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Paper Authors

B.SNEHA LATHA,B.SATYANARAYANA REDDY,DR.B.TAREKESWARA RAO

KHIT College, Guntur, AP, India.

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GRAPH BASED RANKING MODEL FOR IMAGE RETRIEVAL

[1]B.SNEHA LATHA,[2]B.SATYANARAYANA REDDY,[3]DR.B.TARAKESWARA RAO

[1]PG Scholar, Dept of CSE,KHIT College , Guntur,AP,India.

[2]Professor & HOD,Dept of CSE,KHIT College,Guntur ,AP,India

[3]Professor Dept of CSE,KHIT College,Guntur ,AP,India.

Abstract - Manifold Ranking (MR) technique has been applied to content based image retrieval. This ranking requires higher computation cost. So it is difficult to apply this technique for the cases where queries are not from the database (out of the database retrieval). The proposed work is an attempt to improve graph based ranking model which deals with ambiguity issue present in the system. The goal of our work is to annotate images with some manually defined concepts using visual and contextual features for learning a latent space. We try to use the latent vectors and feed it into the existing classification models. It can be applied to multimedia annotation. This is one of the most important problems in multimedia retrieval. Our proposed technique tries to use combination of the context and content information from the latent structure present in the semantic concept space.

Index Terms – semantic gap, Manifold Ranking (MR), Efficient Manifold Ranking (EMR).

I.INTRODUCTION The traditional methods for image retrieval are based on the data features but they do not use the underlying structure information. It has been observed that databases have underlying cluster or manifold structure. Under such cases, it is possible that we can assume label consistency. It means that those nearby data points or points that belong to the same cluster are likely to have the same semantic label. Such phenomenon is very important to explore the semantic relevance in the absence of label information.

2.1.1 Objectives

We have identified following objectives for the proposed work. These objectives are useful to enhance retrieval process.

2.3 To learn various ranking methods used for content based image retrieval (CBIR). 2.4 To understand the details of Manifold Ranking methodology.

2.5 To propose a technique to resolve ambiguity present in existing technique.

II. LITERATURE SURVEY The retrieval of images started back in the late 1970s. The aim is to provide an effective and efficient way tool for retrieving images from large databases. Till this date due to development of internet the number of digital images used for various purposes has grown tremendously. Many researchers have put their attention to the development of an image retrieval system which works better for specific contexts. In the initial stage image retrieval is based on keyword annotation. This is a similar mechanism used in text retrieval methods. In this approach images in the database are first annotated manually by keywords. It is then retrieved according to their annotations. [3] However this approach has following difficulties for e.g. it requires large amount of workers required to tag the entire database. It is possible that such manual annotations may introduce the inconsistency among different annotations in perceiving the same image. The problem is serious in case of real world applications where the size of the data is very large. The generalized manifold ranking approach suggested by Jingrui He, Mingjing Li, Hong-Jiang Zhang, Hanghang Tong and Changshui Zhang to tackle these issues. They have proposed general manifold ranking model which works better as compared to Support Vector Machine (SVM). [2] Bin Xu, Jiajun Bu, Chun Chen, Deng Cai, Xiaofei He, Wei Liu and Jiebo Luo extended previous work by addressing issues in manifold ranking by two ways in terms of graph construction and computation of ranking score. Wei Liu applied the idea of large graph construction for semi-supervised approach. He showed anchor graph works well as compared to traditional KNN strategy. [5] Xue-Qi Cheng, Pan Du, Jiafeng Guo, Xiaofei Zhu and Yixin Chen suggested the concept of sink points in manifold ranking. They covered relevance along with diversity in raking. They converted ranked objects (points) into sink points preventing redundant objects from receiving higher rank. They applied this approach to query recommendation and update summarization tasks. We revisit existing manifold ranking algorithm which we are using a base point for our proposed work. Manifold Ranking (MR) In MRBIR technique relevance between the query image and database images is evaluated by using the relationship of all the data points present in the feature space. Manifold Ranking considers each unlabeled image as a vertex point in a weighted graph. It will propagate the ranking score from labeled examples to query image.

A.Manifold Ranking Algorithm [3] 1. Calculate the nearest neighbors for each point; connect two points with an edge if they are neighbors.

2. Form the affinity matrix **W** defined by

$$W_{ij} = e^{(-d(x_i,x_j)/2\sigma^2)}$$

If there is an edge linking betweenX_I and X_J. Let

$$W_{ii} = 0$$

3 .Symmetrically normalize by $S = D^{-1/2}WD^{-1/2}$ in which is the diagonal matrix with –element equal to the sum of the

the sum of the i th row of W

4.Let f(0) is a zero vector. Iterate $f(t+1) = \alpha Sf(t) + (1-\alpha)y$ until convergence, where is a parameter in [0, 1).

5. Let denote the ith component of the limit of the Sequence . Rank each point according to its ranking scores (largest ranked first).

$\{f(t)\}$ Rank each point X_i according to its ranking scores (largest ranked first).

B. Procedure

[2] Given a set of points $X = \{X_1, X_2, \ldots, X_n\} \subset R^m$, Where the first q points are the queries which form the query set and the rest of the points are to be ranked according to their relevance to the query point. Let $d: X * X \rightarrow R$ denotes a metric X which assigns to each pair of Points and a distance $d(X_i, X_j)$ and $f: X \rightarrow R$ denote a ranking function which assigns each point X_i a ranking score f_i to form the vector $y = [y_1, \ldots, y_n]^T$ f. We define a vector in which $y_i = 1$ if X_i if is a query and $y_i = 0$ otherwise

Step in Given Algorithm	Significance
1	Construction of a connected network
2	Assignment of weight values to the nodes in a network
3	Symmetrically normalize the network to obtain the convergence
4	Spread the ranking scores to the neighborhood points in a network and repeat the process until global state is reached
5	Ranking of points in a network according to their final ranking scores

Table 2.1: steps to construct a manifold ranked connected network

3.1 K_0 : Number of nearest neighbors between which an edge should be put.

3.2 σ : Width of the kernel for defining the edge weight. By using iteration scheme we get, $r(t+1) = \alpha S r(t) + (1-\alpha) y$

Each vertex point (data point) obtains information from its neighboring points and keeps its initial information. The iteration process is repeated until convergence condition is obtained. When manifold ranking is applied to image retrieval after applying a query image given by the user we can use the closed form or iteration scheme to compute the ranking score for each point. The ranking score can be viewed as a metric. This is more meaningful to measure the semantic relevance.

C. Problems

1. Manifold Ranking is used when a query image is in a database. It considers a query image as one of the vertex point in the graph construction process.

2. When the query image is not in the database it is difficult task for Manifold Ranking to spread its ranking score to images in the database. In real world applications the query image is provided by the user may not be present in the database. Efficient Manifold Ranking [1, 2] The problems in original manifold ranking method are handled from two main aspects: 1. Scalable graph construction It is identified that the graph construction cost is in proportion with the graph size. It means that for each data point it is not possible to

search the whole database as per the kNN strategy. Instead of using KNN strategy anchor graph is constructed.

2. Efficient ranking computation Now we consider a data set

$X = \{x_1, x_2, \dots \dots, x_n\} \in R^m$ with n samples in m dimensions. And an anchor set,
$U = \{u_1, u_2, \dots \dots, u_n\} \in R^m$

Anchor set shares the same space with the data set. Let $f: X \rightarrow R$ be a real valued function which assigns a semantic label to every data point in . We then try to find a weight matrix $Z \in R^{d*n}$ which measures the potential relationships between data points in and anchor points in U. It is used to estimate $f(x)$ for each data point as a weighted average of the labels present on the anchor points

$$f(x_i) = \sum_{k=1}^{d} Z_{ki} f(u_k)$$

With the constraints $\sum_{k=1}^{d} Z_{ki} = 1$ and $Z_{ki} \geq 0$. . Element Z_{ki} represents the weight between data point and anchor point . The key point in the anchor graph construction is computation of the weight vector Z_i for each data point X_i . In this graph construction we have to consider following issues.

1. The quality of the weight vector

2. The computation cost.

Once the construction of graph completed, the main computational cost for manifold ranking is the matrix inversion phase a shown in equation whose complexity is Therefore the iteration algorithm is inefficient for large scale retrieval. We have identified following key points about ranking models Manifold Ranking and Enhanced Manifold Ranking respectively. [1, 2]

Manifold Ranking Model:

1. Manifold Ranking creates a kNN graph for each data sample. It calculates the relationships to its knearest neighbours.

2. In the ranking computation step the important part is to perform the matrix inversion operation.

Enhanced Manifold Ranking Model:

1. EMR step creates an anchor graph for each data sample. It calculates the relationships to its snearest anchors. Anchor point can be selected using k-means method.
2. The ranking computation stage performed at reduced complexity.

III. PROPOSED WORK

We propose removal of the problem of the ambiguity in manifold Ranking technique. This solution works on future enhancement with added accuracy. The system deals with the ambiguity problem. Ambiguity is the middle vision stage in visual processing that provides incorrect retrieval

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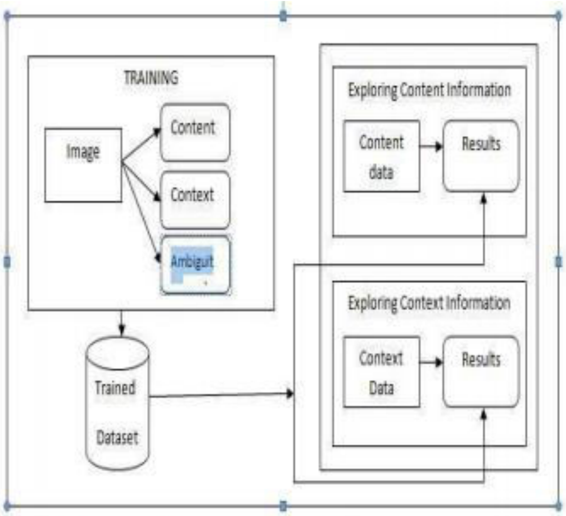

Figure 3.1: Architecture of proposed system

A.Advantages of proposed system

We have identified that our proposed model deals with issues present in the EMR model. We have listed down following advantages of proposed work.

1. It is possible to perform out of sample retrieval on a large scale database efficiently in a shorter time period. So the proposed approach can efficiently handle the new sample image as a query image for retrieval.

2. The proposed method gives a way to deal with the ambiguity present in the system.

B. Implementation Steps

1. We extract low level features of images in a database and use them as coordinates of data points in the graph.

2. We select representative anchor points and construct the weight matrix Z by kernel regression with small neighborhood size s. 3. The user uploads an image as a query. We extract its low level features and update the weight matrix Z.

4. We combine image features and tag information to compute ranking score given by equation

$$r^* = (I_n - \alpha H^T H)^{-1} y$$

5. Images with highest ranking score are selected as most relevant image(s) to given query image and return to the user.

IV. RESULTS AND CONCLUSIONS

We have collected images for five categories i.e. beach, boat, cherry, crater, sunset. We have considered that images in the same category belong to the same semantic concept. It means that images from the same category are judged relevant and otherwise irrelevant. We use each image as a query for testing the in-sample retrieval performance. We have extracted colour features for learning semantic concept. The results for retrieval performance are as shown in Figure 4.1

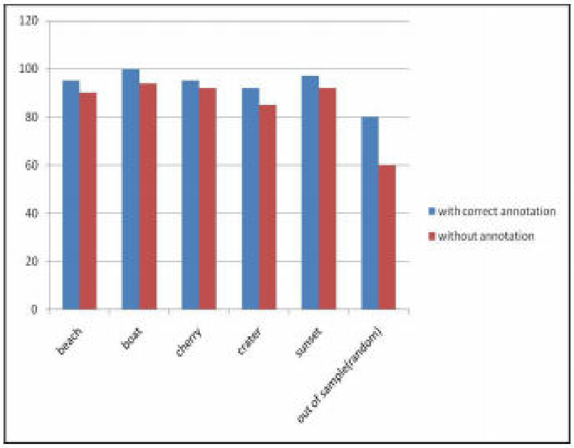

Figure 4.1: Showing the results of proposed Retrieval System

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The Efficient Manifold Ranking algorithm extends the original manifold ranking model to handle scalable data sets. The application of EMR to a content based image retrieval used for real world image databases. Our proposed method deals with resolution of ambiguity present in Image Retrieval. It tries to reduce computational complexity and decides a strategy about an anchor graph construction.

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