IOT ENABLED CLOSED-CIRCUIT TELEVISION SURVEILLANCE MONITORING USING BACKWARD-CHANNEL COMPRESSION

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Abstract: Video surveillance is an important tool to enhance public safety and privacy protection. It is used to analyze video content and to monitor the activity required to effectively transmit and store surveillance video data. Video compression techniques can be used to reduce or resize video. A less sophisticated encoding method based on the Weiner-Civ coding principle can be used for surveillance video compression, and the backward-channel-aware Weiner-Civ video coding approach is applied to improve coding efficiency. Encoder Motion vectors obtained from the decoder are sent back to the encoder via the feedback channel for object detection and event analysis. Encoder and decoder use different motion vectors in motion compensation for the same frame. Rebuilt frames on the encoder and decoder therefore lose synchronization, which causes a drift problem and propagates to the rest of the range. To address the reliability of credible broadcasts, an error replacement plan has been proposed for BCAWZ for reliable transmission on the back-channel, which is essential for direct and reliable object identification, event analysis and video data quality. Watermarking is also applied to securely transmit surveillance video stream.

Key Terms: IoT, Closed Circuit Television, Surveillance, Backward Channel Compression

1. Introduction

Video surveillance is an important tool to increase public surveillance and privacy protection. It has long been used for home security purposes such as airports, train and subway stations, city entrances and major sporting events. The video surveillance system is client-side and server-side, as shown in Figure 1. On the client side, the video was first filmed by a surveillance camera. Such cameras can be analog or digital. Digital capture has become increasingly popular, with video surveillance cameras captured primarily by digital surveillance cameras being easy to track and analyze using content analysis tools [1].

The extracted video is sent to the server for further processing. On the server side, video data is used for object detection, activity tracking and event analysis.Video compression is useful for achieving effective representation and transmission of surveillance video by reducing video size without causing small or minimal damage. This allows for the efficient and low compression, transmission and surveillance video data storage availability to fit a large number of ultimate surveillance cameras, which improves the accuracy and efficiency of surveillance systems [2].

Video compression design considerations for surveillance video - Direct use of existing image and video coding standards for surveillance video compression. Video compression motion used in video surveillance systems extends beyond JPEG, MPEG-1, MPEG-2, MPEG-4, H.261, H.263 and the current state of the art H.264 / AVC. The .264 / AVC encoder input divides the video frame into fractions and macroblocks, which is the basic coding unit [3]. Macroblocks can be divided into smaller blocks. A block is estimated from spatial or temporary neighborhood blocks. For INTRA coding, the block is derived from its spatial neighboring blocks. For INTER coding, the block is estimated from previously reconstructed frames and motion vectors indicating the location of the reference block are obtained. In a video surveillance system, the encoder is implemented in a simple and inexpenCive video surveillance camera, and many similar surveillance cameras are installed in one surveillance system [4].

Low-complexity video encoding procedures for surveillance video comb - Theoretically this goal can be achieved as a result of two theories discovered in the 1970s, known as the Slepian-Wolf theory and the Weiner-Civ theory. Consider two interconnected data sources X and Y as shown in the figure, when two different encoders, A and B. are switched off, the other resources are not available. The Slepian-Wolf theory shows that if joint decoding is allowed, the system has an allowable rate range [5].

$$RX\ H(X \mid Y)$$
$$RY\ H(Y \mid X) \quad (1)$$
$$RX + RY\ H(X, Y)$$

Where H (X | Y) and H (Y | X) denote the conditional entropy and H (X, Y) denotes the combined entropy of X and Y

2. Surveillance video compression using Weiner-Cive video coding

In this section, we will build such a compression system for our WZVC based surveillance video as shown in the picture. The extracted video sequence is divided into two groups, which are encoded in two different ways. All frames are freely encoded. Some of the frames are encoded using the traditional low-complexity coding method, H.264 INTRA Encoder. These frames are referred to as keyframes and side information is generated in the decoder for other frames. The remaining frames are encoded using channel coding methods and encoding parity or syndrome bits are sent to the decoder. These frames are referred to as Wyner– Ziv frames. Two channel coding methods are supported in the system: Turbo code and low-density-parity-check (LDPC) code.

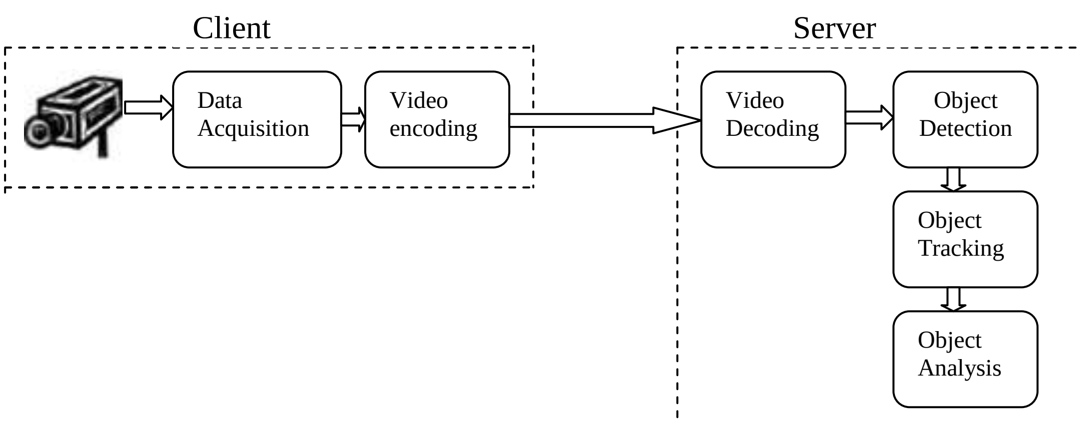


Figure 1. IoT Enabled Wyner–Ziv Video Codec

Parity or Syndrome bits are sent to the decoder. These frames are called Weiner-Cive frames. The system supports two channel coding methods: turbo code and low-density-parity-check (LDPC) code. Weiner-Cive frames can be encoded in the pixel domain or in the Transform domain with an integer transformer. Pixel values or conversion modules are encoded bit by bit level. The most important bit level is encoded first by the channel encoder, followed by the other bit planes in order of importance. The entire bit level of the frame is encoded with the channel coder. In the case of the LDPC encoder the turbo encoder and in the case of the syndrome bits the parity bits are sent to the output coder of the channel coder.

In decoder, keyframes are decoded independently by the H.264 INTRA decoder. Or Weiner-Civ frames, whose initial assessment was taken from the originally reconstructed key frames, which serve as side information. There are multiple ways to get an initial estimate. Assume that the frames are key frames that have already been decoded. The simplest way to collect the initial estimate is to use the co-existing pixel value in the previous reconstruction. (n - 1) th frame as side information for the pixel in the current frame.

Another method is to take the mean of the co-existing pixel values in the (N - 1) th and (n + 1) th reconstructed frames. Derivation of side information by extrapolation. An initial estimate can be obtained by extropolating a previously reconstructed frame as shown in the figure. For each block in the current NT frame, we search for the motion vector MVn-1 of the co-existing block in the previous frame (n− 1).

Assuming that the motion field is continuous, we can use MVn-1 as the predictor of the motion vector of the current block in the ninth frame. When the motion vector MVn is applied to the reconstructed frame n - 1, we can find its reference block, which is used as the initial estimate as shown in the figure.

3. Image. Derivation of side information by interpolation.

We can also use motion-compensation interpolation to get side information. As shown in the figure, the motion search takes place between (n - 1) th frame s (n - 1) and (n + 1) th frame ˆs (n + 1). For each block in the current frame, as shown in Figure 7, the initial estimator first uses the COS (n + 1) source in the next reconstructed frame and the co-existing block in the previous reconstructed frame (s - n - 1). As an indication to estimate forward motion.

We refer to the obtained motion vector as MVF. We use the co-position block in the reconstructed frame as a reference to predict backward movement. Specify the resulting motion vector as MVB. The side estimator uses MVF / 2 from s s (n - 1) to find the corresponding reference block PF1 and also finds the corresponding reference block PF2 from the previous frame source and the next −MVF / 2 s (n + 1). The reference block used to find the MVB / 2 related reference block from Reference (n + 1) is used to find the VMVB / 2 from the corresponding reference block PB1 and Vs (n - 1).

$$P = (PF1 + PF2 + PB1 + PB2) / 4$$

4. Backward-Channel Aware Weiner-Civ Video Coding for Video Surveillance

We have expanded the above coding method by encoding keyframes using the Backward Channel Aware Motion Estimate (BCAME). We refer to our WZVC method as BCAWZ based on BCAME. The basic idea of BCAME is to estimate the movement in the decoder and send the movement information to the encoder through the backward-channel. If user assumes that the motion field is constant in natural video sequences, the motion of the current frame can be dictated using the information of the frames closest to it. For the series we encode the first and third frames as INTRA frames. All other strange frames are encoded with BCAME and we refer to these backward exceptionally coded frames as BP frames.

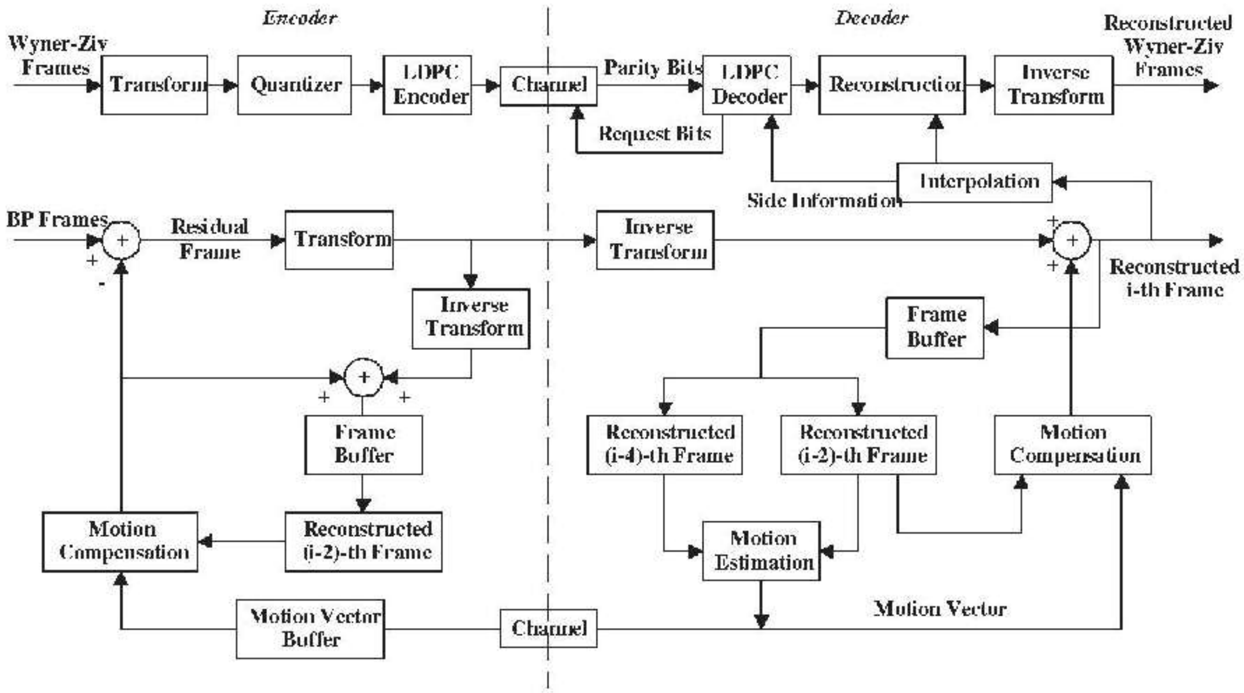
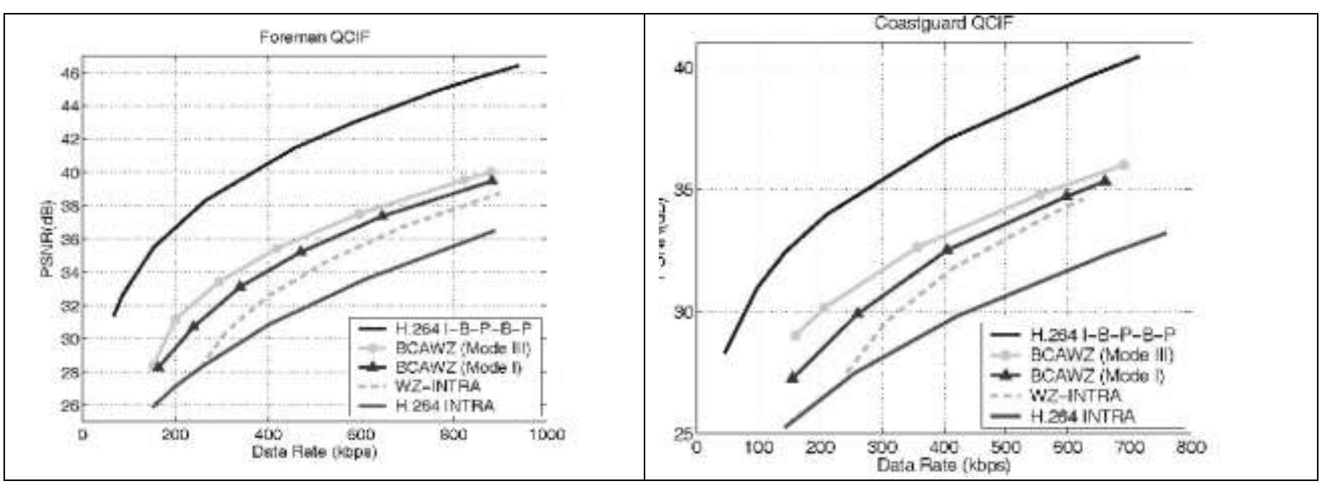


Figure 2: Weiner-Civ Video Coding for Video Surveillance – Backward Channel Compression

All dual frames are encoded as a Weiner-Cive frame. A BP frame is coded as follows. Suppose the two BP frames before the current BP frame are decoded as shown in the figure. For each block in the current BP frame, we will use one of the previous two BP frames as its co-established block source and the other BP frame as reference. Performs block-based motion search in decoder to calculate motion vector. Motion vectors are sent backwards to the motion-vector buffer in the encoder via the channel. This buffer will be updated when the next vector receives motion vectors. In the encoder, we use the motion vectors obtained with the previous reconstructed BP frames to create a motion-compensation reference for the current BP frame. Depending on which of the previously decoded BP frames with the source and reference in the decoder, we get two sets of motion vectors, namely forward and backward motion vectors.



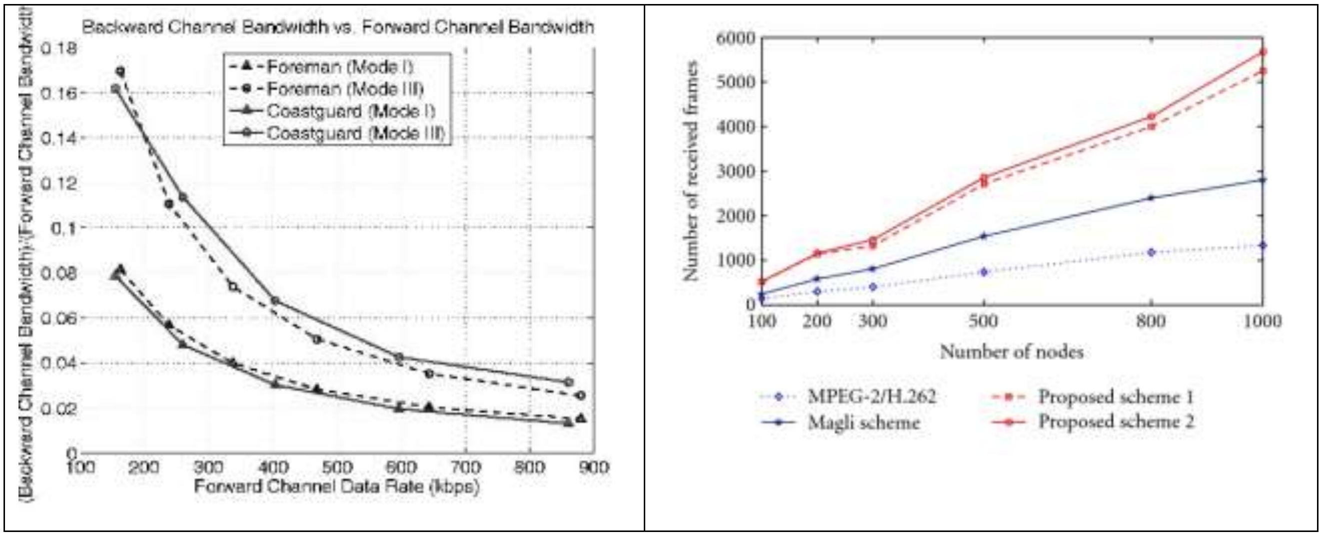


Figure 3: Simulation results of Backward – Channel compression in Video Surveillance results

For a large-scale video surveillance system, compressed surveillance video must be sent to bitcoin servers over wired or wireless networks. The transmission bit may be subject to errors such as corruption or packet damage. Such transmissions cause errors Image. Back-channel enabled WZVC Delay or loss of quality of the captured video further affects the accuracy of object tracking and event analysis. To resolve a reliable transmission concern, error recovery is used. Indicates a two-step error-reinstallation procedure. We first suggest a simple synchronization method. Synchronization marker is used to provide periodic synchronization check. An entry header indicating the frame index is added as information before the motion information is sent to the bit stream.

5. Conclusion

In this paper we present the least complex video encoding framework for surveillance video compression and transmission to resolve the transaction between computational complexity and coding efficiency. Although the use of existing video coding standards for surveillance video compression is straightforward, we show that more careful treatment is required due to different design principles. Between traditional video compression applications and surveillance video compression. We suggest the backward-channel-aware Weiner-Civ (BCAWZ) video coding approach to improve coding efficiency while maintaining low complexity in the encoder. We suggest sending the motion vectors obtained from the decoder back to the encoder. Since Mokon information is required in the decoder and server for decoding, object detection and event analysis, this scheme only increases the nominal complexity of the decoder and encoder and is usually available under video surveillance system.

6. References

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