Implementation of Codec in Video Processing

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***Abstract*: This paper is proposed to distinguish the classical codecs MPEG4 and H.264. The task is to compress video for surveillance system with stationary cameras by decreasing of temporal redundancy. The layers mentioned to process are Alpha channel, background estimation, image with intensities of objects and background estimation, correcting image. Some layers are compressed with lossy version of WebP and others are compressed with lossless version of WebP.**

***Keywords*: compress video, WebP, MPEG4 and H.264.**

I. INTRODUCTION

The problem of video coding, solving of which is important in different practical applications have some weak points, noticed in: 1) limited work with non standard resolutions, 2) orientation on rapid changes in video like in news on TV, 3) Groups of Pictures approach leads to delays in work of codecs and the necessity of big buffers, 4) problem of crest factor (peak-to-average ratio) of bit rate in case of Groups of Pictures approach, 5) no support for metadata or have limited options for annotating individual frames, which is an essential limit in case of video surveillance, because it is common practice to create inverted index for fast search of objects.

II. CODEC

A codec is a device or computer program for encoding or decoding a digital data stream or signal. Codec is a portmanteau of coder-decoder. A codec encodes a data stream or a signal for transmission and storage, possibly in encrypted form, and the decoder function reverses the encoding for playback or editing.

A codec is either a hardware device or a software-based process that compresses and decompresses large amounts of data used in voice over IP, video conferencing and streaming media. A codec takes data in one form, encodes it into another form and decodes it at the egress point in the communications session.

There are two types [1] of codecs used in communications. The first codec is typically hardware-based, and it performs analog-to-digital and digital-to-analog conversion. A common example is a modem used for sending data traffic over analog voice circuits. In this case, the term codec is an acronym for coder/decoder.

The second type of codec is now more commonly used to describe the process of encoding source voice and video captured by a microphone or video camera in digital form for transmission to other participants in calls, video conferences, and streams or broadcasts. In this example, the term codec stands for compression/decompression.

A codec's primary job is data transformation and encapsulation for transmission across a network. Voice and video codecs use a software algorithm running on a common processor or in specialty hardware optimized for data encapsulation and decapsulation [2].

III. H.264

The intent of the H.264/AVC project was to create a standard capable of providing good video quality at substantially lower bit rates than previous standards (i.e., half or less the bit rate of MPEG-2, H.263, or MPEG-4 Part 2), without increasing the complexity of design so much that it would be impractical or excessively expensive to implement. An additional goal was to provide enough flexibility to allow the standard to be applied to a wide variety of applications on a wide variety of networks and systems, including low and high bit rates, low and high resolution video, broadcast, DVD storage, RTP/IP packet networks, and ITU-T multimedia telephony systems. The H.264 standard can be viewed as a "family of standards" composed of a number of different profiles. A specific decoder decodes at least one, but not necessarily all profiles. The decoder specification describes which profiles can be decoded. H.264 is typically used for lossy compression, although it is also possible to create truly lossless-coded regions within lossy-coded pictures or to support rare use cases for which the entire encoding is lossless.

IV. APPLICATIONS OF H.264

Several application systems [3], such as high-definition DVD and digital video broadcasting for handheld devices and high-definition television systems, have adopted H.264 or its modified versions as the video coding standard. In addition, the extensions of H.264/AVC to scalable and multiview video coding applications are nearly finalized. Many video services, especially bandwidth-limited wireless video, will benefit from the H.264 coder due to its outstanding features.

The use of variable block sizes for intra- and interprediction in combination with different intra-prediction modes and motion compensation using multiple reference frames is one of the main reasons for the improved coding efficiency in H.264/AVC.

V. WebP

WebP is a modern image format that provides superior lossless and lossy compression for images on the web. Using WebP, webmasters and web developers can create smaller, richer images that make the web faster.

WebP lossless images are 26% smaller in size compared to PNGs. WebP lossy images are 25-34% smaller than comparable JPEG images at equivalent SSIM quality index.

Lossy WebP compression uses predictive coding to encode an image, the same method used by the VP8 video codec to compress keyframes in videos. Predictive coding uses the values in neighboring blocks of pixels to predict the values in a block, and then encodes only the difference.

Lossless WebP compression uses already seen image fragments in order to exactly reconstruct new pixels. It can also use a local palette if no interesting match is found.

VI. PROPOSED SCHEME

Codec consist of coder and decoder. Scheme of coder is shown on Figure.

Coder consists of several units (or blocks)[4]: background estimation unit, segmentation (pixel classification) unit, extraction of areas with objects, synthesis unit, correction image calculation unit, etc.). Decoder is doing operations in inverse order.

The work of coder starts in the block “Motion detection”. Then image is segmented using background estimation image. The resulted binary image plays key role in creation of image with difference between intensities of objects and background estimation (block “Foreground”). The copy of binary image is called alpha channel. Foreground, background estimation and alpha channel mixed for creation of synthesis image. The difference between current frame and synthesis image forms correcting image. Block based nature of transforms in modern image formats gives severely degradation of quality in decoded image. For better quality of compressed frames alpha channel is converted into extended alpha channel (if any pixel of block is white (include parts of foreground), then all pixels of this block will be white). Extended alpha channel used only for correct synthesis and calculation of correcting image inside coder, the decoder operates with usual alpha channel as shown in scheme. The minimum bounding box is a well known technique, used for efficiency. Another sort of task is a renewing of background estimation image. It can be done on a very low speed, by sending several blocks per frame.

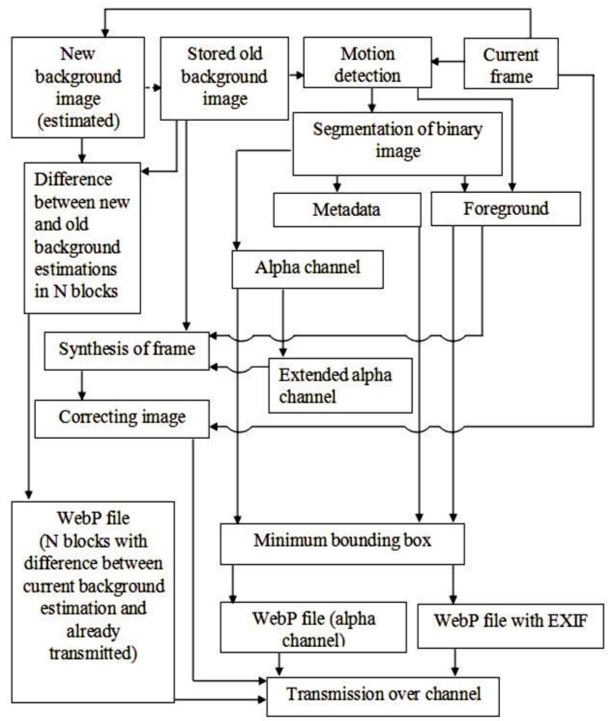

Fig1. Scheme of coder in proposed codec

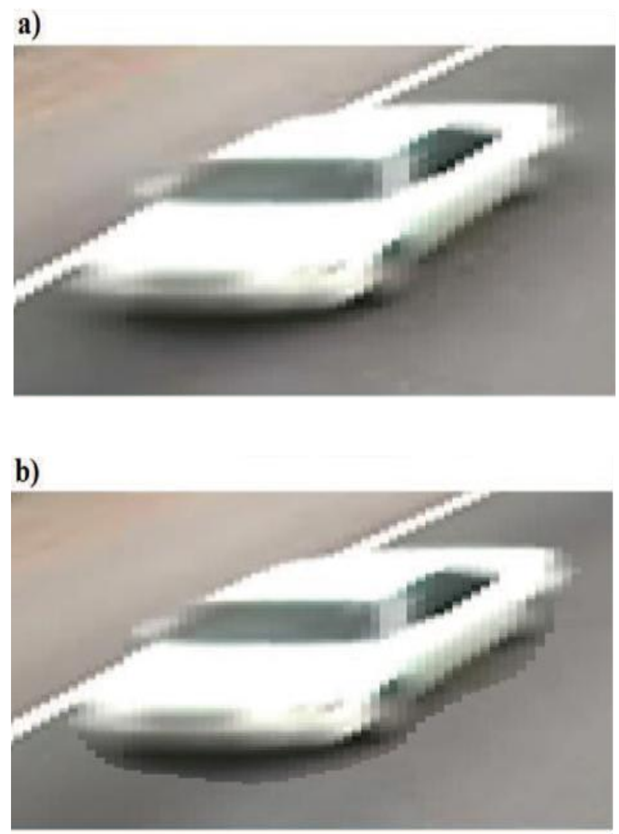

Fig2: Comparison of input image and image after synthesis, but before correction: a) part of current frame (source), b) part of image during decoding (after synthesis – moving car located on background estimation)

VII. CONCLUSION

Separation of input frame into several images (alpha channel, background estimation, image with difference between intensities of objects and background estimation, correcting image) gives higher quality. This result is obtained by the use of concept of adaptive rate of renewing for every pixel. The implementation of concept is mainly based on reduction of temporal statistical redundancy; the other types of redundancies are decreased by WebP codec.

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