Fast shot boundary detection based on separable moments and support vector machine

ABSTRACT

The large number of visual applications in multimedia sharing websites and social networks contribute to the increasing amounts of multimedia data in cyberspace. Video data is a rich source of information and considered the most demanding in terms of storage space. With the huge development of digital video production, video management becomes a challenging task. Video content analysis (VCA) aims to provide big data solutions by automating the video management. To this end, shot boundary detection (SBD) is considered an essential step in VCA. It aims to partition the video sequence into shots by detecting shot transitions. High computational cost in transition detection is considered a bottleneck for real-time applications. Thus, in this paper, a balance between detection accuracy and speed for SBD is addressed by presenting a new method for fast video processing. The proposed SBD framework is based on the concept of candidate segment selection with frame active area and separable moments. First, for each frame, the active area is selected such that only the informative content is considered. This leads to a reduction in the computational cost and disturbance factors. Second, for each active area, the moments are computed using orthogonal polynomials. Then, an adaptive threshold and inequality criteria are used to eliminate most of the non-transition frames and preserve candidate segments. For further elimination, two rounds of bisection comparisons are applied. As a result, the computational cost is reduced in the subsequent stages. Finally, machine learning statistics based on the support vector machine is implemented to detect the cut transitions. The enhancement of the proposed fast video processing method over existing methods in terms of computational complexity and accuracy is verified. The average improvements in terms of frame percentage and transition accuracy percentage are 1.63% and 2.05%, respectively. Moreover, for the proposed SBD algorithm, a comparative study is performed with state-of-the-art algorithms. The comparison results confirm the superiority of the proposed algorithm in computation time with improvement of over 38%.

Keyword: Multimedia databases; Image processing; Mathematics; Orthogonal polynomial; Orthogonal moments; Shot boundary detection; Multimedia; Cut transitions