A Study on Applying Association Mining Technique on Endoscopic Videos

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***Abstract*: - Video data processing could be a complicated and attention-grabbing analysis space as deals with the unstructured video knowledge. Association rules are generated between things in a very massive video information plays a very important role within the video mining analysis areas. Video mining could be a domain embrace ideas from data processing to image mining that consists of techniques like computer vision, image processing, machine learning and Artifitial Intelligence. This paper provides a detailed study of various association mining algorithmic program techniques and a general framework of association rules mining from endoscopic video data.**

Keywords: **Video Mining, Video Association Mining, Endoscopy video, Data Mining.**

I. INTRODUCTION

Video is a wealthy source of data, it comprises of sound, video and content along. various video mining approaches have been proposed for extracting knowledge from video data. retrieving important information in a video data or in a video database is still a challenging and tough task because there is a semantic gap between the low-level features and high level semantic topics. One of the major domain to consider in video data mining is video association mining technique. Mining of Association rules from the video database is a direct expansion of association mining in structured minable databases. Video Association Mining is a new and developing area in the field of data mining to explore pattern. The procedure of finding associations in a given video is called association mining. Association mining may be used to determine the correlation between objects in the video data and to find frequent pattern present in videos. By using Video association mining, we can extract semantic content from video data. The Semantic information has several kinds of activities like, detecting different events or retrieving anomalous patterns related to individual person or an object. Video association mining is an interdisciplinary field that combines techniques like data mining, computer vision, machine learning. It is still an unexplored field and very little work has been done in this area.

An upper gastrointestinal endoscopy is a procedure which uses an endoscope, which involves small, flexible tube with a light, to see the inner lining of the upper Gastro intestinal tract. One more famous technique is Wireless capsule endoscopy technique, which is a standard technique to screen and dragonize gastro intestinal tract, specifically small intestine mucosa, which cannot be reached easily by upper Gastrointestinal endoscopy. In wireless capsule endoscopy technique, the process starts by swallowing capsule which includes very small camera, light, power source and video data stream transmitter, which can easily pass through the small intestine mucosa [1]. The process of upper GI endoscopy done by health care technician, where they pass a small tool with the endoscope to remove unwanted harmful polyps. Polyps are common symptoms in adults and are most of the times harmless. whereas, few polyps can turn into cancerous polyps, therefore removing such polyps in the early stages is an effective and eminent way to prevent the cancer.

II. PROBLEM STATEMENT

Cancer is a dangerous disease which may not be cured, when it attains certain condition. Therefore, identification of symptoms early and proceeding with remedies is needed to fight against cancer. This proposed data mining technique targets towards finding hidden pattern or knowledge from endoscope videos which are useful in eliminating cancer. Limited work has been done in data mining on endoscopic videos. The endoscope videos reveal more information than what we see visually, therefore endoscope videos are viewed and stored for the future investigations.

III. LITERATURE SURVEY

Smita R. Sankhe Kavita Kelkar et.al [18] experimented optimization of execution time for primitive Apriori and an advanced Apriori algorithm (DFR Direct Fined and Remove) which increases the efficiency of producing association rules. The above algorithm included a novice method to reduce the repeated generation of frequent itemsets while pruning the candidate itemsets, which creates set of frequent itemsets and eliminates candidates having a subset which is not frequent in the realtime. This algorithm increased the probability of

retrieving information in scanned database and lessened the potential measure of item sets.

Patel Tushar S, Panchal Mayur et.al [20] has discussed few combining features and internal working of several mining algorithms. The pros and cons of Apriori , Partitioning, sampling, DHP, DIC, and Eclat, FP-growth, and H-mine algorithms were discussed [20]. The overall execution time of these algorithms were calculated using several support threshold of a sample data set. The execution time is reduced when the support threshold is high. The research proved that , the split and merge (SaM) algorithm has improved performace than other algorithms. The Apriori algorithm takes more time as compared to other algorithms.

J.R. Jeba Dr. S.P.Victor et.al [21] discussed the implementations of the various frequent item set Mining algorithms like SMine and Apriori Algorithms. The performance of the algorithms were analysed with several support threshold values. The paper proposed an SMine (Sorted Mine) Algorithm for detecting frequent item sets. This method has reduced the number of scans in the database compared to other algorithms.

SivaSelvan [5] discussed an m-ary tree based frequent temporal pattern mining algorithm to avoid the repeated scans, which is the major limitation of Apriori based FTP mining algorithm. This approach requires only two input scans. Frequent and Infrequent single patterns will be identified while scanning in first pass and several patterns' temporal count will be produced in the second pass of scanning, which updates m-ary tree constructed by the end of first scan. Tree is constructed and traversed with respect to minimum support threshold, which generates the complete frequent temporal patterns. This approach reduces the burden occurred due to the results of tree update strategies.

Vijayakumar.V [25] discussed a framework for mining the association rules from the video data base, which can be used for any type of videos. This approach targets several video association mining challenges including bridging the semantic gap between the low-level features and high-level semantic concepts. Several drawbacks has been discussed in this paper, no well-defined data models to represent video content, synchronizing multiple feature streams like audio, video and text, transforming data form video database to structured minable database, managing high dimensionality and temporal features of videos.

Xingquan Z [8] addressed a video association technique for building knowledge based video indexing structure for supporting efficient video database management. This approach discussed techniques to extract visual and audio semantic , and grouped into single hybrid stream by considering the original temporal order present in the video database. In this regard, the video data is converted into a relational data , which is handier in applying several data mining techniques.

S. Vijayarani [22] proposed a architecture showing of all association mining algorithms in figure 1 and conducted an experiment proving The Eclat and Dclat algorithm have produced better results with respect to execution time comparing to other algorithms. Compared with respect to memory consumption shown that, Apriori algorithm has produced better results than other stated algorithms. The Apriori TID algorithm consumes more execution time and FIN algorithm consumes more memory usage compared to other algorithms. The Association rules are generated for all the eight algorithms using different minimum support and confidence. The comparative analysis has proved that that the Dclat algorithm is giving best results comparing with other algorithms.

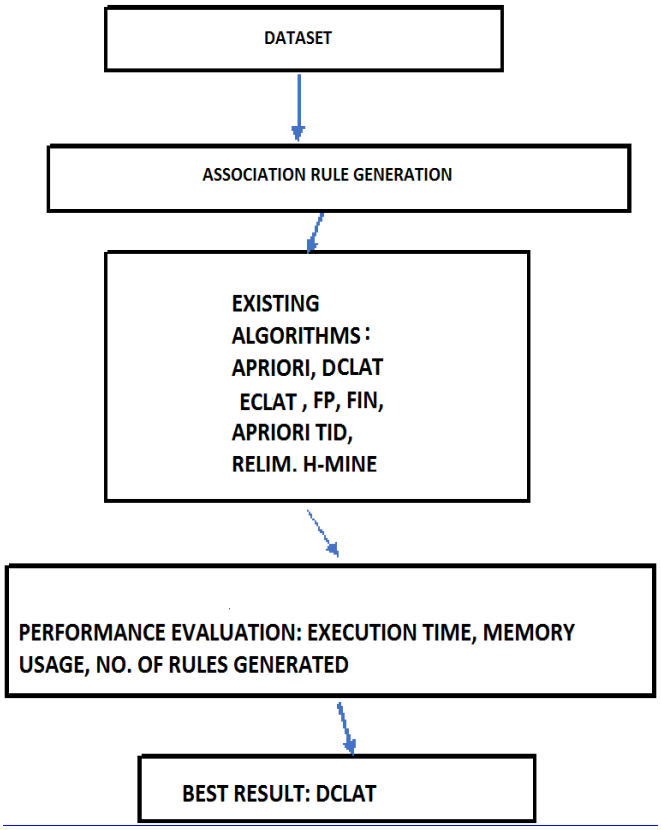

Fig. 1 System Architecture

IV. METHODOLOGY

A video database may include different types of semantic information. The semantic information describes, what is happening in the videos and also what is understood by the human eye. This semantic information in the video includes two important aspects [9] [10] [11]. They are,

1) *Spatial aspect:* which is a semantic data present in a video frame, like characters, location and objects in the video frame.

2) *A temporal aspect:* which is a semantic content present in a sequence of video frames for a specific time, such as object's movement and character's action in the video sequence.

The temporal representation done using higher level semantic information of video by analysing the features like audio, video and text by neglecting the noise. [2][3].

The semantic information in video data includes identifying trigger events, identifying unique and irregular patterns of activity, producing a person-centric or object-centric views events, classifying the activities into relevant categories, and clustering and determining the interactions between these entities. The temporal aspect of videos prevents the efficient browsing of the large databases. Many efforts have been made to extract the association between low-level visual features and high-level semantic theories for explaining the image [12].

The endoscopy videos contain many interesting objects like polyp, tumors and many more symptoms used to predict the diseases, which can be decided as important semantics. Knowledge based video indexing framework can be used to achieve above mentioned concepts [8].

For successful video indexing identification of the three problems proposed by Zhu [8] is important, they are, identifying no of levels present in the model, identifying decision rules for each node and identified nodes should make sense for human beings.

Association rule discovery is one of the efficient data mining technique for discovering relationships between sets of variable values from large video datasets.

Agrawal, Imielinski, and Swami proposed the technique for association rule mining[13], which includes the procedure of using three important measures: *support, confidence* and *interest*.

considering a set of transactions, where a single transaction includes a set of items called itemsets, an expression X ->Y is a association rule where X and Y are subsets of itemset and X ∩Y = null. The rule states that, the transactions of the database which include itemset X will have itemset Y. The support defined as the relative occurrence of both X and Y itemsets in the complete data set of transactions and formally defined as the ratio of the finite set of tuples satisfying both X and Y itemsets over the total number of transactions. The confidence is defined as the probability of Y given X , that is, the ratio of the number of transactions satisfying both X and Y over the finite number of tuples satisfying X itemset in a data set. The interesting factor here is, a measure of human interest, i.e. high interest means, if a transaction contains X itemset, then it is more likely to have Y itemset than the other items in data set. [6].

The association rule technique comprises of identifying all the association rules which satisfy the minimum support and minimum confidence decided by the analyst and this can be analyzed in two steps.

Step 1. The item sets, whose support value is greater than the decided minimum support count is identified and are called frequent itemsets.

Video association mining cannot be considered same as traditional association mining. Video data will be having temporal properties and images will be having spatial properties. Video sequence wll have temporal information, which conveys video content. Temporal pattern mining is another variation, which is also dissimilar from traditional association mining technique. The itemset in traditional association mining contains distinct items excluding quantity of each item in the item set, but temporal pattern mining searches the entire video to recognize frequent item sets.

In event detection, it is neccessary that an event is categorized by the attribute type and by its occurrence frequency.

Step 2: In traditional association mining, the order of the items present in the transaction is considered insignificant. i.e., transaction {a, b} is considered same as the transaction {b, a} [14] [4]. But in video assosciation mining, the change in the position of frequent items in a pattern concludes with another pattern, which is different in the video database. i.e., In video association rule mining technique the pattern ABCD is different from ABDC [6]. In this regard, two types of associations are identified in video data.

Intra associations, where all items involved in the association are the similar to view, similar shots of the same object taken from various views are considered.

Inter associations, which includes items of several types, considering the frames that consist of visually different shots of different objects. For example, the Traffic surveillance video database which consists of various objects like vehicles of different shape size in the different shots.

The above mentioned techniques consider video inputs, which has temporal properties, the frequent temporal pattern mining process is handled using two data specific parameters, they are: temporal support threshold and temporal distance threshold.

V. PROPOSED ARCHITECTURE

Video is a collection of a sequence of images, image is called as frame. A shot in a video is defined as a continuous series of frames taken from camera at a particular moment in time.

The below Figure 2 shows image frames containing polyps.

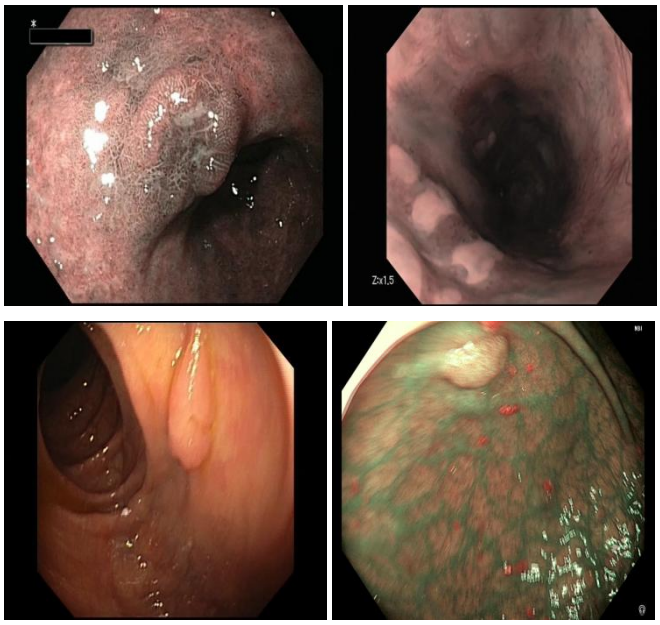

Figure 2: Images from endoscopic videos with polyps

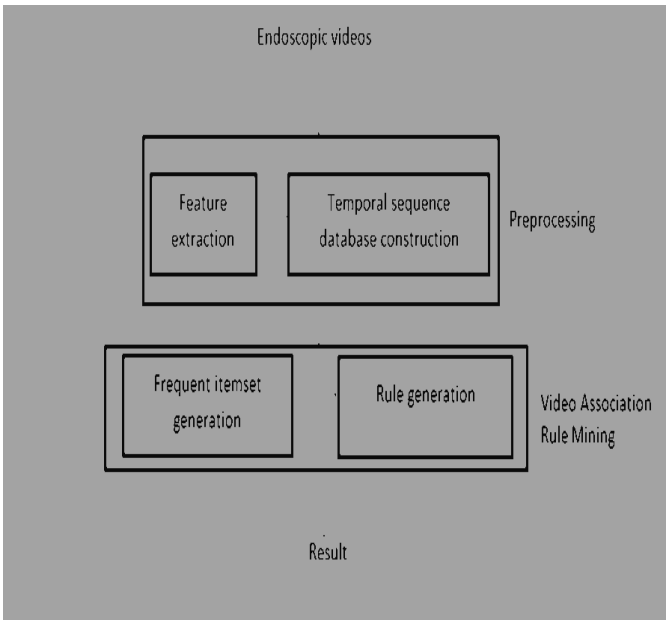

Figure No. 3: Endoscopic Video Association Mining Framework

The videos can be processed using two approaches. *Shot-based approach* and *Object based approach*.

The *shot based analysis* is performed at the shot-level, the continuous shots are considered as transaction and the attributes in the shots can be considered as feature descriptors or event types in the transaction.

The *object-based* representation provides video search and content analysis very effectively and efficiently. This is performed using spatio-temporal segmentation and region tracking. we can consider two types of videos, videos which have content structure and videos which does not any content structure. The movie videos are considered as video with content and the surveillance videos considered as videos without content structure [9].

The important steps required in the association rule mining are pre-processing, feature extraction and association rules generation. The procedure is initiated by preprocessing of video, where the video data will be converted from unstructured data format to structured data format by applying existing methodology [6]. The preprocessed video data is transformed to extract features for generating the important features from the video data and storing the extracted data in a minable structured format. using this minable structured video database, the data mining techniques can be applied to discover hidden required pattern from the data sets. The results are evaluated and analyzed to explore the knowledge of particular application. The generalized proposed system framework is shown in figure No. 3.

Video Pre-processing

Video data is considered as unstructured data source. Therefore, the pattern or knowledge in videos cannot be extracted directly. The conversion from unstructured to structured format is required. The video shots are analyzed by identifying the shot boundary. A video shot is the basic unit of video data. Video shot may also consist of audio, video and text features. Visual features in videos are recorded using color analysis and object segmentation techniques. Audio features are mined from time domain and frequency domain and the text features are mined using video text processing techniques. All the above features are segmented into a set of consecutive video shots. Now, The key frames are take out from the video shot by applying the existing shot partitioning algorithm. The extracted key frames are used to retrieve multimodal features, followed by building a video temporal data sequence .

Feature Extraction

This step includes image processing algorithms, used to extract many visual features from the key frames. To extract and manage the audio features in video from the input audio signal, the Audio signal classification systems are used.

All the above features are ordered into video hybrid sequence called as feature vectors. The feature vectors are then used to model as transactions, which are used in the association mining process.

Building Temporal video database

Visual and audio are given a symbol for building the video sequence. Every key frame in the video is assumed as, a time unit and by using the look-up table, the extracted features of

each time unit are converted into symbolic streams, this process of transforming is called mapping. The Look-up Table will have equivalent symbol for every feature mapping. At the end, the original video data is converted into temporal video sequence. This transformed minable structured video sequence is used to mine the association rule from the video database [6].

Video Association Mining

The process of mining association rules from video data can be considered into two sub problems:

1. *Finding all frequent itemsets:* Itemsets having support ,which is greater than minimum support value. Itemsets which have minimum support are called large frequent itemsets. The other items are considered to be small infrequent itemsets [23]. The support for an itemset is calculated using equation 1.

$$support(X=>Y,D) = support(X \cup Y,D)/ |D| \quad (1)$$

2. *Extract the association rules:* The rules that have minimum confidence greater than the user-specified minimum confidence, from the frequent itemsets [23]. The confidence between two itemsets is calculated using equation 2.

$$Confidence(X=>Y,D)=support(XUY,D)/support(X,D) \quad (2)$$

This is one of the effective and efficient data mining technique, which targets to extract the interesting frequent patterns and associations among the item set in a video temporal sequence database. It includes two steps: discovering the frequent sub sequence and Rule generation.

Frequent Subsequence Generation

There are several algorithms proposed for discovering the frequent temporal subsequence in video Sequence. For example, Frequent temporal sequential pattern mining can be achieved using any one of the below mentioned algorithms: Apriori algorithm or FP-growth. The Apriori based approach has a restriction of performing high cost multiple database scans on itemsets and candidate generation. Apriori algorithm follows level wise and iterative scanning procedure, first generates the candidates and tests them to avoid the non-frequent item sets. Most of researchers used this Apriori approach for candidate generation and test approach [4] [17]. Comparing with Apriori algorithm, FP growth algorithm has the following features.

1) FP tree is used to store the information present the video database. The database is scaned twice which avoids multiple database scans reducing the I/O time.
2) FP growth algorithm does not generate candidates, which reduces the huge amount of time taken for candidate generation and test for goodness.
3) FP approach uses a divide and conquer technique while mining, therefore the searching space is very much decreased. The efficiency of the FP growth algorithm is about order of magnitude, which is faster than Apriori algorithm [15] [16].

Rule generation

The knowledge that need to be discovered and analyzed is in the form of association rules, which can be mined from temporal video sequences built using video database. Rule generation targets towards newer efficient algorithms for generating various types of association rules and interestingness of the rules.

VI. CONCLUSION

This paper tries to analyze the research work carried out so far in the field of Association video mining, including various data mining techniques applied on the various video data sports video, surveillance video, medical video etc,. This paper also presents proposed future work to identify harmful polyps from endoscopy videos. In this regard, an architecture of Association rule mining has been discussed.

VII. FUTURE ENHANCEMENTS

Selecting a suitable supervised and unsupervised machine learning technique. The proposed research methodology need to be implemented using association mining and machine learning techniques.

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