COMPARATIVE PERFORMANCE EVALUATION OF VIDEO ANALYTICS TECHNIQUES USING PRE-ANALYSIS AND TANGENT BASED APPROACH

Jyoti
M.Tech Scholar
GNDU(MainCampus)Amritsar

Amit Chhabra
Assistant Professor
GNDU(Main Campus)Amritsar

ABSTRACT

Video analysis is one of the key aspects associated with applications like accident detection, abnormal activities detection, moving vehicles detection etc. this paper represent pre-analysis and tangent based approach for detection of moving object within a frame. The frame analysis using static frames is accomplished using mean framing mechanism. The problems of this mechanism is highlighted and changes in terms of pre-processing by improving color contrast levels using color scaling scheme. After color enhancement, tangent motion detection mechanism is applied to extract the object from moving frames correctly. The first step in the video processing is to convert the observed into set of frames. The frames are then fed into the system of tangent based bounding box in order to eliminate the extra pixels and stabilised the intensities levels. After the intensities levels are stabilised, motion detection within the video frames begin. The tangent based mechanism observe the slopes within the intensities. In case intensities slope indicates through tan(theta) is noted within .mat file. In case slope is greater than 1, motion within the video frame is detected. The comparative analysis of tangent based approach and tangent based bounding box is presented to determine the best possible approach. Overall result is presented in the form of peak signal to noise ratio and classification accuracy.

Keywords: Mean framing, color scaling, tangent motion detection, PSNR, classification accuracy

I. INRODUCTION

The analysis of video is complex task but it is useful for handling noise, detection of anomaly, prediction of traffic and route. Chien and Chen 2011 [1] describes the morphological algorithm that reconfigure the frames that are involved within the video. The frame remains same during a scene representation but there is case that frames goes missing. In case of missing frames it is replaced with the known frames in existing video without any distortion. Young and Jargstorff 2017 [2] describes CUDA software based mechanism for analysis of videos. It extracts frames from the videos at good rate and it does not considered any trajectory analysis. For analyzing motion in videos complex task and it must required trajectory analysis. Figure 1 shows the analysis of motion and non-motion video analysis mechanism

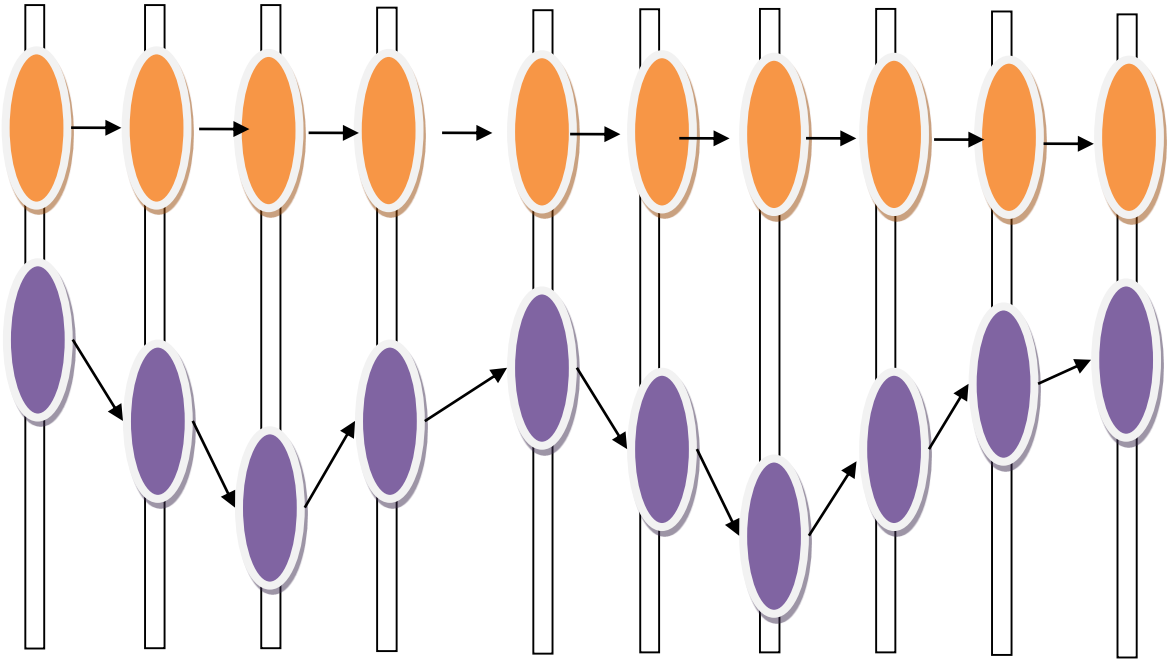

Figure 1: '1' labelled figure indicates the static video analysis and '2' labelled figure indicates motion video analysis based on trajectories.

The mechanism that are present for videos analysis exploit the redundancy and it is discussed by Mahadev A. Bandi 2016 [3]. The motion can affect the video analysis mechanism and it is shown in figure. The 1 labelled indicates the extracted pixels using the relationships between them and 2 indicate motion in which pixel is destroyed and it passes through object. It utilizes the trajectory mechanism for analysis of videos.

Paper is organised as given below: the 2 section gives review of literature and techniques that are used for video analysis along with comparative analysis, 3 section describes the pre-analysis and tangent based methodology, 4 section provides experimental results, 5 section provides conclusion and at last references is given.

II. EXISTING WORK

In videos there is lot of frames presents so t is complex task to process videos and extract information from these frames. It can include noise during capturing process because of various reasons. Singh 2014 [4], Zhang et al [5] and Wang et al. 2010[6] describes various mechanisms that handles noise present within the frames. This noise can be originated because of transmission channel or technique of capturing. In this section various mechanism for handling noise present within video frames.

a. Mean Framing

Ghutke 2016 [7] proposed worldly frame extraction component for video preparing. This instrument is helpful for movement video in which movement remuneration is missing. This component is fit for handling noise from the video. Noise corruption model is recorded as under:

$$G_n(x,y) = I_n(x,y) + \partial_n(x,y)$$

Equation 1: Noise degradation model

'G' indicates the observed frame gray-scale levels at distinct 'x' and 'y' positions. 'I' is the actual non degraded signals. Noise is represented with '∂'.

This system is straightforward yet very successful in catching the video and removes noise from the picture frame from video. June 2014 and Vyas et al. 2016 [8], [9]Suggested pixel force levels from the picture shift from 0 to 255. In the event that this force interims are disregarded then loud pixel are identified and component of mean framing is connected. Mean F-framing component utilize neighbourhood investigation to decide the force levels. The defiled pixel force levels are supplanted with the normal of neighbour pixel power levels to take out the noisy segment of the frame. The execution of Mean framing instrument is for the most part of the structure

$$U(x,y) = \frac{1}{m}[(m-1)U(x,y) + G_n(x,y)]$$

Equation 2: Noise handling model employed in Mean framing

'U' indicates the current image frame extracted from video, 'G' indicates the current noisy image, 'm' indicates the number of pixels requires replacement to obtain corrected video frame. Problem with this approach is too much motion blurring affect introduced within the captured video.

b. Motion Adaptive Video Capturing

Hsia et al. 2015 [10] describes mechanism for capturing videos that are recursive in nature. In this the videos are captured frame by frame and these frames are compared with each other. This comparison will discover the errors presents within the frames and if more error is present then it will indicate motion. The equation that is used given below:

$$G(x,y) = G(x,y) + a\big(G(x,y) - I(x,y)\big)$$

Equation 3: Motion Adaptive video capturing mechanism

The 'a' shows the frame measure which is equal of the all out size of the separated video frame. 'G' shows the boisterous frame. Blunder rate recognize the kind of frame removed. On the off chance that this blunder rate is high movement video frame is separated and estimation of 'an' is set near '1'. On the off chance that high movement video frame is extricated then separating is killed. This instrument thus processes the video at must quicker rate when contrasted with Mean framing system. Movement location is inbuilt into the adaption coefficient 'a'.

A small estimation of error rate shows static frame and estimation of 'a' can be set to littler qualities to permit filtering. This procedure performs better if there should be an occurrence of static video frame yet indicates inconsistencies amid high movement videos.

c. Motion Handling Temporal Mechanism

N.Dey 2016[11] proposed motion versatile component for video preparing. Motion versatile system can deal with static video frame however motion taking care of instrument fused with motion versatile component is named as Motion handling of temporal system. Trajectory handling of instrument is utilized in this component to deal with motion and sifting system is incorporated to handle noise inside the video frame. This channel is equipped for taking care of impediment impact. Noise levels are seen by differing the estimations of 'a'. Motion estimation with differing estimations of 'an' is given through the accompanying condition.

$$a = f(x) = \begin{cases} -x, & DFD < \Delta \\ x, & DFD \geq \Delta \end{cases}$$

'DFD' is the displaced frame difference. This is obtained by observing the pattern of video frame along the trajectory. Values of 'DFD' is obtained using the following equation

$$DFD = G(x,y) - I\big(x + dx(x,y), y + dy(x,y)\big)$$

Equation 4: Displaced frame difference equation

This mechanism after motion detection filtering is applied on the video frames and it also handles noise present within frames. It also preserve image and the motion that is estimated is uniform.

d. Kurtosis Based Video Analysis

Snehkunj et. Al [12] gives mechanism for handling noise within the MRI images and this will used optical flow analyser. It processes the image frame and obtain accurate model for video analysis. Dynamic pixel locales could be gotten precisely by including cutting method inside this component. Genuine motion inside every pixel could cause bending that could be dealt with by utilizing separating and framing. Condition utilized for same is given as under

$$H_0 : b_k(r) = z_k(r)$$
$$H_1 : b_k(r) = u_k(r) + z_k(r)$$

Equation 5: Kurtosis based analysis model

Kurtosis is gotten by subtracting the present frame from the current frames acquired from video. The pinnacle esteem gives the estimation of kurtosis. At the end of the day higher the deviation more kurtosis there will be. Kurtosis subsequently must be decreased which is practiced utilizing fluctuating window estimate. Window estimate is differed and balanced by noise level wanted inside caught frame arrangement.

e. Candidate Selection Motion Estimation

Best-Rowden et. Al [13] proposed a candidate choice instrument for face acknowledgment. This calculation is novel nearby motion based calculation to decide the static and motion inside the video frame. Hopeful choice calculation carefully utilizes competitor vectors at each site where motion recognition is wanted. This calculation was shaped under Bayesian framework to yield least conceivable estimation error. Naraei [14] proposed a component to deal with social insurance issues. Engendering system is utilized to handle the issue of mean square error. Engendering instrument changes the info vectors so as to get adjusted contribution to request to acquire the yield which lies between as far as possible.

In spite of the fact that this system is fit for dealing with motion based videos yet it is moderate in nature. Overhead engaged with the engendering model is exceedingly high.

f. Local and Global Motion detection

Flevaris et. Al [15] and S. Afric [16] proposed a neighborhood and global component extraction system from videos incorporated with AI instruments. Neighborhood motion discovery component utilizes nearby valuators and vectors that checks for the motion of article inside the scene. This discovery instrument utilizes the static motion finder since frame changes to little degree utilizing this model. Worldwide location incorporates recognition of motion because of the camera development. The noise dealing with instrument must be coordinated inside such model to dispense with noise that could be available due to catching component. Fleeting repetition is investigated utilizing this demonstrating procedure.

The methods talked about in this segment relate to static and motion video catching instruments. It is found that motion based video catching is progressively intricate and requires pressure instruments to be incorporated to diminish unpredictability of

activity. Noise taking care of components must be coordinated with the catching instrument to perform exact gauges if there should be an occurrence of uses like traffic forecast.

III. METHODOLOGY OF PRE-ANALYSIS AND TANGENT BASED APPROCH

The methodology for the pre-analysis and tangent based work is divided into phases. The first phase n includes pre-analysis of the input video frames. The videos frames are extracted using the MATLAB toolbox for video and visual effect analysis. After pre-analysis, next phase is to detect motion from video frames using tangent based methodology. The phases are described in this section as

- **Pre-analysis**

Pre-analysis mechanism given by N.dey [11] improves the clarity within extracted video frames. Video frames that are extracted must be trained. In case noise is present within the extracted frames than accuracy of extraction is poor. To improve this process, color contrast levels are improved using color scaling mechanism. The employed mechanism operates on all the three levels of image including red, green and blue color schemes.

Pre-analysis(Video) with S-scaling factor=2

- Input video(Extenssion .avi)
- $Frames_i$=Extract_Frames(Video)
- For i=1: Length(Frames)
  H=$Frames_i$(:,:,1)
  S=Frames(:,:,2)
  V=Frames(:,:,3)
  S=2
  H=H*2
  S=S*2
  V=V*2
- End of for
- Enhanced_image=cat(3,H,S,V)
- Enhanced_Image=HSV2RGB(Enhanced_image)

The enhanced image using scaling factor of 2 increases the contrast of the frame that is degraded due to noise. After enhancement image frames has to be converted into RGB format. After the enhanced videos frames tangent based technique is applied to extract necessary features to detect the moving object from the video frames.

- **Tangent Based Motion detection mechanism**

The tangent based approach by S.Africa[16] is capable of detecting the object from motion videos. The pre processed mechanism enhances the video frames and then this approach extract the object feature for accurately motion detection. The algorithm is as given below:

1) First of all Video inputted for analysis must be converted into image frames. The standardized library of Matlab for signal analysis can be used for this purpose. Mmread function is available in MATLAB and format of analysis is .avi
2) After extracting the images, each image is labeled as Image1, Image2, Image3,-----Image N.
3) Loop from first image to last image is applied for analysis each image frame
   a) Extracting Fabric features using the Tangent feature extraction technique and store it in .mat file(Assuming fabric of younger and older persons is different)
   b) Image analysis Tangent bounding box mechanism can be used to estimate the height of the object from the image
   c) The extracted feature corresponding to height will be maintained within .mat file.
   d) If($Training_f == Testing_f$) *then*

      Object detected

      Return

      Else

      Frame=Frame+1

      End of if

   End of Loop

   Stop

The tangent based approach extract the features from the videos and then compare it against the training set to determine the object in the motion based videos. Features extracted and performance analysis is expressed in the next section.

IV. Results and Discussion

The features extracted from the video frames are compared against the training image-set. The holdout rate for training is 0.3. The distinct features analyzed for video analysis are elaborated in this section.

- **Contrast**

Contrast is the relationship between brighter and darker parts of the regions within the image. Contrast is generally estimated using intensity values. Equation for estimating contrast values is given as under

$$Contrast = T_i/(I_B + I_D)$$

Here T indicates total intensity of the region, I_B is the intensity of brighter region and I_D indicates the intensity of darker region.

- **Energy**

It describes the information when operating on probability framework in image analysis. In classification process energy must be maximized but in segmentation process energy must be minimized.

$$Energy = \frac{Object_{Detection}}{Segmentation}$$

Segmentation process yield critical segments and object detection is a result from classification process.

- **Homogeneity**

Degree of similarity between different regions in image is known as homogeneity. The homogeneity is obtained by summing the total pixel intensity having common characteristics.

$$Homogeneity = \sum_{i=1}^{n} I_i = I_{i+1}$$

I_i is the intensity of the current region and I_{i+1} is the intensity of next region.

- **Standard Deviation**

This metric is a measure of variation of t he pixel from original intensity level. The values of standard deviation could be positive or negative. The positive value indicates positive skewed deviations and negative values indicates negatively skewed deviations.

$$\sigma = \sqrt{((X - \left(\frac{X}{n}\right)^2)/n)}$$

- **Kurtosis**

This metric is a statistical measure used to describe the distribution of pixels within the image. Large Kurtosis indicates the tail data from the normal distribution. Analysis of series becomes complex if kurtosis is high.

$$kurtosis = \sum \frac{X - \frac{X}{N}}{\frac{N}{S^4}}$$

'S' is the standard deviation and X indicates values from the series.

The result obtained after simulating tangent based approach is listed as under

In terms of peak signal to noise ratio compared with existing literature is shows variations and it is higher as compared to existing literature.

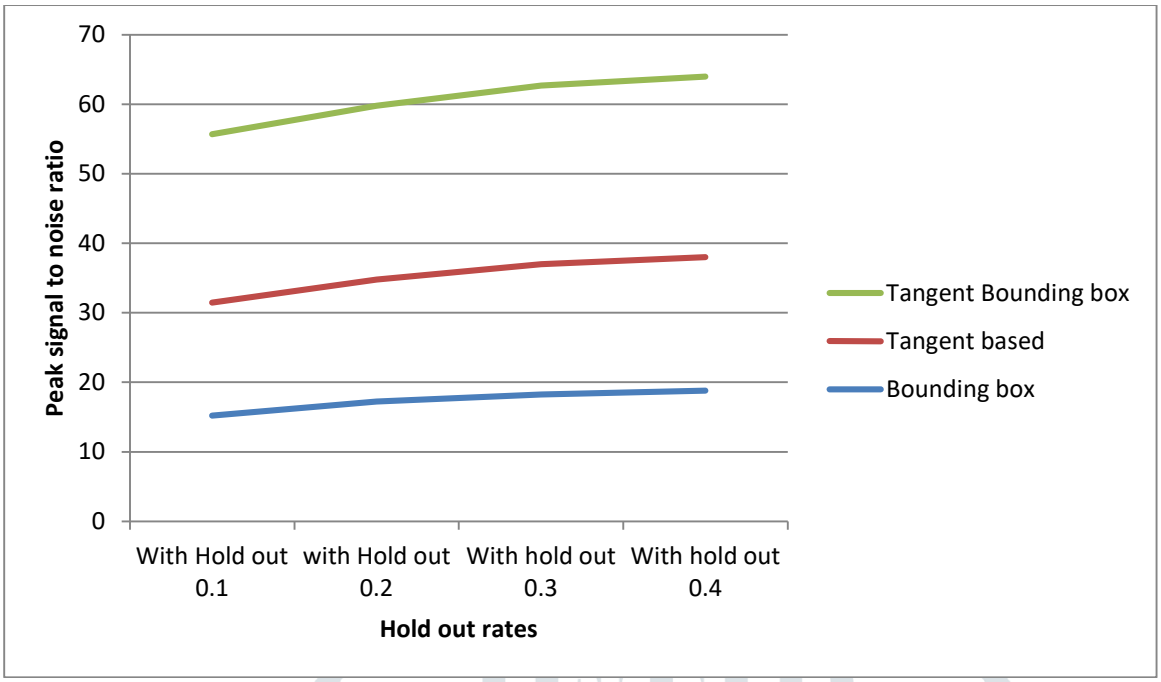

Figure 1: with varying hold out rate impact on peak signal to noise ratio

Peak signal to noise ratio is compared against the tangent based approach without bounding box and with plan bounding box mechanism. The region of interest is not accurately identified by the use of existing literature. The pre-analysis and tangent based approach however produces much better result as compared to existing system.

Result in terms of classification accuracy also shows improvement. The classification accuracy is significantly high and increased by the margin of 3%. The classification accuracy is observed by subtracting actual values of the frames averaged over all the pixels within the frame to the obtained values over the region of interest.

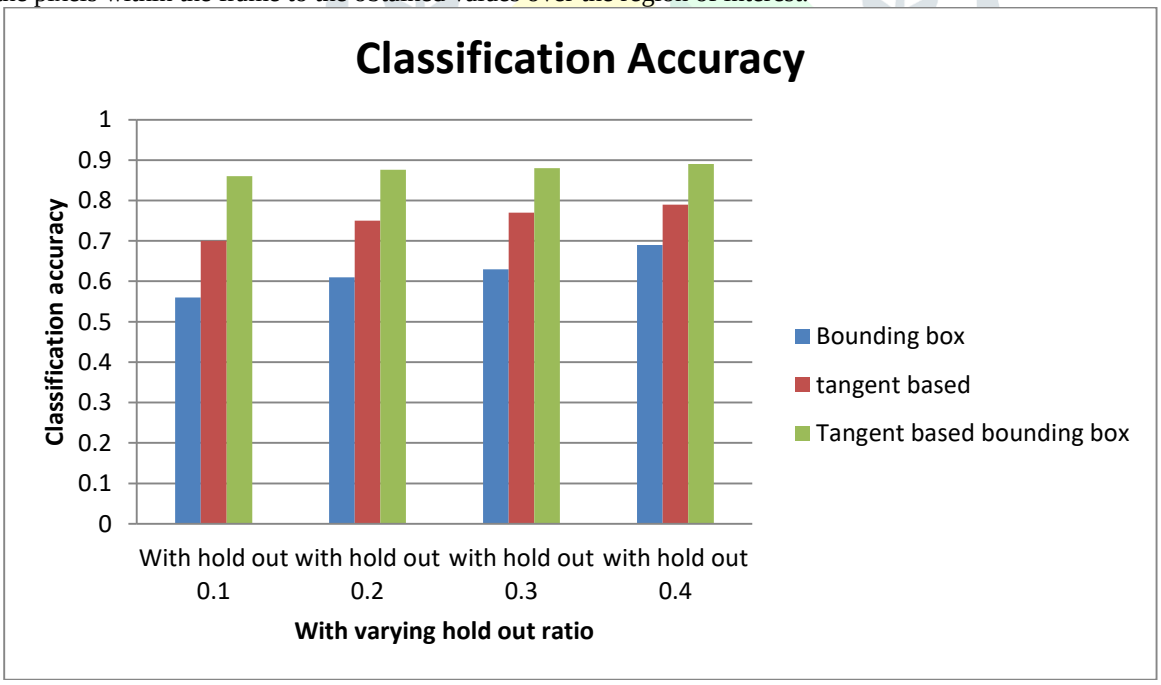

Figure 3: Classification accuracy of existing and pre-analysis [11] and tangent based approach[16]

Classification accuracy is a primary parameter that is enhanced using the pre-analysis and tangent based system proving worth of the study.

V. CONCLUSION AND FUTURE SCOPE

This system using tangent based approach better detect the object within the motion video. The applications of object detection in moving video frames is on road accident detection, abnormal activities detection etc. Classification accuracy of pre-analysis and tangent based literature is compared against the bounding box and plan tangent based approach. Mean shift filtering by subtracting foreground and background does not accomplished contrast enhancement hence pre-analysis in pre-analysis and tangent based approach is done using individual color scale factor enhancement. Scale factor of 2 yield classification accuracy upto 89%.

In future morphological filtering can be accommodated with the tangent based approach for abnormal behavior detection in video frames.

REFERENCES

[1] S.-Y. Chien and L.-G. Chen, "Reconfigurable Morphological Image Analysis Accelerator for Video Object Segmentation," *J. Signal Process. Syst.*, vol. 62, no. 1, pp. 77–96, 2011.

[2] E. Young and F. Jargstorff, "Image Analysis & Video Algorithms with CUDA," *IEEE 17th Int. Conf. Parallel Distrib. Syst.*, 2017.

[3] M. A. Bandi, "Video Analysis For Flame Detection 1," *IEEE Access*, no. 11, pp. 2–5, 2016.

[4] A. Singh, "Analysis of Image Noise Removal Methodologies for High Density Impulse Noise," *IEEE ACCESS*, vol. 3, no. 6, pp. 659–665, 2014.

[5] Y. Zhang, Y. Liu, X. Li, and C. Zhang, "Salt and pepper noise removal in surveillance video based on low-rank matrix recovery," *Comput. Vis. Media*, vol. 1, no. 1, pp. 59–68, Aug. 2015.

[6] G. Wang, D. Li, W. Pan, and Z. Zang, "Modified switching median filter for impulse noise removal," *Signal Analysis*, vol. 90, no. 12, pp. 3213–3218, 2010.

[7] R. Ghutke, "Temporal video frame interpolation using new cubic motion compensation technique," *2016 Int. Conf. Signal Process. Commun. SPCOM 2016*, pp. 1–5, 2016.

[8] N. Vyas, A. Jain, and C. P. Singh, "High Density Impulse Noise Removal A Review," *IEEE 2nd Int. Smart Cities Conf. Improv. Citizens Qual. Life, ISC2 2016 - Proc.*, pp. 1613–1616, 2016.

[9] A. June, "Fuzzy Based New Algorithm For Noise Removal And Edge Detection," vol. 2, no. 2, 2014.

[10] S. C. Hsia, W. C. Hsu, and C. L. Tsai, "High-efficiency TV video noise reduction through adaptive spatial–temporal frame filtering," *J. Real-Time Image Process.*, vol. 10, no. 3, pp. 561–572, 2015.

[11] N. Dey, "Motion Detection and Tracking in Video Analysis Applications (Preface)," *IEEE Access*, no. September, 2016.

[12] R. Snehkunj, A. N. Jani, and N. N. Jani, "Brain MRI / CT Images Feature Extraction to Enhance Abnormalities Quantification," *Springer Int. Publ.*, vol. 11, no. January, pp. 1–10, 2018.

[13] L. Best-Rowden, H. Han, C. Otto, B. F. Klare, and A. K. Jain, "Unconstrained face recognition: Identifying a person of interest from a media collection," *IEEE Trans. Inf. Forensics Secur.*, vol. 9, no. 12, pp. 2144–2157, 2014.

[**14**] P. Naraei, V. Street, V. Street, and V. Street, "Application of Multilayer Perceptron Neural Networks and Support Vector Machines in Classification of Healthcare Data," *IEEE Access*, no. December, pp. 848–852, 2016.

[15] A. V. Flevaris, A. Martínez, and S. A. Hillyard, "Attending to global versus local stimulus features modulates neural analysis of low versus high spatial frequencies: An analysis with event-related brain potentials," *Front. Psychol.*, vol. 5, no. APR, pp. 1–11, 2014.

[16] S. Africa, "From Local to Global Analysis: The Development of Illusory Contour Perception," vol. 4, no. 11, pp. 38–55, 2017.

[17] K. Prasad, R. Sharma, and D. Wadhwani, "A Review on Object Detection in Video Analysis," *Int. J. u- e- Serv. Sci. Technol.*, vol. 5, no. 4, pp. 15–20, 2012.

[18] C. Alvey, C. Orphanidou, J. Coleman, A. Mcintyre, S. Golding, and G. Kochanski, "Image quality in non-gated versus gated reconstruction of tongue motion using Magnetic Resonance Imaging : A comparison using automated image analysis," *IEEE Access*, no. May, 2008.

[19] T. Yeh and P. A. Semi, "Low -Power , HIgh - Performance architecture of the Pwroficient Processor," vol. 2, no. 1, pp. 69–78, 2015.

[20] L. Figueroa, "Low-Cost Video Image Analysis System for Evaluating Pavement Surface Distress," *Transp. Res. Rec.*, 2016.

[21] V. Zlokolica, W. Philips, and D. Van De Ville, "A new non-linear filter for video analysis," *Proc. IEEE Benelux Signal Process. Symp.*, vol. 125050, no. January 2002, pp. 221–224, 2015.

[22] K. Avgerinakis, A. Briassouli, and I. Kompatsiaris, "Video analysis for judicial applications," *CEUR Workshop Proc.*, vol. 582, no. ICT4Justice, pp. 58–64, 2009.

[23] M. Ikbal, Y. K. J. Prakash, and S. Phule, "Video Watermarking using Image Analysis," *IEEE Access*, vol. 4, no. 4, pp. 236–243, 2016.

[24] F. M. Moss, F. Zhang, R. Baddeley, and D. R. Bull, "What's on TV: A large scale quantitative characterisation of modern broadcast video content," *Proc. - Int. Conf. Image Process. ICIP*, vol. 2016-Augus, no. September 2016, pp. 2425–2429, 2016.

[25] S. Wee, B. Shen, and J. Apostolopoulos, *COMPRESSED-DOMAIN VIDEO ANALYSIS*. 2015.

[26] H. Chauhan and S. Tarar, "Image and Video Analysis Edge Detection Technique used for Traffic Control Problem," *Int.*

J. Comput. Sci. Trends Technol., vol. 4, no. 1, pp. 157–162, 2016.

[27] B. Seth, "Motion Analysis Marker for Ease of Image Analysis," *WSEAS*, pp. 133–138, 2017.

[28] F. Kelly, "Fast Probabilistic Inference and GPU Video Analysis," *IEEE Libr.*, no. May, 2006.

[29] P. Murray, G. M. West, K. Law, S. Buckley-Mellor, G. Cocks, and C. Lynch, "Automated Video Analysis and Image Analysis Software to Support Visual Inspection of AGR Cores," *5th EDF Energy Gener. Ltd Nucl. Graph. Conf.*, 2016.

[30] S. H. Lim, "Video Analysis Applications of High Speed CMOS Image Sensors," no. March, pp. 1–103, 2015.