Image Retrieval on Mobile Device: An Overview

[1]Lalit B. Damahe, [2]Nileshsingh V. Thakur

[1]Department of Computer Technology Yeshwantrao Chavan College of Engineering Nagpur, India
[2]Principal Nagpur Institute of Technology Nagpur, India
damahe_l@rediffmail.com[1], [2]thakurnisvis@rediffmail.com[2]

***Abstract*--Query requesting for the retrieval of similar data normally performed by the personal computer. As the number of mobile user increasing day by day, increasing the retrieval of visually similar images, search by user on mobile device i.e. smart phone, PDA or on internet. This paper gives the brief overview of image retrieval performed on such mobile devices. Retrieval on mobile devises is discussed and observations are summarizing into tabular form. Different Evaluation parameters i.e. precision, recall, latency are also discussed and finally it conclude with future scope**

Keywords— Mobile Image Retrieval, Feature extraction, Compression

I. INTRODUCTION

Content based image retrieval for personal computer is a broader and intense area from the last decade and from these point of view researchers contributing a lot. The article present by the R. Datta et al. [1] broadly classifies the user from three perspective, browser, surfer and searcher. As the user browsing the picture he or she is having a no clear end goal, surfer having the moderate clarity of end goal, but searcher having the clarity of end goal. A searcher session for finding information is very short and intends to search for specific information. As the generation moving towards the era of mobile technology, end user browse and surf information through these devises. This not only saves the time of the user but also accessing the information from any location. The objective of information retrieval from searcher perspective is to find valid and similar information in minimum time or latency. The new multimedia devises like mobile phones and personal digital assistant (PDA) combined with the internet technology provide the new forms of sharing of multimedia. The people can annotate/index their multimedia context/content that can later be used for searching though mobile device locally as shown in Fig. 1 or globally i.e. server. The metadata can be automatically generated from the image like location, time, date, and username [2, 3] can be used for the annotation.

As the mobile industry perform the exceptional changes in devises and telecommunication, mobile equipped with camera work as a smart cell and wireless network service 3G [4] offer higher bandwidth. This demand the accessing

Figure 1: Retrieval on Mobile Device

and storing of digital media from mobile itself or the server which is located at the remote location. So the accessing/storing specified and similar data required more processing power for the mobile devices. Hence to minimized the time and power required to compute, needs efficient searching mechanism which requires less computation i.e. power.

The rest of the paper is organized as follows: Section 2 discussed the existing work on mobile image retrieval and its summary with some observations, Section 3 presenting the evolution parameters of mobile image retrieval. Finally Section 4 concludes with some future directions.

II. RELATED WORK

Literature are available for mobile based image retrieval and existing contribution mainly focusing on the feature selection approaches and it manly includes the metadata, color shape and texture. Important work on image retrieval on mobile device using the metadata [5-7] is the good alternative. Hence different features as a color space histogram and gray level co-occurrence matrix [5-13] is presented .Most of the literatures are based on feature selection and low level feature like Color, shape and texture, selection approach [14-16]is discussed . Combining the features using hybrid approach [2-18] is also give the promising results. Invariant feature selection like SIFT, SURF, CHoG and, BoF [19-20] with and without Compression is a good alternative. Summarized analysis is presented in Table 1

TABLE I. SUMMARY OF MOBILE IMAGE RETRIEVAL

Ref. No.	Retrieval Device	Feature Extract	Remark
[5]	Nokia 6630 and Nokia 6620	Histogram of color and GLCM	• No feature Compression • Used Java enabled Tomcat Web Server • MIDP
[21]	Nokia 6630	Histogram of color and GLCM	• No feature Compression • PQ reduced retrieval time. It requires less memory but consume lot power.
[8]	NOKIA 9500	Histogram of color and GLCM	• No feature Compression. • Retrieve images send to client.
[9]	Nokia 6630	Histogram of color	• No feature Compression • This work is based on Symbian OS.
[10]	NOKIA 9500	Histogram of color	• No feature Compression • PQ performed on subset of database
[6]	Mobile	Histogram of color and GLCM	• No feature Compression • Suitable for various range of mobile devices
[11]	N93and N95	Histogram of color and GLCM+MFCC	• No feature Compression • Used Interactive query with Hierarchical Cellular Tree
[12]	Nokia N95 Nokia 5800	Histogram of color and GLCM	• No feature Compression • Query path is formed over the cluster.
[13]	N5800 N95	Histogram of color and GLCM	• No feature Compression • Used CMD architecture which support for Interactive Query.
[17]	Nokia 3650	DFT of image and Wavelet Decomposition	• No feature Compression • Web based application based on Principal Component
[14]	PDA & PHS	Color and shape	• No feature Compression • Deformed images are used for Evaluation.
[22]	HP – PDA	Not Specified	• No feature Compression • Used selective loading of features.
[2]	Nokia 3650	Metadata, Color histogram, and Texture.	• No feature Compression • Used Symbian 6.1
[19]	HP h5550-pocket PC	SIFT	• No feature Compression • Suitable for change in Intensity and degraded images • Used 2 stage ranking.
[18]	3G-Phone	Color blobs-histogram	• No feature Compression • Use lookup table for mapping. Image is represented by set of features.
[23]	Samsang - SPH-m 4650	3-Histogram of Color, X and Y Co-ordinate	• No feature Compression • Lookup table based feature extraction
[3]	HTC touch smart phone	Metadata of location ,date, time ,user and For Audio-10 MFCC	• No feature Compression • Searching takes Time
[24]	Mobile	SURF	• feature Compression using Runlength encoding • Pruning using optimize algorithm.
[25]	Mobile	RGB histogram, Gabor filter, EXIF data and Time	• No feature Compression • Perform onboard image indexing

[16]	PDA	Shape, color ,and GLCM	• No feature Compression • MATLAB based Implementation. • Translation, scale and rotation invariant.
[26]	Nokia 5800	NA	• Searching through oracle proprietary search function
[20]	Cell phone and DG CAM	SIFT	• Used Geometric consistent rotation • Re-ranking.
[7]	Mobile	Histogram Bag of Feature Vector	• Compression is applied on Features • MHVT is used.

Small amount of computational power, less memory and telecommunication bandwidth posing a significant challenge for performing the image retrieval on mobile devises. From the studied literature it is analyzed and found that the retrieval is performed using different types of approaches. The general classifications of approaches are Text, Image, Audio and Hybrid is discussed in next section.

a) *Text approach:-* Normally used metadata (location, date, time , user etc.) for tagging and classifying the images.

b) *Image approach:-* Normally used image feature or feature set to index and classify the images.

c) *Audio approach:-* Normally used audio feature like Audio-Mel frequency cepstral coefficient (MFCC) for tagging and classifying the images.

d) *Hybrid approach:-*Normally used combination of Text feature/feature set, image feature/feature set audio feature to index and classify the images.

III. PERFORMANCE EVALUATION PARAMETERS

The query size affects on the performance of retrieval rate of the image. Similarly efficient query having a good matching accuracy. When it considers the client-server approach for the purpose of similarity search, it has to be maintained efficient query with minimum size.

A. Matching accuracy:

Requested query may result in retrieval of images but the retrieval image depends upon the accuracy of matching the image. Accuracy can be evaluated on the basis of following two parameters.

a) *Precision :* The percentage of retrieved images that are relevant to the query.

b) *Recall:-* The percentage of all the relevant images in the database, which are retrieved.

B. Processing Latency:

It refers to the total time required to display the output on mobile device. Network latency and Server latency is completely eliminated while searching the desired output at local level but it limiting the searching scope at global level. Different types of latency exist for the searching and display similar types of images patterns on mobile device i.e. client, server, network.

a) *Client latency*:-Time required to process/send the query and display the result.

b) *Sever latency:-* Time required to process and send the result to client

c) *Network latency:-* Time required to send the query and receive the result. Normally depend upon the bandwidth capacity and number of bits transmitted over the network.

IV. CONCLUSION AND FUTURE SCOPE

Image retrieval is important for the desktop system and almost used in many application areas and if retrieval extended towards the mobility performance is the issue. The findings from the studied literature is , to improve the performance of retrieval, selection of features matters and possibly more no. of features improve the performance. The addition of more no. of features increases the time to retrieve but improve accuracy. The performance of the system is evaluated using precision, and recall. Future direction needs to investigate the fusion of more no. of features, and feature-compression.

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