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Semantic Based Ima`Ge And Video Retrieval Techniques: A Comparative Study

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Abstract
Today IT world, multimedia plays a vital role and also due to relevance it circle makes it’s well known to the users. Storage of multimedia contents increased rapidly at the same time cost for storage is cheaper. So, huge amount of video and images are available in storage repository. Due to this reasons, retrieving relevant statistics based on user query. For this scope semantic methodology is introduced which meets the user needs. There is lots of and variety of semantic based video retrieval techniques are introduced by the previous researchers. This paper gives the overview of previous traditional image and video retrieval algorithm methods and techniques. Generally used procedures are feature extraction, indexing and ranking etc moreover this paper concludes with the future research directions of semantic based retrieval systems.

Keywords: Video and image retrieval, feature extraction, semantic based retrieval.

Introduction
One of the largest video repositories is YouTube, here the large amounts of videos are uploaded by the user and the statistics states that above 48h of new videos are uploaded by the user in every minute and 14 billion users view the videos in May 2000. Applications of multimedia are online medical transcription, e-learning and teleconferencing etc and popularity of multimedia is increased day by day. So, it will leads to confusion and also does not meet user satisfaction. For efficient retrieval process numbers of semantic retrieval strategies are introduced by the researchers. Retrieving images and videos from the large database is a very tedious process and also to finding out the efficient searching and retrieving mechanism is more challenging to the reviewers. Generally the image file or video retrieved based on two different methods. First one is that based upon the annotation, metadata and filename the outputs are retrieved but it’s a time consuming task because of the searching process are done based on matching the words with particular words it does not gives accurate results to the user.
Another strategy they discover results based upon the low level features such as color, texture and features of the images or image in videos. This kind of retrieval system is called as the content based image retrieval mechanisms. It’ll automatically generate the annotation for the images and also for identifying similarity offers simple distance similarity measures. Semantic information retrieval system aim is to well know or meaning full information to the user based on their queries. The user give query may be the text or image. With the help of the semantic web the user can able to build the information and upload into the web and also set the restrictions for accessing the data. Main aim of this semantic web is to manipulate database which is more easily understandable by machines in order to effectively aggregate the data and to search and retrieve data in more effective manner. In this paper we discuss the overview of existing methodologies and algorithms which are discussed by the reviewers which are present in section 2. Section 3 concludes with the overall procedure with future research scope.

Literature review of Algorithm
Markovian Semantic Indexing
Paper [1], the author Konstantinos A. et al. introduces the Markovian semantic indexing (MSI) approach for online image retrieval. MSI is adaptable for the Annotation Based Image Retrieval (ABIR) system. Stochastic approach is invited because of user has possibility to unselect the relevance images, for this scope Aggregate Markovian Chain was interpreted. During training phase, the images are not has annotation. After submission by the user defined query the annotation will be generated for relevance image and also user define Queries are in the combination of keywords. Testing phase, collect annotation data from training phase and retrieve the results based upon the keyword relevance probability weights in order to offer the more relevant images. The main scope of this paper is to give more relevant or increase user satisfaction. MSI is compared with the LSI and pLSI from that MSI achieves great result. Advantage of this concept is that it will try to provide more relevant images and also perform automatic annotation and indexing process in the ABIR system. But the time consumption is more and also it does not fully meet the user satisfaction.

Personalized Concept Based Clustering
Kenneth Wai-Ting Leung et al.[2] define the new approaches for providing personalized query suggestion to the user in order to enhance the semantic query searching. Most of the users given queries are too short or it may be ambiguous, to alleviate this problem in this paper the researchers invite the personalized concept based clustering strategy. Major steps of this approach are that construction of relationship graph and concept based clustering. There are

four different steps are performed like this, first step of this concept is that, after specifying query by the user, extract the information of concepts and their relations between the query with the help of web-snippets which are phrases and crucial terms. Next forecasted user preferences from the clickthrough data's.

Third, the integration of user's conceptual preferences and relationship graph as acts as input for the adapted agglomerative clustering algorithm which is introduced to finding queries that are conceptually close to one another.

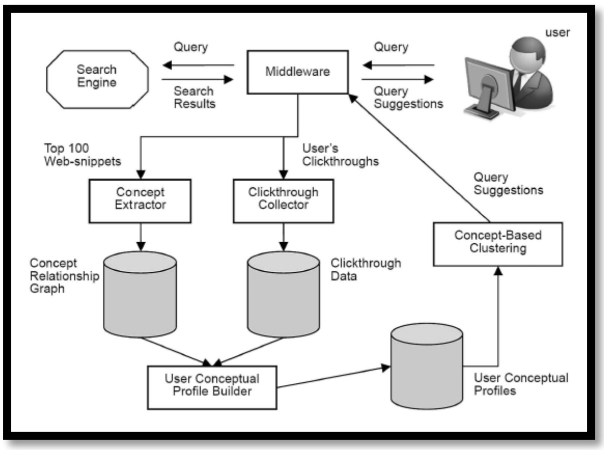

Fig.1 personalized concept based clustering

This clustering would find out the conceptually close queries. Finally the personalized queries are suggested to the users. Google middleware were developed to gather the clickthrough data. By using those details they conduct experiments. Figure 1 shows the basic architecture of personalized concept based clustering technique. Benefits of this personalized concept-based clustering is that it increases the prediction accuracy at the same time reduce the computational cost than the BB's algorithm. But it also has some limitations like does not discuss about the ranking and indexing mechanism because if we were not index or rank the items means the redundancy would happen.

Adaboost with SVM

The literatures S.M. Valiollahzadeh; et al [3] introduce the one new algorithm which is combination of the adaboost and SVM classifier algorithm. This algorithm is applied in the face recognition system. Usually in face recognition system, the identification of face and non face is a difficult task. In generally the face detection system learns the statistical models of face and nonface image. After that apply the two-class classification rule to differentiate the face and nonface patterns. Generally in face recognition system the region of interest play a vital role. Because depend on the region only the other functionalities are performed in image processing. In this paper in order to reduce the region of interest they use the skin color as the input for the face recognition system. The skin color distribution of different people is found to be clustered in a small area of chromatic color space. Skin color of different people is close and differs mainly in intensity. The given input color skin image is converted into the gray scale image. This is the first stage of this system.

After that the feature extraction process is performed in the offline face. For feature extraction they use the 2D haar feature extraction algorithm. Next based upon the features the images are classified. For classification here the author introduces the combination of Adaboost with SVM classifier. Finally the face images are identified after preprocessing stage completed. One of the advantages of this paper is that which provide accurate classification result when compared with other classifiers such as neural networks and decision trees. The processing speed also increased. The detection rate of this Adaboost with SVM is high compared with the neural network and decision tree classifier detection rate. This concept has some advantage but the face recognition system mostly concentrate on the classification not the feature extraction process and also for reducing the region of interest they choose the skin color. But the skin color of the particular person is also varied in different situation due to various reasons. The 2D haar is an old technique for feature extraction process. Now a day more recent trends are introduced by various authors for feature extraction process.

Semisupervisied Support Vector Machine

This paper mainly concentrates onto to providing the efficient classification in hyperspectral images. For this reason the reviewers [4] Devis Tuia, et al establishes the semisupervisied SVM with cluster kernel. Here the authors use the remote sensing images for the classification process. Usually the unlabeled images shorten with the set of free parameters. Also the general classification method as transductive does not perform efficient classification which predicts the values only. This leads to increase the computation burden. For this scope they perform classification with the help of the cluster kernel. The working procedure of this concept is that follows: First of all the given input images are clusters using the semisupervised SVM for creating the bagged kernel. The similarity between the unlabeled images defined as the bagged kernel. After building the bagged kernel the base kernels are modified.

The kernel is formed by identifying the number of occurrences of the two image pixel present in one cluster. The first process of this algorithm is that find the base kernel. After that the k-means clustering with different initialization times but same cluster value. Then find the bagged kernel. Compute the sum or product between the bagged and base. Finally train the SVM with the bagged kernel. Generally in transductive clustering process, the bagged kernel is calculated for the all the pixel in the image and the cluster is derived directly from the matrix. But which is not possible in hyper spectral images. But in this paper they calculate the bagged kernel from the center cluster. From the reduced dataset only they find the center of the cluster. One can assign the test pixel to the nearest cluster in each of the bagged runs to compute kernel bag. These processes are sequentially or parallelized performed.

In this paper the kernel is precomputed before the SVM classification so it prevents the large classification problems. This is one of the advantages of this semi supervised support vector machine classification process. When compared to the

RBF classification algorithm this Semisupervisied offers efficient classification result. The existing method does not provide the final classification result. These are all the advantage of this paper. This kernel provides more important for weight not the regularization parameter. By adjusting the weight value the performance can be varied. This is one of the limitations of the kernel algorithm.

Distance Metric Learning

In image retrieval process one of the important tasks is image ranking. If we want to rank the images means first of all we have to identify the ranking difference between the images with the help of the distance metric. For ranking process not only find which image comes under which category and also need to find the ordinal relationship between the images. For these reasons in this paper [5] the authors Changsheng Li, et al inaugurate the Distance metric learning algorithm. For ranking the images in proper way need to compute the local geometry information and the ordinal relationship of data. Three ordinal algorithms are used for the ranking process. The reviewers use the LDMLR (Linear Distance Metric Learning for ranking) approach for identifying the geometry information and the ordinal relationship of data. Then they apply non linear kernel trick to capture the non linear structure of the data. Here the authors take the real world image data. So, each image has the unique features. In order for this purpose they extend the approach into the multiple kernels learning technique. This improves the multiple features of the images.

There are four different types of datasets are considered in this process. They are the UMIST face dataset, the FG-NET aging dataset, the Microsoft Research Asia Multimedia (MSRA-MM) image dataset, and the mixed-gambles task dataset. The experimental results show that this paper proves their concept is more efficient when compared to the existing state of the art methods. Generally these Distance Metric Learning algorithms are mainly used for the classification, clustering process. But in this paper only the authors use these algorithms for the ranking purpose. This is one of the unique advances of this paper. One more thing is that the multiple features are also considered for providing accurate result. For experimental results they had taken different kind of linear methods and non linear methods with multiple kernel methods. From those we easily identify whether one offer efficient result. In linear distance metric learning they use the three different kind of algorithm such as LDMLR, LMNN, and mkNN and for single kernel method KDMLR, KDistBoost, KDLOR algorithm. It permit some advantages but also has some issues like the time complexity of the MKBosst clustering algorithm is high and also it's a tedious task. This is the limitation of this Distance Metric Learning algorithm for image ranking.

Ontology with Hierarchical Boosting

For providing the efficient classification and also to provide the automatic annotation of large scale video in this paper [6] the authors Jianping Fan, et al. integrate the ontology concept to boost hierarchical video classifier training and multi modal feature selection. Generally the content based video retrieval system having the struggle to overcome the semantic gap problem. The automatic video detection with the semantic classification is one of the solutions for this semantic gap. To overcome this problem in this paper they integrate the ontology with hierarchical boosting. In this paper the author focus on one specific domain of surgery education videos for ontology construction. Segmenting the video objects with the physical object leads to increase the storage size in feature extraction process and also extracting the high dimensional features leads to very expensive to learn the video classifier directly from the high dimensional perceptual features. For this reasons they use the multimodal boosting algorithm. Another challenge for the video retrieval is that one single clip represents more than one meaning at different video or single video clip may refer similar meaning at the different semantic levels. The ontology concept is introduced for this purpose only. Ontology provides the effective way of defining the vocabulary of domain-dependent videos and the contextual relationships. In hierarchical video classification one of the problems is that inter level transmission.

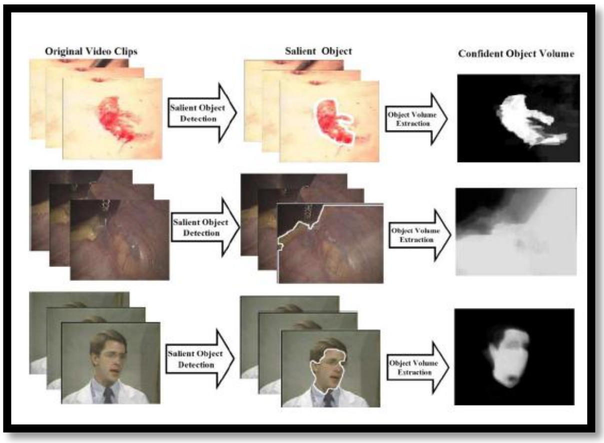

Fig.2 Hierarchical boosting

The hierarchical boosting algorithm is introduced to overcome those kinds of problems. The result of hierarchical boosting was given in figure 2. Finally to understand the query given by the user, need of the customer and also to provide the semantic result, in this paper they initiate the hyperbolic visualization scheme. The advantages of integrating ontology to hierarchical boosting algorithms are:

a) the computation complexity and the storage space are reduced.
b) The contextual and the logical relationship are well-defined by the concept ontology.
c) The inter-level transmission error problems are reduced.
d) This provides more intitutive solution for the query specification and evaluation.

This has the drabacks also, which initiate the ontology for one unique surgery education, but this one ontology concept does not meet the all user needs. For meeting all the user needs means we have to create multiple ontology concepts.

Coupled Kernel Embedding

One of the most challenges of face recognition system is that uses of low resolution images at input. Some times in the video, faces are very small if the video is clear, they are all difficult to measure the similarity between the face images and high resolution samples. In this system [7] the authors Chuan-Xian Ren, et al considered HR (High Resolution) image as training and the LR (Low Resolution) images as test samples. In traditional face recognition system they use the Super Resolution (SR) methods for the feature extraction process. But it does not offer the efficient result because it does not maintain the consistent state of classification and also it's a time consuming task. This is not suitable for some real time applications. Other researches use the linear projection subspace to solve the problem of computing similarity between the HR and LR space images. But in this paper they considered the problem and objective is something when compared to conventional methods. For this scope the literatures introduce a coherent kernel based face recognition system without any SR preprocessing. According to the aim of recognition, in this paper the reviewers learn a coupled kernel embedding (CKE) method to map the face images with different resolutions onto an infinite subspace and carry out the recognition step in the new space. The different resolution with face images are given in figure 3.

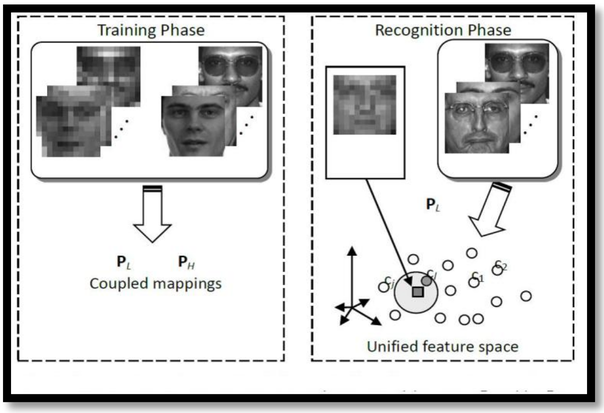

Fig 3 Coupled kernel Embedding

They apply the kernel metric to learn the similarity between the face images but the images comes from the different modes. To determine the embedding features they use the locality-preserving projections (LPP) approach. The recognition stage is implements in the learning embedding subspace.

Here they initialize the nearest neighbor classifier for the classification and the Euclidean distance as similarity measure. The embedding approaches are all different in this paper when comparing the traditional methods. This means that there are two kernel metrics are constructed and then combined into large objective function for global decomposition. This coupled kernel metrics solve the problem presented in traditional system is that comparing multimodal data due to inefficient similarity measure. This problem is solved by reducing the inconsistency similarity measure by computing the gram metrics. The advantage of this face recognition system is the authors present face recognition without SR preprocessing. Also for computing the similarity metric in this paper they introduce new kernel based learning method. In this method the LR and HR images features are extracted from the high dimensional or infinite dimensional subspaces. Through the CKE algorithm, the samples become more separable and they are classified into the respective classes with a large margin. Another one more thing is that why we integrate the coupled based kernel metric into the semi supervised learning problems. Because now a day the semi supervised learning approaches provide efficient result for the face recognition system, image retrieval and video retrieval process.

Hybrid Approach

The four step hybrid approach is applied into the digital video news system for image retrieval and composition of the video newscast based upon information contained in metadata sets. There are two different kinds of metadata's are used in this paper such as the unstructured data and annotated data. The unstructured data is nothing but free form of data. In paper [8] Gulrukh Ahanger, et al little initiate four different steps for the retrieving process. The annotated metadata contain segment and structure. The unstructured metadata contain the segment transcripts. Based upon those kinds of multiple metadata set they differentiate the video information for the composition.

With the help of the speech-to-text conversion tool and closed caption decoding the unstructured data are retrieved. At the time of capture the content metadata are recorded such as date, time, and title etc. The first step of this system is that, to use the conventional technique to differentiate the video segments from the data using the segment metadata. This means that the users given queries is matched with the annotated and unstructured metadata associated with segments and retrieve the relevant data for improving the recall. In next process the retrieved segments are clustered using the vector based clustering approach for retrieving potentially value added data, which was explained in figure 4. In third stage they apply the transitive technique to improve the recall process of the retrieval system. Finally based on the creation time relationship expand the final candidate set of relationship for increasing the recall.

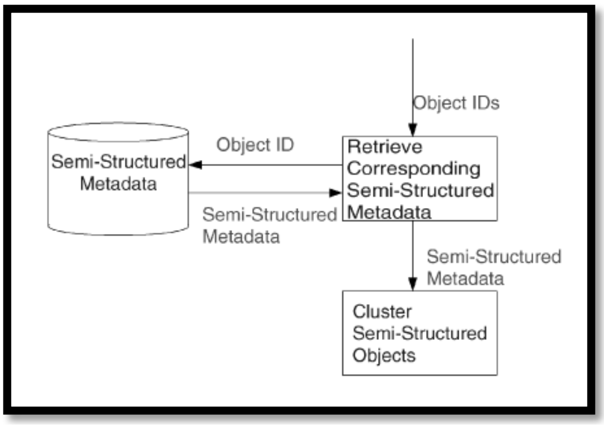

Fig.4 Clustering Process

These are all the four different steps applied in the hybrid approach. The advantage of this approach is that it increases the recall rate of the data using the four step hybrid approach. Also in this concept they discuss the vector based clustering approach in order to achieve the efficient video stories based on the chronological or thematic ordering. In this digital video new system they use the vector based clustering approach but now the variety of clustering algorithms are available for the video retrieval system. Those offer efficient result when compared to this clustering process.

Laplacian Regularized Metric Learning (LRML)

Steven C.H. Hoi et al propose the Laplacian Regularized Metric Learning (LRML) algorithm in [9] in order to learn efficient distance metric in collaborative image retrieval (CIR). Diverse of distance metric learning approaches are discussed by the reviewers from that most one is that Euclidean distance metric. But it does not produce efficient results. From that LRML is infer the log data of feedback relevance from the CBIR (Content Based Image Retrieval). It would retrieve the whole feedback information in long duration period, so it would give potential information of log data to resolve the semantic gap issue. This LRML algorithm aggregate both log data and unlabeled data by using the graph regularization frame work. From this result they know that reliable metrics are learned even when the CIR has noisy and limited data. It was gave some benefits but if they collect huge historical data means the storage cost maintenance would be increased and also the user's feedback should be changed frequently in timing manner. So, it had some problems to learning metric in effective way.

Multiple Kernel Boosting (MKBoost)

The thought of this paper is to boosting the multiple kernel learning (MKL) for classification process. For this reason the author Hao Xia et al [10] defines the MKBoost algorithm. Most of the traditional MKL was applied in many fields like data mining, image processing etc to learn the optimization tasks.

Furthermore any one of the kernel was utilized to solve the optimization problem but in this paper multiple kernels were utilized for learning process which solves the variant MKL issues in effective manner. Innovative idea for this approach is that, it builds the framework to learn the group of multiple base kernel classifiers from that each of which was learned from single kernel. With the help of the boosting learning process, the combinations of weight of kernel were calculated. Accordingly, they could learn the classifier in effective way without resolving complicated optimization tasks needed in ordinary MKL approach. When compared with traditional approach it utilized group of multiple kernel classifier and each of which is learned from the single kernel. Regarding to the performance of weighted combination of classifiers the final classifier was obtained. They first propose two deterministic MKBoost algorithm with utilizing all kernels at each boosting trail after that apply two stochastic approach as same as deterministic approach for trade off between accuracy and efficiency. It would offer some benefits but all of that was present in only theoretical part not an implementation.

Boosting Margin Based Distance Functions

Generally the graph based clustering performance was depending on the grade of distance metric learning, which was used to measure the similarity between the pairs of points. The main scope of this paper was defines new distance metric learning approaches for clustering process. For this reason the author Tomer Hertz et al introduces boosting margin distance based function in [11]. This is a semi supervised learning approach. They concentrate on to employ DistBoost algorithm, which was distance metric learning algorithm. In order to boosting the binary classifier with confidence interval in product space we learn distance function by using the weak learner in the original feature space. Boosting scheme absorbs the unlabeled data point which gives density prior and also during the boosting process the weight was reduced. The weak learner was utilized based on the constraint EM (Expectation Maximization) algorithm; it calculates Gaussian mixture model, and also give a partition of original space. Unlabeled data was used by constrain EM and equivalence constraint is to find a Gaussian mixture. It gives better result but when compared with nearest neighbor classification it does not grant effective result.

Query Based Pre-Retrieval Model

Literature Ben He et al define the query based pre-retrieval model in the information retrieval approach for model selection problem [12]. Usually in information retrieval system, after entering query by user the relevant information's were retrieved with the help of the relevance feedback data of user. Numbers of model selection approaches were introduced by the researchers in IR for various purposes but the scope of this paper is to automatically select the suitable and also efficient retrieval model with unique features.

Table (1) Comparison of Various Algorithms Used in Image Retrieval Process

TITLE	ALGORITHM	FUNCTION	ADVANTAGES	DISADVANTAGES
Mining User Queries with Markov Chains: Application to Online Image Retrieval	Markovian Semantic Indexing	Online image retrieval	* Try to offer relevant image * Perform automatic annotation and indexing process.	* It's a time consuming task and also does not fully meet user satisfaction.
Personalized Concept-Based Clustering of Search Engine Queries	Agglomerative clustering and web snippets	Semantic query searching	* increase the prediction accuracy * Reduce the computational cost	* Not discussing about indexing and raking * It leads to redundant data retrieval.

Adaptive Boosting of Support Vector Machine Component Classifiers Applied in Face Detection	Adaboost with SVM Classifier 2D Haar	For Classification Feature Extraction	* Provides accurate classification result * Processing speed is high.	* Skin color of particular person varies for various reasons. * 2D haar is old technique.
Semi supervised Remote Sensing Image Classification With Cluster Kernels	Semisupervised SVM	To create Cluster Kernel	* It prevents large classification problem.	* Kernel provides importance for weight, depends on the weight performance value can be varied.
Ordinal Distance Metric Learning for Image Ranking	Distance Metric Learning	Ranking Process	* Multiple features are considered to provide accurate result.	* Compared to adaboost, MKboost is a high time consuming.
Incorporating Concept Ontology for Hierarchical Video Classification, Annotation, and Visualization	Ontology with Hierarchical Boosting Multimodal Boosting Algorithm	For Classification Feature Extraction	* Computation complexity & storage space is reduced. * Inter level Transmission error is reduced.	* One ontology concept does not meet all the user needs.
Coupled Kernel Embedding for Low-Resolution Face Image Recognition	Coupled Kernel Embedding	To map the face images	* Samples become more separable	* While integrating with Semisupervised SVM we will get accurate result.

Data Semantics for Improving Retrieval Performance of Digital News Video Systems	Minimum Spanning Tree Algorithm	For Clustering	* Increases recall rate of data	* Now variety of clustering algorithms are available so it will not give the result accurate compare to recent techniques.
Semi-Supervised Distance Metric Learning for Collaborative Image Retrieval	Laplacian Regularized Metric Learning (LRML)	For distance metric learning	* Effectively learn the distance between pair of images.	* It collect vast historical data leads to increase maintenance and storage cost. * User feedback can change frequently so we can't accurately measure.
MKBoost: A Framework of Multiple Kernel Boosting	Multiple Kernel Boosting(MKBoost)	For classification purpose	* It produces well organized classification result.	* It was proved only in theoretical manner not in real time.
Boosting Margin Based Distance Functions for Clustering	DistBoost Constraint EM(Expectation Maximization)	For coherent clustering use distance metric learning It calculates Gaussian mixture model	* it gives better result when compared with nearest neighbor classification algorithm	* It does not provide effective result.
A Query-based Pre-retrieval Model Selection Approach to Information Retrieval	Query based pre-retrieval approach	For selecting perfect selection model.	* It selects better selection approach for information retrieval	* It use old concept for similarity measurement. So, when compared with latest techniques it does not give best result.

Geometric Optimum Experimental Design for Collaborative Image Retrieval	Geometric Optimal Experimental Design (GOED) RKHS (Reproducing Kernel Hilbert Space)	For image retrieval For sorting purpose	* It gives efficient result when compared with SVMactive approach. * It's a label independent approach * Avoid diverse of potential issues	* It's a time consuming approach

First of all after specifying query, the queries were clustered according to the statistical characteristic after that perfect selection model was selected based upon the users given feedback document considered into account but which was not suitable for this paper. For this reason in this paper there are three different unique features are considered into account for selecting perfect selection model. There was query length, the relative informative amount carried in each query term and the clarity/ambiguity of a query. In query length, the non stop words are take into account and for informative retrieval the term id(tf) were considered furthermore use diverse languages to identify clarity/ambiguity of words. This gives best result for selection models. But the drawback was that for information retrieval they use old concept df-idf when compared with this other new similarity measure does not permit efficient result.

Geometric Optimal Experimental Design (GOED)
In order to overcome the problem of small-sized training data problem the reviewer Lining Zhang et al propose GOED in [13], by holding the geometric structure of unlabeled samples. Manually, First of all after giving user query image, the low level features are extracted from the images and then images are sorted based upon the similarity metric. By using GOED select the large amount of images from the database to label the images by user. With the help of this relevance feedback information the results are effectively retrieved in collaborative image retrieval (CIR). Top informative images labeled as positive and negative feedback samples.
These samples were considered as training samples after that by using RKHS (Reproducing Kernel Hilbert Space) the images are sorted.
It gives efficient result for information retrieval when compared with popular SVMactive and also this is a label-independent method, avoids diverse potential issues due to insufficient and inexactly labeled feedback samples moreover beneficial for image retrieval at the same time it's a time consuming task. Table 1 Shows the different algorithms used to obtain the image and video.
Fig 5 will give you the better understanding of different algorithm functions with its advantages and limitations. From the analysis our proposed work will enable the combination of algorithms to obtain the perfect image and video retrieval.

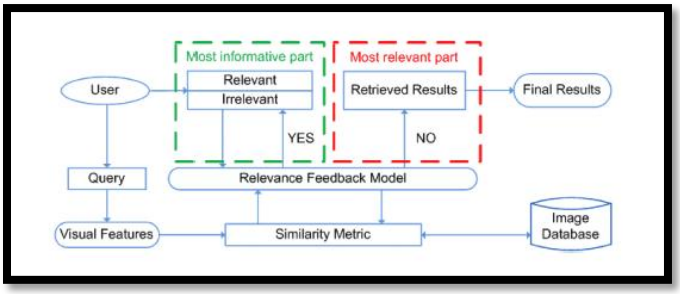

Fig.5 Overall architecture of GOED

Conclusion
We have prompted a review on past and modern developments in semantic content based image and video retrieval techniques. In this paper we provide comprehensive survey of previous approaches and also with each major problem has been discussed with pivot on following tasks: searching, classification and feature extraction, clustering, ranking, mapping, distance metric learning, selection and information retrieval. From these we observed that semantic based retrieval concept produces more coherent results in multimedia systems. It offers both advantages at the same time it has some limitations also. So, in our future we are going to define new semantic content based video retrieval system to overcome those issues discussed in this survey.

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