

IEEE 1857 Standard Empowering Smart Video Surveillance Systems

Wen Gao, Yonghong Tian, Tiejun Huang, Siwei Ma,
Xianguo Zhang

to be published in IEEE Intelligent Systems (released in 2013).

Effrosyni Doutsis

PhD candidate in Signal and Image Processing, SIS pole, MediaCoding Team, I3S
laboratoire, CNRS, SGME

Sophia Antipolis, 24 September 2014



Outline

- 1 Introduction
- 2 IEEE 1857 Standard
- 3 Background Scene
- 4 Regions Of Interest (ROIs)
- 5 Conclusion
- 6 Bibliography

Definition

Video Surveillance System also known as Closed-Circuit TeleVision (CCTV), is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors.

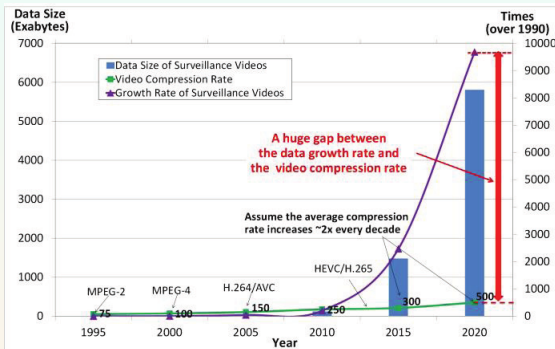


Figure : The gap between the growth rates of video surveillance data and video compression rate in the recent three decades.

Definition of the problem

- Exponential increase of the amount of video-surveillance data
- Low growth rate of compression (H.264/AVC, H.265/HEVC)

Goal

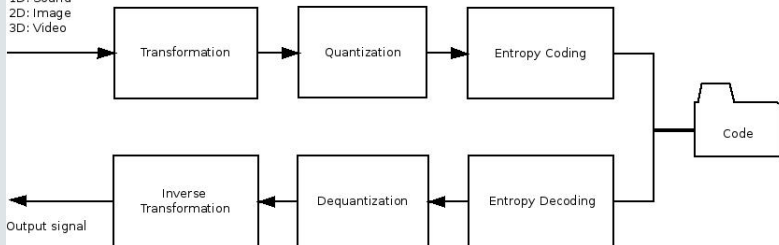
- Efficient video CODing and DECoding (CODEC) algorithm according to the special constraints of video-surveillance systems and find the tradeoff between:
 - High resolution cameras
 - Bandwidth transmission network
 - Storage capacity
 - Recognition capability
- Replace H.264/AVC and H.265/HEVC which have been built for broadcasting television

Recall

CODEC Schema

Input signal

1D: Sound
2D: Image
3D: Video



Recall

H.264/AVC Encoding

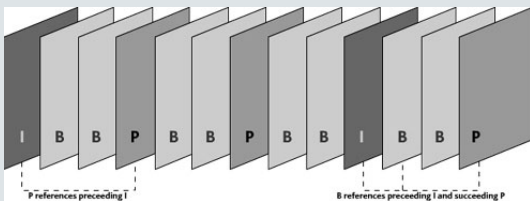


Figure : GOP (Group of Pictures) structure for video compression. I-frames (Intra-frames) P-frames (Predictive inter-frames) and B-frames (Bi-predictive inter-frames).

Compression Algorithms linked to video analysis

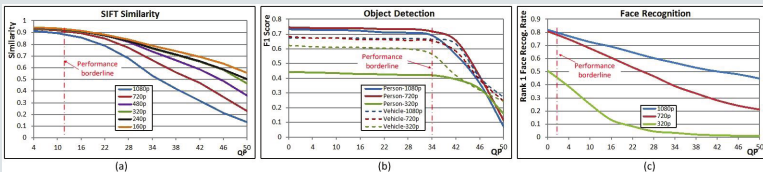


Figure : The influence of the Quantization Parameter (QP) in object and face recognition for different resolution videos. (a) SIFT. (b) Object Detection. (c) Face Detection.

Result

Dilemma: High video compression ratio or high recognition accuracy?

Compression Algorithms linked to video analysis

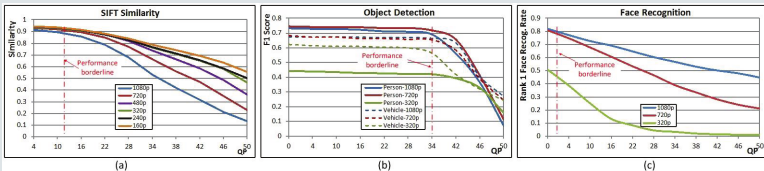


Figure : The influence of the Quantization Parameter (QP) in object and face recognition for different resolution videos. (a) SIFT. (b) Object Detection. (c) Face Detection.

Result

Dilemma: High video compression ratio or high recognition accuracy?

Overview:

- Released in June 2013
- Constructed by 6 different groups (Main, Portable, Enhanced, Broadcasting, Surveillance Baseline and Surveillance)
- Double compression rate comparing to H.264/AVC similar to H.265/HEVC)
- Almost the same complexity as H.264/AVC
- High-Efficiency and low-complexity video coding technologies which reduce the scene redundancy (**Background Scene**)
- Recognition-friendliness (**Regions Of Interest (ROIs)**)

Characteristics:

- A novel model-based coding framework
- Low-complexity **Background Scene** modeling
- G-pictures background prediction
- Optional Difference coding for mixed macroblocks (MBs) (**Regions Of Interest (ROIs)**)
- Improved motion vector prediction
- Improved BBV buffer management
- Error-resilience coding tools

Reducing scene redundancy

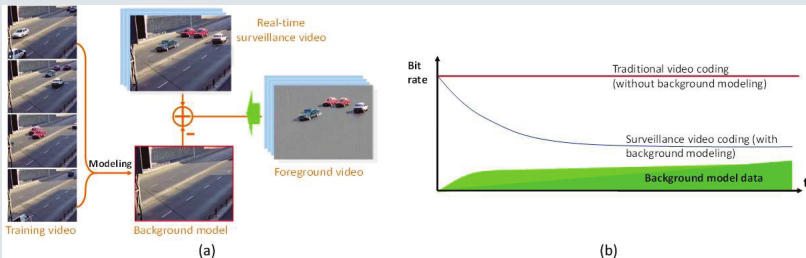


Figure : (a) Surveillance video coding with the background model. (b) Ideal bitrate curve.

IEEE 1857 vs H.264/AVC



Figure : Some dataset examples of different (a) resolution and (b) weather and time conditions.

IEEE 1857-S vs H.264/AVC and IEEE 1857-M

	SD	720p	1600x1200	1080p
IEEE 1857 vs H.264-HP	38.9%	61.8%	35.5%	33.0%
IEEE 1857 vs IEEE 1857-M	39.6%	60.8%	30.7%	33.1%

IEEE 1857-S vs H.264/AVC

	dawn	morning	noon	afternoon	dusk	night
SD	59.1%	37.5%	26.4%	33.8%	14.2%	15.1%
720p	87.95%	52.80 %	46.60%	46.79%	63.01%	69.75%
1080p	-	38.4%	45.4%	-	22.6%	-

Model-based HEVC vs H.264/AVC

	SD	720p	1600x1200	1080p	AVG
Bitrate Reduction	45.40%	53.47%	45.43%	39.24%	45.89%
Time Saving	49.40%	53.47 %	45.94%	24.68%	45.86%

Supporting video analysis and recognition

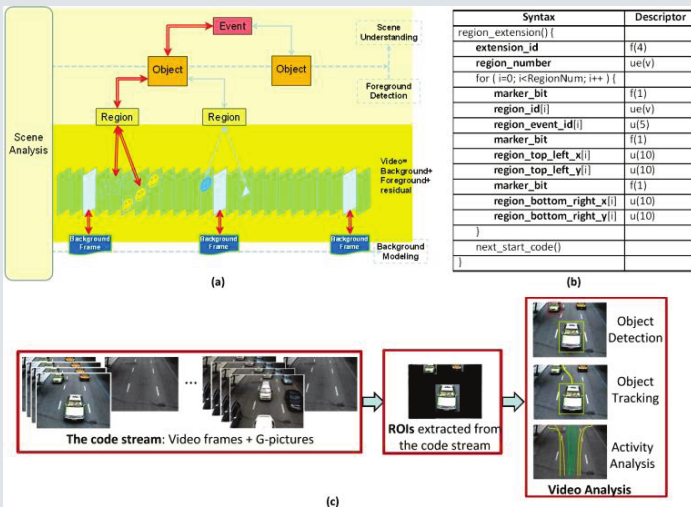


Figure : Some dataset examples of different (a) resolution and (b) weather and time conditions.

Supporting video analysis and recognition

- Apply the background model
- Detect the ROIs
- Increase the bit allocation to ROIs
- Produce the code stream
- Extract only ROIs to be further analysed

Result

The Dilemma between High video compression ratio and high recognition accuracy doesn't exist anymore.

Supporting video analysis and recognition

- Apply the background model
- Detect the ROIs
- Increase the bit allocation to ROIs
- Produce the code stream
- Extract only ROIs to be further analysed

Result

The Dilemma between High video compression ratio and high recognition accuracy doesn't exist anymore.

To sum up, IEEE 1857 standard:

- Is a new compression standard for video surveillance systems
- Transforms a camera-eye of a scene into an intelligent-camera which is able to remove the scenic redundancy based on the background scene technology
- Reduces the bitrate compare to H.264/AVC
- Is recognition-friendly by coding only the ROIs
- Supports video analysis and recognition

Bibliography

[1] *WenGao, YonghongTian, TiejunHuang, SiweiMa, Xianguo Zhang*, IEEE 1857 Standard Empowering Smart Video Surveillance Systems, to be published in IEEE Intelligent Systems.

Thank you for your attention..

