

摘要

近年来视频监控系统得到了广泛的应用，而监控视频对主观质量要求高，视频存储时间长，且占用空间大等特征，使得如何在节约监控视频的存储和传输成本的同时，保证监控视频的主观质量，实现快速且高效的监控视频转码，成为近期监控视频转码的一个重要研究方向。

最近提出的基于背景建模技术的转码方法，与传统的全解全编转码方法相比，在增加微小复杂度的前提下，实现了近一半的码率节省，然而基于背景建模技术的转码方法其转码复杂度并没有降低。以降低基于背景建模转码复杂度为目标，同时将背景建模与感兴趣区域转码算法相结合，本文进行了如下基于视频内容的监控视频转码算法研究：

(1) 面向削减基于背景建模转码方法中复杂度的问题，本文提出了一种基于背景建模的监控视频快速高效转码算法，该算法主要贡献在于提出分类的快速转码过程，特别的包括一种自适应的运动搜索范围缩减步骤。这种快速高效的转码方法的思路是：首先，使用背景建模技术生成背景图像，并利用背景图像对当前图像内不同特性的图像块进行分类，包括背景类图像块、前景边缘类图像块和前景类图像块；其次，分析不同类别图像块选取的参考图像、运动向量信息和最优块模式；最后利用分析的结果，对不同类别的图像块使用不同的转码优化加速过程，包括参考图像的精简、运动搜索范围的自适应缩减和候选模式的优化。最终实验测试结果表明，本文提出的转码方法可以实现在平均约 0.1dB 的视频质量损失的条件下，实现至少 93% 的转码时间节省。

(2) 为了进一步利用背景信息，本文还实现了一种基于感兴趣区域的监控视频转码方法，该方法利用已有的视频编码技术，增强感兴趣区域转码质量，并采用条带集层次的参考帧选取来提升转码性能。本文提出的基于感兴趣区域的转码方法步骤是：首先，使用背景图像判断感兴趣区域，其中包含感兴趣区域的划分和简单聚类；其次，利用 AVS 视频标准中的灵活条带集技术，增强感兴趣区域的转码质量；最后，提出条带集层次的参考帧选取优化，其中采用了 AVS 视频标准的监控档次中的参考帧技术，实现较大的转码性能提升。实验测试结果表

明，该方法可以较好的增强感兴趣区域内的视频主观质量，并且使用参考帧选取优化后的转码器，相比于优化前的版本，平均有 0.77dB 的性能增益，等价于平均 38.60%的码率节省。

基于上述提出的算法，本文实现一个 AVS 格式的快速高效实际转码系统，达到输入视频转码为 AVS 格式视频的目的。

关键词：视频转码，监控视频，快速且高性能，背景建模，转码系统

High-Efficient Content-based Surveillance Video Transcoding Methods

Mingchao Geng (Integrated Circuits and Systems)

Directed by Prof. Tiejun Huang

Abstract

Surveillance video systems are extensively used for the past few years. Therefore, it becomes an important issue in transcoding to save the storage and transmission cost of surveillance video without subjective quality loss. To address the problem, background modeling based transcoding method is introduced recently. Compared with the full-decoding-full-encoding transcoder, this method saves nearly half the bit-rate under the same PSNR performance. However, the transcoding complexity is not reduced in this method. To reduce the computational redundancy in background modeling based transcoding, this paper introduces a low-complexity and high-efficiency surveillance video transcoding method:

(1) Aim at reducing the complexity in background modeling based transcoder, a fast and performance-maintained transcoding method for surveillance video is proposed in this paper. With a macro-block (MB) classification algorithm dividing the MBs into foreground MBs, foreground border MBs and background MBs, statistics show that three categories take entirely different distributions of reference picture, motion vectors and prediction modes. Following the analysis above, this method uses diverse transcoding procedures on different MBs categories. Final experimental results prove that the proposed algorithm can save more than 93% transcoding time with 0.1dB quality loss on average.

(2) To extend the usage of background picture, a region-of-interest based transcoding method is designed for surveillance video. In this method, existing video encoding techniques are used to enhance region-of-interest transcoding quality. The

steps of designed method contains: Firstly, the current picture is divided into different region by the background picture; Secondly, the flexible slice set technique is used to enhance region-of-interest; Finally, the reference picture alteration of slice set is realized to decrease the bitrate of non-region-of-interest, which adopts the reference picture technique in Jiankong profile in AVS video standard. Experimental results indicate that this method is helpful to improve the video subjective quality in regions of interest. Moreover, significant bitrate reduction is achieved.

Based on the algorithms mentioned above, this paper finally implements a fast and high performance AVS format transcoding system, where common videos of different formats could be transcoded into AVS stream.

Keywords: *Video transcoding, Surveillance video, Fast and high-performance, Background modeling, Transcoding system*