Shots Temporal Prediction Rules for High-Dimensional Data of Semantic Video Retrieval

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Abstract: Some research in Semantic video retrieval is concerned with predicting the temporal existence of certain concepts. Most of the used methods in those studies depend on rules defined by experts and use ground-truth annotation. The Ground-truth annotation is time consuming and labour intensive. Additionally, it involves a limited number of annotated concepts, and a limited number of annotated shots . Video concepts have interrelated relations, so the extracted temporal rules from ground-truth annotation are often inaccurate and incomplete. However concept detections scores are a large high-dimensional continuous valued dataset, and generated automatically. Temporal association rules algorithms are efficient methods in revealing temporal relations, but they have some limitations when applied on high-dimensional and continuous-valued data. These constraints have led to a lack of research used temporal association rules. So, we propose a novel framework to encode the high-dimensional continuous-valued concept detection scores data into a single stream of characters without loss of important information and to predict a temporal shot behavior by generating temporal association rules.

Key–Words: Semantic Video Retrieval, Temporal Association Rules, Principle Component Analysis, Guassian Mixture Model Clustering, Expectation Maximization Algorithm, Sequential Pattern Discovery Algorithm.

1 Introduction

Tremendous growth in digital devices and digital media has led to the capture and storage of a huge amount of digital videos. As a result, there is an urgent need to manage, analyses, automate and retrieve videos efficiently. One of the most important subjects in video retrieval is semantic video retrieval. Semantic video retrieval is the search and retrieval of videos based on their relevance to a users requirements. Semantic video retrieval still represents a big challenge to researchers, as bridging the gap between the users needs and views and the low level features of videos is a complicated problem that requires a tremendous amount of research. This is called the semantic gap; much research has been done on bridging the semantic gap using various methods and techniques, but it is still an open problem.

Semantic video retrieval involves two aspects. One of them is concerned with concept presence detection according to the context concepts. The other aspect is concerned with temporal concept mining, which predicts the temporal presence of certain concepts in the next shots, so it can enhance or refute the presence of these concepts.

Temporal concept mining relies on the consistency of the video. Temporal concept rule mining may involve expert-made rules, be based on statistical dependency tests, or use information extracted from association rules. Temporal association concept rules are extracted from ground-truth annotation. However, ground-truth annotation involves a limited number of annotated concepts, a limited number of annotated videos, many missing values, and binary values.

The main goal of our paper is to model and automate a framework to reduce the volume of video concept detection score data and extract a compact representation of the temporal concept rules. These rules predict the behaviour of the concepts in the next shot based on the current shot behaviour. The results of our method are tested on the cu-vireo concept detection scores. .

The size of the detection score matrix may exceed 150000X300, which is considered large. Applying temporal association rule learning algorithms on such a large matrix involves many difficulties or is, in some cases, impossible. Some of these difficulties include a long processing time, high space requirements, the huge number of resulting association rules, rule redundancy, and the selection of rule pruning criteria. Thus, most of the studies that apply association rule learning algorithms either use only a slice of the concept detection scores with a small number of concepts or use ground-truth annotation. The major issue with using association rule learning algorithms is that