INFLUENCE OF H264 DECODER ERROR CONCEALMENT ON PEDESTRIANS DETECTION ALGORITHM

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Abstract - *Automotive industry using a modern ethernet camera for capturing real-time videos and processing the videos using intelligent computer vision algorithms to accurately identify and classify objects to enhance the automotive safety system. The H264/AVC codec is most widely used to encode and decode the videos. H264 decoder decodes the encoded video frames, while transmission of the encoded video frames there are the possibility of video packet loss which leads to bitstream corruption. The traditional way of fixing the bitstream data losses by using different error concealment approaches. By using the Error concealment video subjective quality is maintained but the objective quality is not up to the level of original video due to which the computer vision algorithms performance degraded, the proposed approach is to maintain the video quality along with the error concealment algorithm which maintains the computer vision algorithm performance.*

Key Words: Error Concealment, Pedestrian's Detection, bitstream error.

1.INTRODUCTION

The camera playing a major role in the safety functions such as automatic parking, pedestrian detection, surround view, finding the parking, driver drowsiness detection etc. Broadcom started with this automotive Ethernet standard called BroadR-Reach which has since been standardized as IEEE 802.3bw 100BASE-T1, Automotive ethernet is rapidly moving its way into next-generation vehicle designs, but increasingly those hybrid designs also include innovative safety systems that require minimal latency for the camera systems. To transmit the high definition uncompressed video over ethernet requires a higher bandwidth. So, need to compress the source video, then transmit, and then decompress [5] on the other end. That does add a little bit of latency. But if carefully optimize the encoder, transport, and decoder match the expected performance [1]. At the time of transmission, there could be a network error or packet loss which will interrupt the real-time decoding and displaying the frames at the head unit.

H264 Decoder output is the input to the computer vision algorithm so input video should have quality. This paper proposed an idea to improve the quality of video with H264 Decoder error concealment and improves the computer vision algorithm performance.

2. VIDEO PIPELINE

Fig-1 shows the conventional method of image capture followed by the encoder, at the receiver end decoder decodes the encoded video. In case any error in the bit stream decoder not capable to decode the bit stream, also the quality of the image can be degraded.

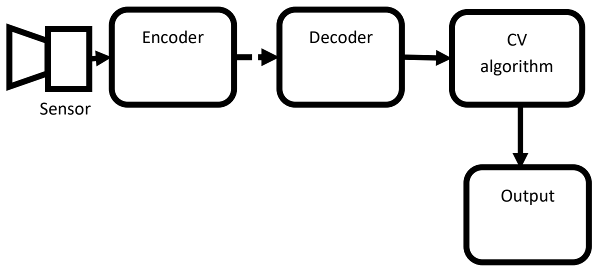

Fig-1 Video Pipeline

The traditional way of network channel compression methods [5] introduces structured data redundant information which is used by the H264/AVC decoder for error detection and correction. In addition to the error-control schemes for video/image applications can exploit the information redundancy available after compression to ensure that only valid image slices or frames are derived. There is no specified control scheme available, the objective of control is to obtain the quality of the frame after the compression methods.

3. PROPOSED METHOD

1.1 Decoder Error concealment

H264/AVC decoder is robust to bitstream error, to make it robust the major bit stream error is considered and concealed with different implementation level. Fig – 2 shows the major type of bitstream error handled in the decoder.

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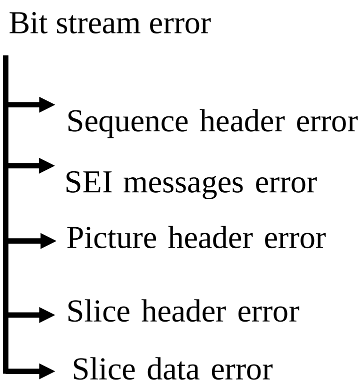

Fig-2 Bit stream error

By implementing the bit stream error handling [2] and [4], decoder can decode the video frames smoothly without stopping its operations. From the bitstream start to end of the bitstream error could be monitored and corrected for smooth operations.

3.2 Decoded frame handling

At the decoded end, any payload loss, invalid payloads, missing payload or copied payload to be handled correctly, based on the payload situations the video frame sending to the computer vision algorithm decided, if the complete frame is sufficient and no loss can be identified based on the frame marker we could decode that valid frame and send as an input to vision algorithm. Fig- 3 shows the decoded frame handling.

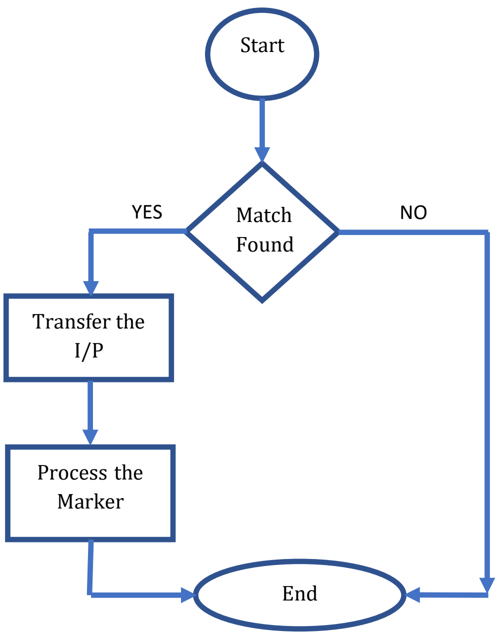

Fig-3 Decoder frame handling

3.3 Pedestrian detection

To validate the video decoder output, here pedestrian's detection algorithm taken as a reference, as many papers explained [3] about the design, implementation, and operation of the pedestrian's algorithm, the same kind of conventional algorithm used for verification. Since pedestrian's detection algorithm uses the majority of the computer vision image processing techniques it is a good choice to evaluate the decoder compression performance.

4. RESULTS AND DISCUSSION

The below diagram shows that the experimental analysis of the decoder without any error i.e. no network loss and no payload loss and no frame loss. So the detection of the pedestrian algorithm is monitored and taken as a reference frame Fig-4, and the same test video was taken as input to the decoder where there could be a possibility of bitstream error and packet loss and frame handling at the decoder end, the same frame given to the pedestrians algorithm we could find the same detections Fig-4, Though there is a 2% - 4% of loss of frame found in each test but detection remains same not much degraded the pedestrian detections.

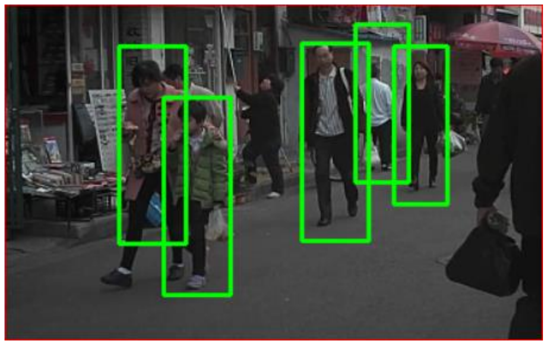

Fig-4 Reference frame (No frame loss, network loss and payload loss)

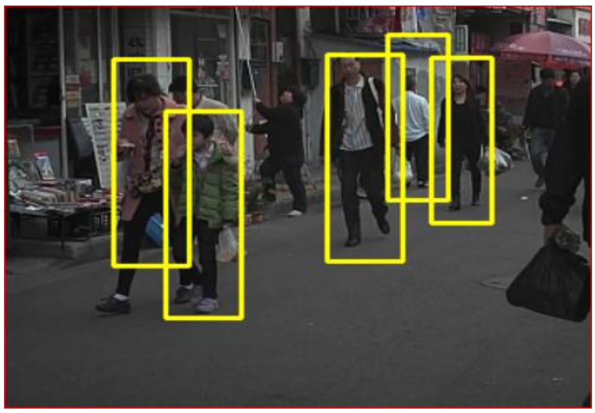

Fig-5 Output frame (Error concealed and frame handling)

The proposed method is tested by three different test vectors, mainly the considerable amount of 100, 500 and 3000 frames with a good number of pedestrians appeared on each frame and captured the pedestrian detections on each frames then listed for reference, from the list we could see that there is not much deviation in the detections.

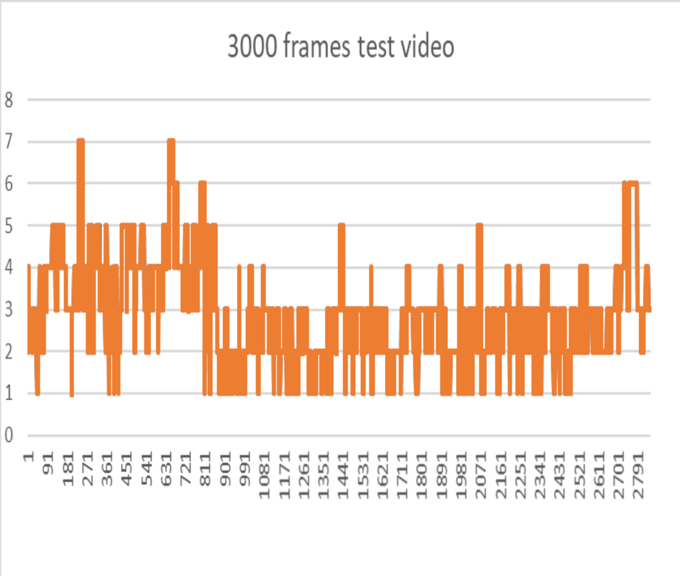

Fig-4 Output of the Scenario-1 with 3000 frames (Pedestrians detection count Min-1 to Max-7)

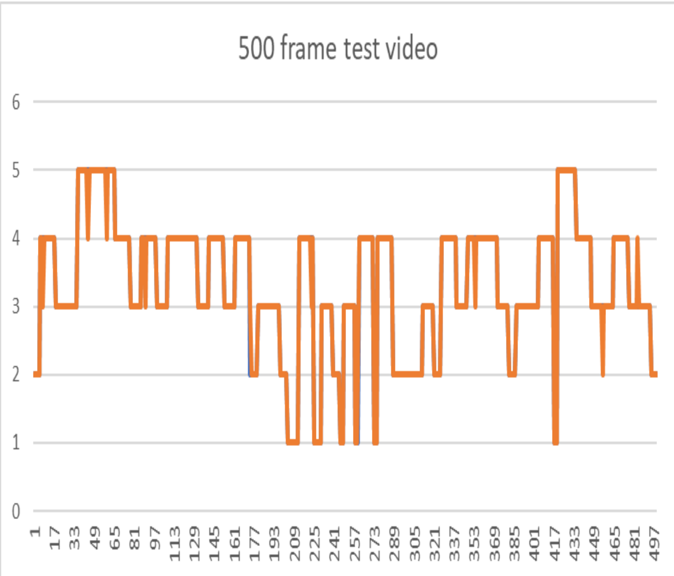

Fig-5 Output of the Scenario-2 with 500 frames (Pedestrians detection count Min-1 to Max-5)

5. CONCLUSIONS

In this paper, we observe the influence of H264 Decoder error concealment along with decoder frame handling on the performance of pedestrian's detection algorithms. We have observed that quality metrics i.e. number of detections studied image compression techniques show approximately equal performance. H.264/AVC decoder is suitable for computer vision applications. Even though there being a considerable compression impact on the image, the algorithm still offers enough performance, the pedestrian detection does not take a negative influence. This analysis can certainly same for other image processing algorithms, though each will examine the different methods but safe to assume video compression does not affect the performance of the algorithms.

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