of this present research work is the development of star topology for detecting user's activity direction by using a combination of both orientation sensor and BLE in IoT.

The objective of the present investigation is to detect the position and direction of the user both at the times of emergences and at normal condition like walking, sitting and standing in an organization. The subject under study performed various four different algorithm classified activities in different directions with the help of a smartphone, and the signals were captured using LabVIEW toolkit in human tracking system. Therefore, obviously the present research would be a promising system for the users who are in urgent and normal in an indoor organization. In addition, it has a great target application towards the remote health monitoring system, commercial applications and safety services. The present research work is performed by using latest technological features like orientation sensors and BLE in IoT where these technologies are used as in-built with smartphone. Thus, it has a high advantage of not having an external support or sensors either on the user's body or on the walls or entrances or ceiling. Since BLE in IoT is best suited for indoor communication technology, it could be efficiently used for detection of indoor user's activity direction for its wide range of applications. Thus, the smartphones involving the combination of both the orientation sensors and BLE were much attractive as it is cheaper than other existing methods. This technology also consumes low power, energy and low latency.

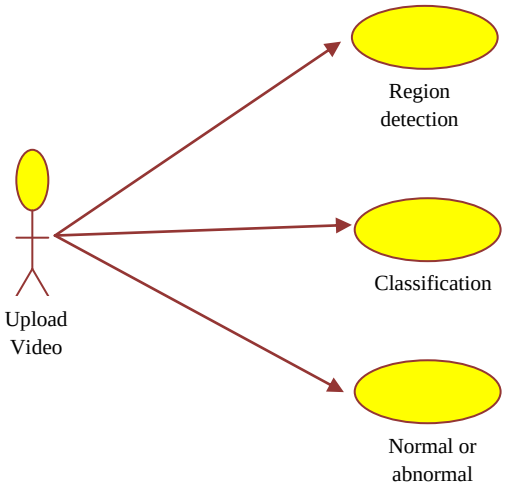

Fig 1: Flow diagram of proposed system.

III. EXISTING SYSTEM

Most vision-based methods use traditional pattern recognition and machine learning methods to perform data classification and detection. Since traditional methods for extracting features of video frames or images use complex manual methods,

vision-based human activity recognition is a complex method. It is challenging to enhance low-contrast images, be they natural, multifocal, infrared, and visible images, whose image intensity in the gray domain is very high in one position and very low in other parts of the image.

IV. PROPOSED SYSTEM

According to the advantage of automatic feature extraction and the use of large data sets of deep learning methods, which have achieved state-of-the-art results in the field of human activity detection and recognition in the industry. The existing image fusion algorithms have their pros and cons, and their pros and cons should be combined to improve the quality of the fused image. There is a need to design an image fusion algorithm that can automatically adjust the contrast of images to preserve energy information, smooth edges, contours, and sufficient additional information to introduce artifacts and noise.

V. IMPLEMENTATION

Image Fusion Dataset

We used 2 pairs of RGB image datasets to compare the proposed method with state-of-the-art image fusion techniques.

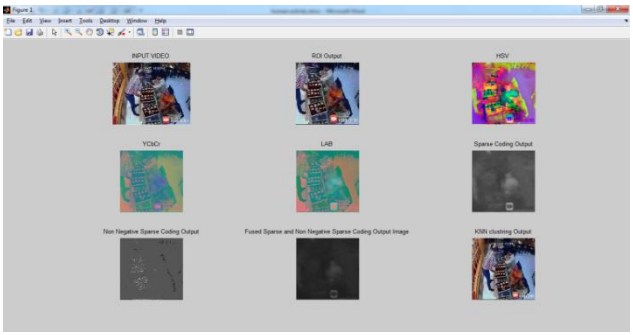

Fig 2: Bleeding Frame and Region Detection

Methodology

PCA Fusion, Convolutional Neural Networks (CNN), Deep Belief Network (DBN), Recurrent Neural Networks (RNN) and Long Short Term Memory (LSTM) are the most common deep learning architectures. In fact, deep learning based methods are models that can extract features automatically without using any manual methods. Furthermore, functions are created hierarchically from low-level to high-level.

Fig 3: Final Abnormal Detection

Result

In order to classify human action frames instead of using conventional CNNs, a specific CNN and PCA architecture is proposed, which includes five convolutional layers, four pooling layers, and three fully connected layers. In the last fully connected layer, softmax was considered to determine the likelihood of 112 classes of the activity dataset.

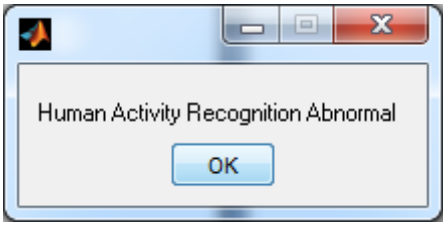

Fig 4: Result

VI. CONCLUSION

A CNN architecture and PCA techinques as a deep learning method was designed to recognize the human activity of a smart home video dataset. These combined methods provide better contrast, preserve sufficient energy information, achieve clear textures, smooth contours, and better visual effects than existing state-of-the-art techniques.

Intuitively, the proposed method has tremendous fusion effects that can be observed from both subjective and objective evaluations, revealing the superiority of the proposed work. Many research points are still open and need to be considered for future work. Another research direction would be to design a simpler image fusion algorithm that could identify abnormal activity. Essential role in improving image quality and applicable for real-time applications.

VII. FUTURE ENHANCEMENT

A future study is planned as a combination of different deep learning models and classifiers on a huge specific dataset of human activity, which will also be provided by our team.datasets. However, the performance of the proposed method can be improved by learning more data. A future study is planned as a combination of different deep learning models and classifiers on a huge specific dataset of human activity, which will also be provided by our team.

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