

# Motion-Information-Based Video Retrieval System Using Rough Pre-classification

Zhe Yuan, Yu Wu, Guoyin Wang, and Jianbo Li

Institute of Computer Science and Technology,  
Chongqing University of Posts and Telecommunications,  
Chongqing 400065, P.R. China  
oxfordss4903@gmail.com, {wuyu, wanggy, icst}@cqupt.edu.cn

**Abstract.** Motion information is the basic element for analyzing video. It represents the change of video on the time-axis and plays an important role in describing the video content. In this paper, a robust motion-based, video retrieval system is proposed. At first, shot boundary detection is achieved by analyzing luminance information, and motion information of video is abstracted and analyzed. Then rough set theory is introduced to classify the shots into two classes, global motions and local motions. Finally, shots of these two types are respectively retrieved according to the motion types of submitted shots. Experiments show that it's effective to distinguish shots with global motions from those with local motions in various types of video, and in this situation motion-information-based video retrieval are more accurate.

**Keywords:** Global motion, local motion, shot boundary detection, video retrieval, rough sets.

## 1 Introduction

With the development of network, computer and multimedia technologies, the demands for video are becoming greater and greater. There is widespread interest in finding a quick way to obtain interesting video materials. Obviously, traditional retrieval based on text cannot meet these demands, so content-based video retrieval has been proposed as a solution. This technology uses objects such as video features, to retrieve video. This approach contrasts with identifiers that are used in traditional text-based retrieval. Video features such as colors, textures, motion types can be extracted from video for retrieval. Among these features, motion information of objects and backgrounds, as the unique feature of video, is essential in the study of video retrieval. So, motion-information-based video retrieval has had broad attention.

Video motions can be divided into two types, global and local. The global motions are caused by camera movements, and there are six motion types defined in MPEG-7 [14], including panning, titling, zooming, tracking, booming, and dollying. The local motions refers to object motions in the scene, which can be considered as parts not matching the global motion model. Referring

to MPEG-7, a motion descriptor, called the parameter motion, can be used to describe local motions. It mainly depicts changes with the times of arbitrary object regions in video via 2-D geometry transition. In the study of global motions, several parameter estimation methods for global motions in the uncompressed domain have been proposed in recent years [4] [5] [29]. Tan and Saur proposed a quick parametric global motion estimate algorithm, in which motion vectors of macroblocks are extracted from compressed data [22]. A video retrieval system based on global motion information was founded by Tianli Yu [30]. On the other hand, in the study of local motions, there are three primary methods, which are computing motion information after video segmentation [33], segmenting video after computing motion information [1], and processing both of them at the same time [23].

Algorithms and systems mentioned above can be used to obtain good experimental results in certain video application domains. However, if video with complicated motions are applied, or motion types of shots are not the type that the systems deal with, or there are coding errors, they are unreliable. So shots need to be classified before motion analysis. Nevertheless, the classification may bring uncertainty and inconsistency. For example, there are almost similar motion features between frames of two motion types. Therefore, the theory of rough set [19] may be useful in this research. Z. Pawlak proposed rough set theory during the early 1980s as a powerful mathematical analysis tool to process incomplete data and inaccurate knowledge (see, e.g., [16,17,18]). It's a new hot spot in the artificial intelligence field at present and has been widely used in knowledge acquisition, knowledge analysis, decision analysis and so on [24]. Instead of obtaining mathematical descriptions of attributes and features of detected objects in advance, rough set methods make knowledge reduction possible and reduce the number of decision rules. Since uncertainty and inconsistency accompany classification of global and non-global motions, the rough set method is adopted to construct a better global motion model.

In this paper, a robust motion-based video retrieval system is proposed and realized to retrieve similar shots from a video database. We propose a global-motion analysis method in which feature attributions of motion information in video are computed and, then, motion types of P frames are achieved via rough-set-based video pre-classification. Furthermore, we present a method to check motion types of shots based on P frame classification.

The rest of paper is organized as follows. At first, basic theories of rough set and MPEG standard are introduced in Section 2. An extraction method of motion information from P frames is proposed and video pre-classification is performed using rough set method in Section 3. In Section 4, the method using video luminance information to detect shot boundary is given. In Section 5, shot classification based on the classification of P frames is proposed. In Section 6, we present a global-motion-information retrieval scheme by computing distances between shots. Next, in Section 7, experimental results using methods from Section 3 to Section 6 to enhance the performance of the motion based video retrieval are given. In Section 8, we give an overview of the diagram of the