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Re-ranking of Images using Semantic Signatures with Duplicate Images Removal & K-means clustering

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Abstract: Image Search engines mostly use keywords and they rely on surrounding text for searching images. Ambiguity of query images is hard to describe accurately by using keywords.Eg:Apple is query keyword then categories can be "red apple","apple laptop" etc.Another challenge is without online training low level features may not well co-relate with high level semantic meanings. Low-level features are sometimes inconsistent with visual perception. The visual and textual features of images are then projected into their related semantic spaces to get semantic signatures. In online stage images are re-ranked by comparing semantic signatures obtained from semantic space obtained from query keywords. Semantic space of a query keyword can be described by just 20 – 30 concepts (also referred as "reference classes").
Keywords: K-Means Algorithm, Semantic Signatures, Canny Edge Detection

1. INTRODUCTION

In this paper, a novel framework is proposed for web image re-ranking. Instead of manually defining a universal concept dictionary, it learns different semantic spaces for different query keywords individually and automatically. Fig 1 shows traditional framework of Re-ranking of images.

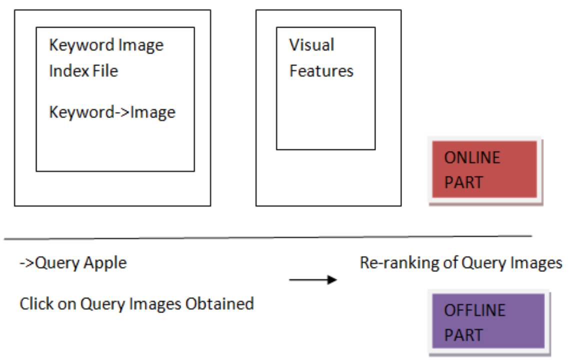

Figure 1: Traditional Approach of Re-ranking Images

The semantic space related to the images to be re-ranked can be significantly narrowed down by the query keyword provided by the user. For example, if the query keyword is "apple", the concepts of "mountain" and "Paris" are irrelevant and should be excluded. "Computer" and "Fruit" will be dimensions to learn semantic space for query keyword "apple". Visual and textual features are projected into semantic spaces to obtain semantic signatures. Images are re-ranked by comparing their semantic signatures with semantic signatures obtained from semantic spaces obtained from query keyword. This paper uses a clustering method called K-means to classify dataset into k-clusters. Clustering is the process of partitioning or grouping a given set of patterns into disjoint clusters. This paper will use one of the clustering methods called K-means. We do that by looking for keywords in the user profile (the learner's context of interest) to help in specifying the intending meaning. Because the target meaning is "computer program language", we look for slave words in the user profile that best fit this specific meaning words such as "computer", "program","awt", "application", and "swing". Content-Based Image Retrieval (CBIR) refers to image retrieval system that is based on visual properties of image objects rather than textual annotation. Contents of an image can be of various forms like, texture, color and shape etc. In this work, shape is selected as a primary feature in indexing the image database. CBIR is more robust and makes it easier for image retrieval.

2. MOTIVATION

Rasiwasia et al. [12] mapped visual features to a universal concept dictionary for image retrieval.Prakash and Parikh used attributes to guide active learning. Farhadi et al. [11] learned part and attribute detectors which were shared across categories and modelled the correlation. Kuo et al. [2] recently augmented each image with relevant semantic features through propagation over a visual graph and a textual graph which were correlated. Sharmanska et al. augmented this representation with additional dimensions and allowed a smooth transition between zero-shot learning, unsupervised training and supervised training. Parikh and Grauman proposed relative attributes to indicate the strength of an attribute in an image with respect to other images. Cui et al. [6], classified query images into eight predefined intention categories and gave different feature weighting schemes to different types of query images.

3. METHODOLOGY

Algorithm:-

1. There are 2 parts online and offline parts.
2. In online stage reference classes representing different concepts related to query keywords are automatically discovered. For a query keyword (e.g. "apple"), a set of most relevant keyword expansions (such as "red apple" and "apple macbook") are automatically selected utilizing both textual and visual information.

3. Set of keyword Expansions define reference classes for different keywords.

4. A multi class classifier is trained on training set of reference classes.

5. If there are k types of visual and textual features like color, shape, texture we can combine them to train single classifier.

6. At online stage pool of images are retrieved according to query keyword. Once user chooses query image semantic signatures are used to compute similarities of image with pre-computed semantic signatures.

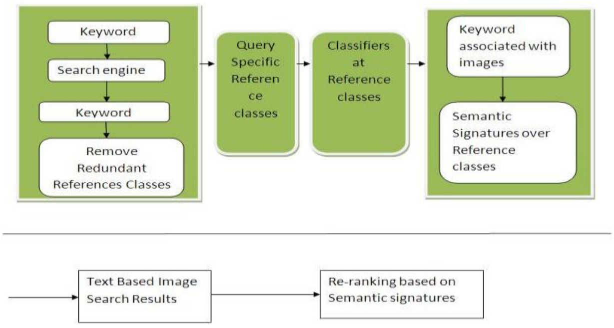

Figure 2: Semantic Approach of Re-ranking of Images

4.KMEANS ALGORITHM FOR CLUSTERING OF IMAGES

4.1 K-Means Algorithm Properties

- There are always K clusters.[19]
- There is always at least one item in each cluster.
- The clusters are non-hierarchical and they do not overlap.
- Every member of a cluster is closer to its cluster than any other cluster because closeness does not always involve the 'center' of clusters.

4.2 The K-Means Algorithm Process

- The dataset is partitioned into K clusters and the data points are randomly assigned to the clusters resulting in clusters that have roughly the same number of data points.
- For each data point:
  - Calculate the distance from the data point to each cluster.
  - If the data point is closest to its own cluster, leave it where it is. If the data point is not closest to its own cluster, move it into the closest cluster.
- Repeat the above step until a complete pass through all the data points results in no data point moving from one cluster to another. At this point the clusters are stable and the clustering process ends.
- The choice of initial partition can greatly affect the final clusters that result, in terms of inter-cluster and intra cluster distances and cohesion.

4.3. K-means algorithm

1) Select K points for initial group centroids.
2) Each object is assigned to the group that has the closest distance to the centroid.
3) After all objects have been assigned, recalculate the positions of the K centroids.
4) Steps 2 and 3 are repeated until the centroids no longer move. This produces a separation of the objects into groups from which the metric to be minimized can be calculated.

5. DUPLICATION IMAGE DETECTION

A duplicate image detection system generates an image table that maps hash codes of images to their corresponding images. The image table may group images according to their group identifiers generated from the most significant elements of hash codes based on significance of elements representing an image. The image table thus segregates images by their group identifiers. To detect a duplicate image of a target image, the detection system generates a target hash code for target image. The detection system then selects the images associated with those similar hash codes as being duplicates of the target image. Duplicate Detection done during image upload phase.

6. ONE CLICK INTENT BASED SEARCH

6.1 Introduction

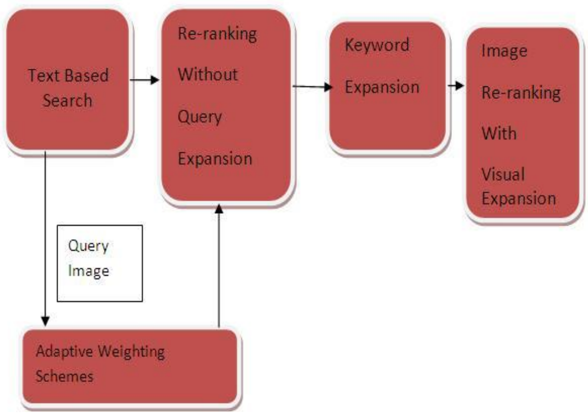

Fig. 4 Flowchart of one click Image Search

7.1. Steps of Algorithm:

1. Adaptive weight categories are used to category query image which reflect user’s search intention at a coarse level.
2. Query keywords are expanded to capture user intention based on the visual content of the query image selected by the user and through image clustering.
3. Expanded keywords are used to enlarge the image pool to contain more relevant images.
4. Expanded keywords are also used to expand the query image to multiple positive visual examples from which new query specific visual and textual similarity metrics are learned to further improve content-based image re-ranking.

CONCLUSION & FUTURE WORK

A unique re-ranking framework is proposed for image search on internet in which only only one-click as feedback by user. Specific intention weight schema is used proposed to combine visual features and visual similarities which are adaptive to query image are used. The feedback of humans is reduced by integrating visual and textual similarities which are compared for more efficient image re-ranking. User has only to do one click on image, based on which re-ranking is done. Also duplication of images is detected and removed by comparing hash codes. Image content can be compactly represented in form of hash code. Specific query semantic spaces are used to get more improved re-ranking of image. Features are projected into semantic spaces which are learned by expansion of keywords.

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RESULTS AND DISCUSSIONS

The project is having many stages given below:-
1) Image uploading
2) Keyword search
3) Keyword expansion
4) Semantic search
5) Query categorization
6) Visual Query Expansion
7) Re-ranking Results

SNAPSHOTS OF SEMANTIC SEARCH

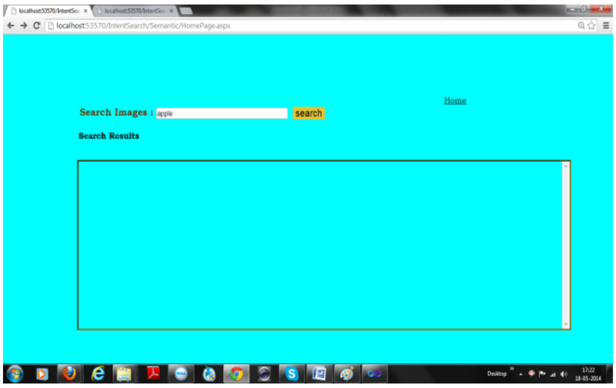

Fig. 5 Search Window

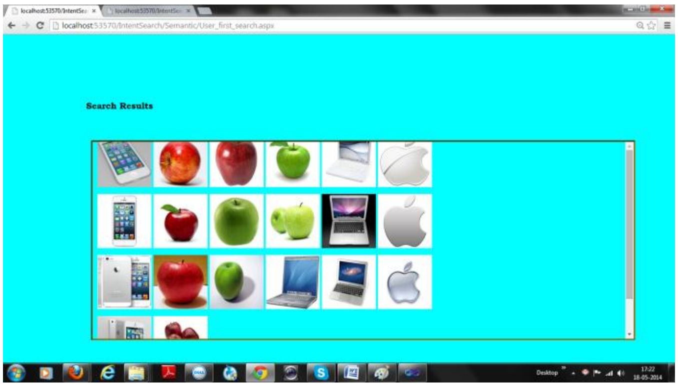

Fig. 6 Search using semantic signatures

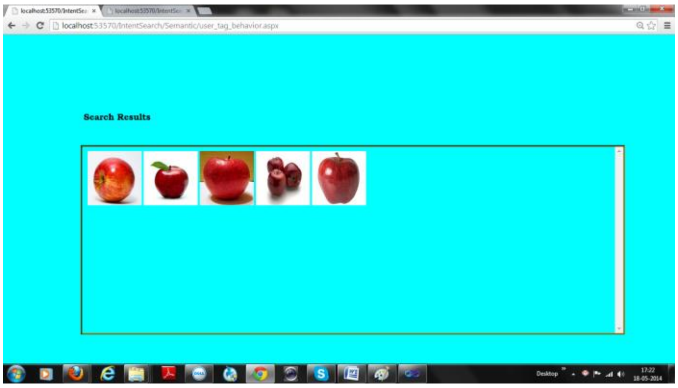

Fig. 7 Search Results for red apple

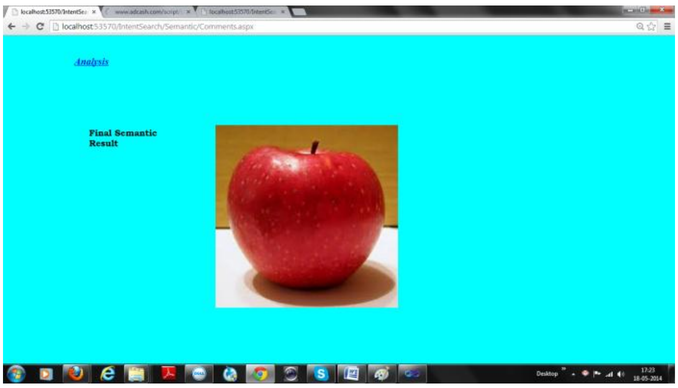

Fig. 8 Constructed Final Results

Intent Based Search

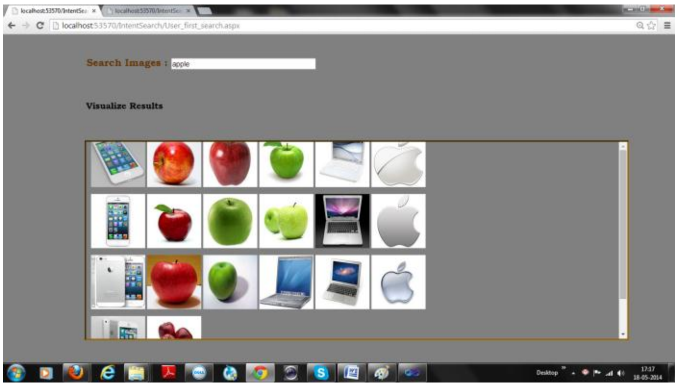

Fig.9 Search Results for Keyword “apple”

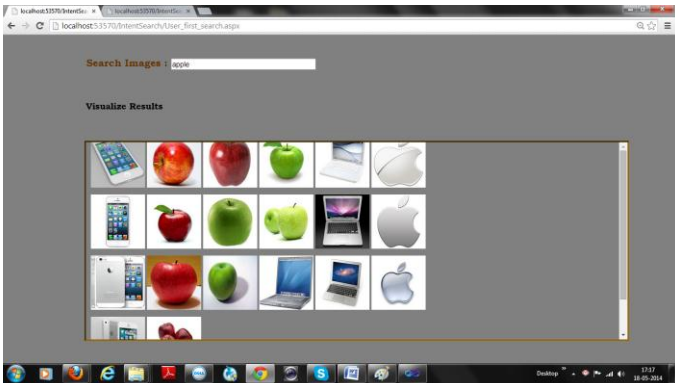

Fig.10 Visualize Results

Fig. 11 Final Results

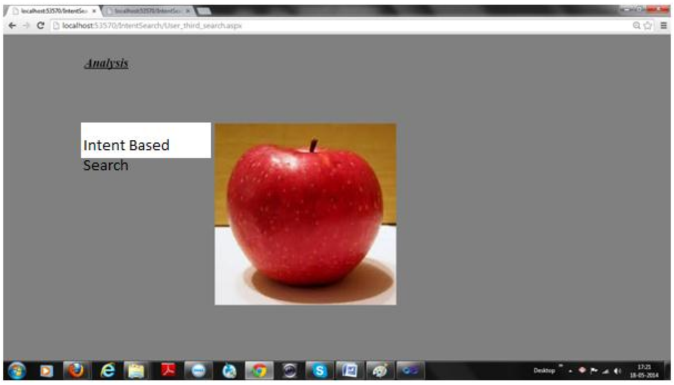

Fig.12 Final Intent Based Search

COMPARISON OF 2 APPROACHES

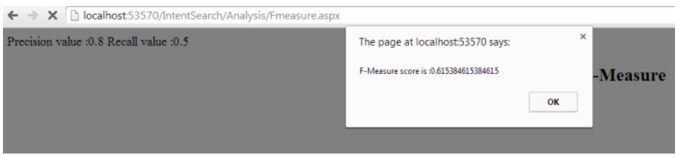

Fig. 13 FMeasure of Semantic Search

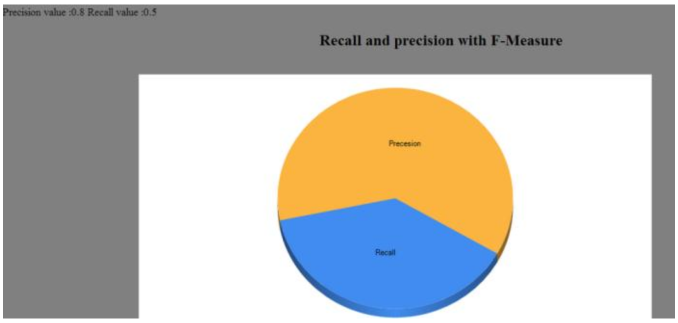

Fig. 14 Recall and Precision of Semantic Search

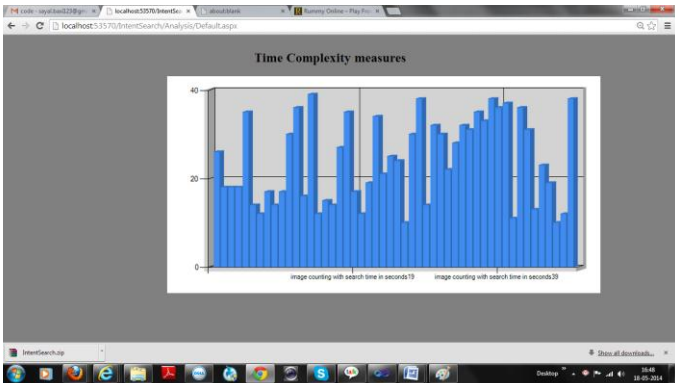

Fig. 15 Time Complexity of both Approaches

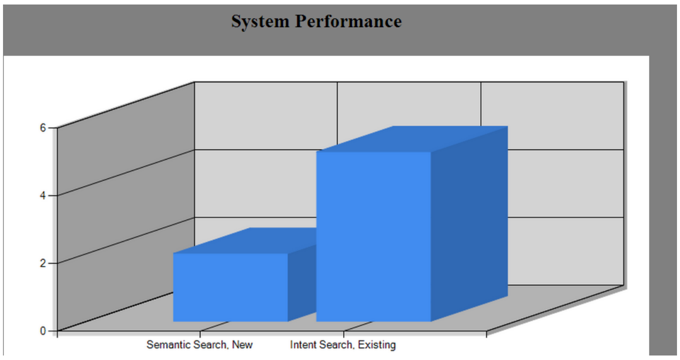

Fig. 16 SYSTEM PERFORMANCE

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