Frame Redundancy Elimination Technology for Big Data Analysis

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Recommended Citation
Essa, ALmabrok Essa; Paheding, Sidike; and Prince, Daniel P., "Frame Redundancy Elimination Technology for Big Data Analysis" (2016). Stander Symposium Posters. 832.
https://ecommons.udayton.edu/stander_posters/832
Frame Redundancy Elimination Technology for Big Data Analysis
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Introduction

An important step in video analysis and content based video processing is key frame (KF) extraction. KF is the frame that can represent salient content of the video and it is an essential part in video summarization in terms of speed and accuracy. The benefits of KF extraction techniques are as follows:
• Reduce data storage space.
• Accelerate data processing speed.
• Improve object detection accuracy in terms of false positive for wide area surveillance.

Methodology

To address the data redundancy problem in aerial imagery, we propose a batch updating modular key-frame selection technique based on two strategies:
• Batch updating processing.
• Sub-region (modular) processing.

Algorithm Details

Given an initial batch \(B_\ell\) with \(r\) frames. If \(S_{ij}^k\) is the \((ij)^{th}\) sub-region of the \(k^{th}\) \((k = 1, 2, ..., \ell)\) frame in \(B_\ell\), then the global mean \(\mu_{ij}^D\) and standard deviation \(\sigma_{ij}^D\) for all \((ij)^{th}\) sub-regions in \(B_\ell\) can be computed as

\[
\mu_{ij}^D = \frac{1}{\ell - 1} \sum_{k=1}^{\ell-1} D_{ij}^k; \quad \sigma_{ij}^D = \sqrt{\frac{1}{\ell - 1} \sum_{k=1}^{\ell-1} (D_{ij}^k - \mu_{ij}^D)^2}
\]

where \(\mu_{ij}^D\) is the global mean, \(\sigma_{ij}^D\) is standard deviation, \(D_{ij}^k\) represents the \(x^{th}\) pixel-wise intensity difference between \((ij)^{th}\) sub-regions in two consecutive frames.

\(T_{ij}^r = \mu_{ij}^D + \sigma_{ij}^D\)

Depend on the adaptive threshold \(T_{ij}^r\), the selection criteria for a key frames is defined as:

\(D_{ij}^r > T_{ij}^r\) for any \((ij)\): Key frame
\(D_{ij}^r \leq T_{ij}^r\) for any \((ij)\): None Key frame

Experimental Results

Sample data sequences, frames # 33 to # 40

The Proposed Technique

Non-Modular Key Frame

Sample Testing Images and KF Processing