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Mobile Image Offloading Using Cloud Computing

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ABSTRACT: The usage of mobile phones has increased rapidly in recent years. With an increase in usage of mobile device users have started expecting that their mobile device performs the execution similar to a desktop device. With limited processing power and memory, executing computationally intensive tasks becomes difficult. With Computation offloading energy can be saved by offloading some or whole computational intensive task from a mobile device (low in resources) to run on a remote cloud (resourceful machine). This research presents mobile image offloading in which images are automatically tagged before uploading it into the cloud. Automatic Image Annotation saves human effort in tagging the images as compared to manually tag the images. For efficient and quick retrieval of images, Intent Based Searching Algorithm is proposed which retrieves the desired image requested by the user on their mobile phone with just a single click in quick time. Our result shows that performing Intent based search to retrieve desired image from remote cloud is convenient, and provides faster results compared to searching it locally on a mobile phone.

KEYWORDS: Computation Offloading, Intent based searching Algorithm, Image Annotation

I. INTRODUCTION

In this mobile era, the usage of mobile phones is not restricted to just call and SMS, users have also started using it for various purposes such as a camera, as an editor, or it may be for playing games. Most of these cell phones have a feature of taking images and are equipped with cameras and can store thousands of images. With such large image collections, accessing specific sets of images from the collection is a difficult task. Also, our phones and tablets are in our hands most of the time, they can be easily damaged by being dropped or, even being out of our hands, they can get lost or stolen. We can't afford to lose any data since we do a lot of work using our mobile phones, thereby saving lot of information on our mobile phones. By uploading the important information to remote cloud, we can rest assured that the data is safe in the cloud and can be made available by bringing it back to our mobile phones in case one of these catastrophes occurs.

The computationally intensive task cannot run on mobile phones due to drawback associated with mobile phones such as limited memory and computing capability. Running computational intensive task on the mobile phones, unfortunately requires more processing power, thereby draining battery at a faster rate. Offloading is a method to enhance the capabilities of a mobile phone by offloading computation to more resourceful machines [5]. Improvements in cloud computing, virtualization technique have shifted the direction of offloading. These developments have made computation offloading more sensible. Computation offloading provides a method to save energy in which some of the application software components can be offloaded from mobile device to run on a remote cloud.

In the rest of the paper, we first review related research work on different techniques of computational offloading in Section II. Then we describe an image offloading mechanism and proposed Intent based searching Algorithm in detail (Section III). We present our implementation result in section IV. Finally, draw conclusions in section V.

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II. RELATED WORK

Several approaches have been proposed for offloading applications from a Smartphone to the cloud, which includes offloading the complete application or offloading an application partially. Related work in the field of offloading applications for Android phones to the cloud has been discussed below.

Alexey Rudenko et al. [1] proposed a mechanism to increase the life of a laptop battery through remote processing of power consuming tasks. They proposed that the battery lifetime of a laptop can be extended by offloading the power consuming tasks onto a server through the internet or wireless connectivity. The more resourceful server will perform the computation as required and will send the results to the laptop thereby saving the laptop from consuming more power and will continue in performing less power consuming task. These researches lead to a new idea of remote processing of power consuming tasks of the smart phones using the cloud computing resources.

Byung Gon Chun and Petros Maniatis [2] proposed augmenting smart phone applications through clone cloud execution. A clone is a virtual machine (VM) on the cloud that runs an operating system and performs the computation. This research proposed to offload an application moderately or fully to a clone.

Kumar et al. [3], [5] suggested various approaches of saving energy. There are four basic approaches to save energy and extending battery lifetime in mobile devices and they are (i) Adopt a new generation of semiconductor technology (ii) Avoid wasting energy (iii) execute program slowly (iv) Eliminate computation altogether through offloading. Amongst all the solution discussed the best choice was to offload the computation from mobile devices into the cloud in which computation is not performed on a mobile device rather it is done on cloud end to reduce execution time, and increase in data storage capacity & increase in processing power.

Another system named MAUI was proposed by Eduardo Cuervo et.al. [4] .MAUI supports fine-grained code offloading scheme and creates two versions of the application. One version of MAUI performs remotely on cloud and another version works locally on the Smartphone. MAUI provides an advantage as it makes decisions during runtime, whether methods should be executed remotely or it should be executed locally.

Dejan et al. [6] in his paper proposed MACS framework and implemented results using two different use case phone applications. The first application implemented N-Queens Problem and second application implemented face detection and recognition of video files. The video file was processed with OpenCV and FFmpeg libraries. The result proved that offloading the computation from mobile devices into cloud saves around 95% of energy of mobile devices through task distribution.

III. IMAGE OFFLOADING MECHANISM

The Image offloading mechanism is divided into 2 phases:
i) Image Uploading ii) Image Searching and retrieval

A. *Image Uploading*

An efficient way to upload the images to the cloud is proposed by manually or automatically tagging the images and also to download images specific to the user's query based on the user's intention.

The first phase in image offloading is to upload images from the user's mobile phone to the cloud through an android application where the user selects the image to be uploaded.

In order to ensure the retrieval of the images at the time of downloading, Meta data such as keywords or description is added to the images so that retrieval of the images can be performed on annotation words. Manual image annotation is time consuming, expensive, unreliable and inconsistent. It is not easy for an annotator to remember the tags given to each and every image that is uploaded. Therefore, Automatic Image Annotation solves the problem. Several auto tagging API's are available. Here we have used clarifai's image tagging API [13] which automatically generates tags based on images sent. With just a simple GET request sent to clarifai's auto-tagging endpoint returns numerous tags describing the photo. The complete flow of uploading is shown in Fig. 1.

Once the image is uploaded the next phase is the retrieval of an image of the remote cloud. Image Retrieval is the process of searching and retrieving images from a large dataset. Success of image retrieval lies in retrieving correct images from a set of images in less time and as per user's intention.

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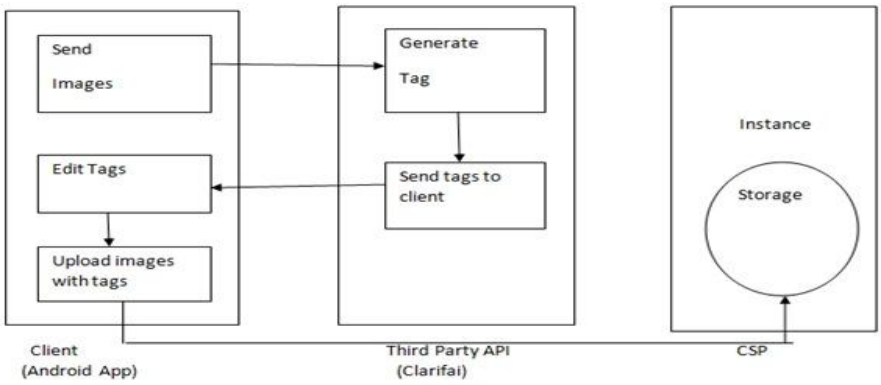

Fig. 1. Flow diagram of uploading images from Android mobile phones to remote cloud

It might be possible that the tag generated from an API may be a noisy tag. To overcome this problem the android application also provides the option to edit, delete or even add the tags as per user's expectation so that desired tags along with images can be stored at the cloud end.

B. *Image Searching and retrieval*

It is found that the keywords provided by users to search is found to be short. For example, the average length of a query of the top 1,000 queries of Picsearch is 1.368 words and 97% of them contain only one or two words [8]. Due to such short keywords entered by the user, the search engine returns thousand of images ranked by the keywords. Therefore, it leads to the retrieval of all the images related to those keywords, but it fails to retrieve the image as per user's expectation.

Figure 2 shows the top ranked images from an AOL image search using "palm" as a query. The search engine had returned the result based on query keyword "palm" out of which all the images returned were of "palm tree". Suppose the user intention was to retrieve the images of "hand, palm" the result could not show any images due to ambiguity associated with the word palm as meaning of word "palm" may be "hand palm" or "palm tree".

The user may not be aware about the requirement of giving exact keyword to get an accurate result. For example the user wanted to have an image of hand palm so instead of querying exact keyword of "hand palm" user had just given the tag of "palm" in the hope that search engines will give an exact result of "hand palm" but unfortunately search engine failed as per users' expectation and gave the result of "palm tree

To overcome the drawbacks associated with retrieving the correct images as faced by search engine, intent based searching algorithm is proposed which retrieves query image based on the user's intention from remote cloud. In order to solve the ambiguity, additional information has to be used to capture users' search intention. The algorithm is divided into three steps: Text query along with clustering, keyword expansion with visual query expansion and histogram matching.

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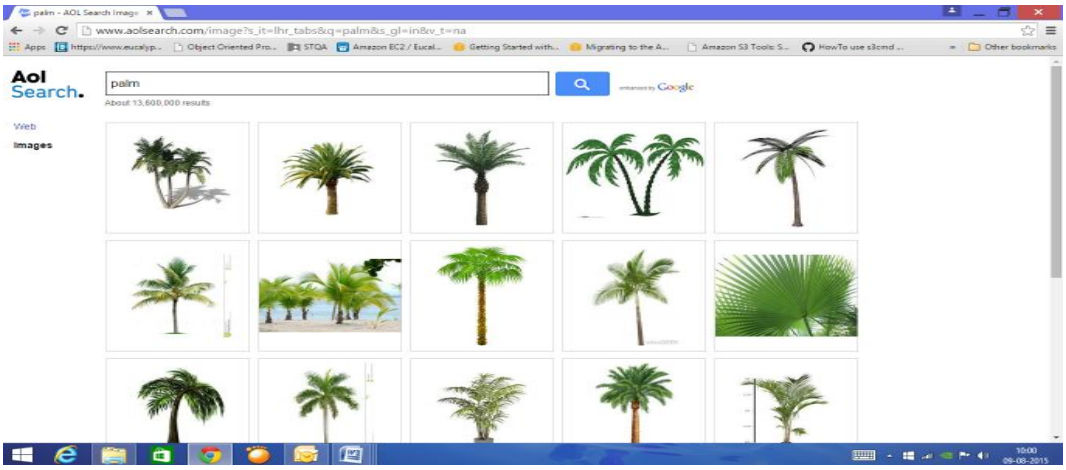

Fig. 2. The result obtained from the AOL search engine after query "palm".

C. *Intent Based Searching Algorithm:*

Figure 3 shows an example to illustrate the proposed algorithm. Intent based searching algorithm is as explained below:

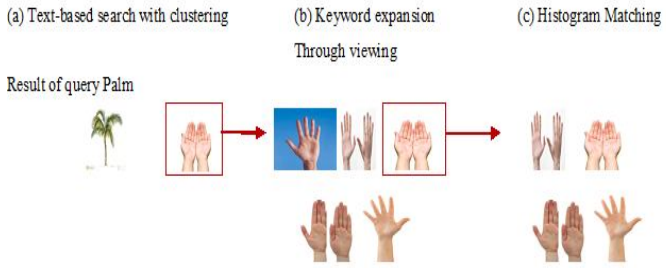

Fig. 3. Example to illustrate the algorithm.

Step1: Text based search along with clustering:

Initially a text query is given from the user's android phone for retrieving images based on users need by performing a tag based image search. All the images matching the tags are retrieved. To optimize search results and to avoid user's time in viewing many irrelevant images clustering of images is proposed. Clustering offers superior organization of images and provides the same information about the image as an entire image collection. Clustering is used for performing the mapping of images into groups.Due to clustering similar images are grouped and only distinct images are displayed thereby saving users time in viewing undesired images.

Here clustering is formed by comparing the tags associated with the images with the other tags present in the database. If the tag gets matched more than forty percent they are considered to be similar and cluster is formed. Clustering is required for faster searching and retrieving of images that are required.

As shown in the figure 3, the user has given a text query of palm to retrieve images of hand palm. Based on keyword palm the images are retrieved. All images here are not retrieved since the similar images are clustered and only a single image from a cluster is displayed as shown in figure 3.

Figure 4 shows our android implementation which displays unique images of keyword 'palm' instead of displaying all the images associated with that keyword.

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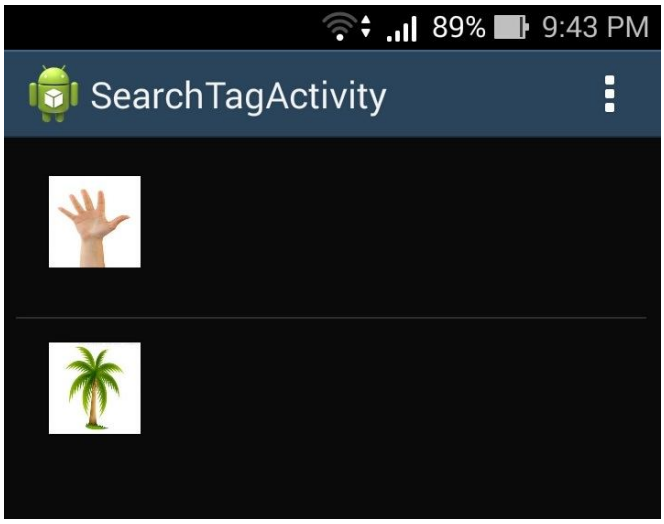

Fig. 4. Android implementation showing result of query "palm".

Step2: Keyword expansion through viewing:

The keyword here is expanded to get more relevant images. To get the desired images additional information is required to know the intention of the user. For example, to get the images of 'hand palm' just giving 'palm' as the query proves to be inefficient in retrieving desired images.

However, asking user to provide additional information will be an overhead. Therefore, keyword expansion is performed by viewing the images where the user has to click on any one the images and the tags associated with that image will be compared with other images and the images associated with matching tags will be displayed filtering the other irrelevant images.

As shown in the figure 3 the user clicks on the image of hand palm and all the images of hand palm is displayed filtering other irrelevant images of palm tree.

Step3: Histogram Matching:

Based on the resultant images of hand palm, histogram matching is done to further filter the result and display the exact image which user has expected based on query image. A histogram is a graph that represents all colors and level of occurrence in an image [9]. Few basic properties about an image can be retrieved from histogram. It is used as a threshold for screening an image.

Intent based search will ensure the correct retrieval of images without asking the user to enter exact and most desired keyword as a query to get the desired image.

D. Security Requirements of Cloud Computing:

The top most concern associated with cloud is security. The data security and privacy concerns rank top on almost all of the surveys. Cloud computing introduces another level of risk because essential services are often outsourced to a third party, making it harder to maintain data integrity and privacy.

Users are unaware about the location where data is stored and the mechanism used by the third party to safeguard user's data. Therefore, to safeguard user's data on the remote cloud, encrypting the data would be a good solution. Whatever is encrypted will remain unreadable to unauthorized viewers.

Here, Blowfish Algorithm is used to secure user image. As the user selects and uploads the image from android device, the image gets encrypted and gets uploaded to the instance of a cloud. Blowfish algorithm is selected as it has a better performance than other common encryption algorithms used [10]. It requires less time to perform and also Memory

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requirement is less. Therefore encrypting data for small embedded systems like mobile, smart card, etc. Blowfish is the best algorithm for security [11].

IV. RESULTS AND TESTING

As per 2013 InfoTrends Mobile Imaging User Survey [13], it was found that trend is shifting from digital cameras to camera phones. The usage of digital camera has reduced from 38% in year 2012 to 33% in the year 2013 while the usage of camera phones increased from 59% in 2012 to 64% in 2013.

A. *Experimental Evaluation of Offloading*

With an increase in the usage of camera phones, it becomes necessary to manage and retrieve desired images from mobile phones in a quick time. Fig. 7 shows the time taken to search a query image from mobile phones as compared to searching an image from a cloud instance using Intent based searching Algorithm.

B. *Setup of the Evaluation*

Hardware: -The hardware we are using in the evaluation is as follows. An ASUS Zenphone 5 mobile phone based on Android platform 4.4.2 is used in the evaluation. A desktop computer which includes Intel-i5 CPU installed with Eucalyptus cloud component acts as a cloud provider that can host the offloaded computation. Eucalyptus is open source software for building private and hybrid clouds compatible with Amazon Web Services APIs [7]. The details about the hardware components for the mobile device and Desktop computer are shown in Table 1.

Table 1. Hardware Components of Mobile Device and Desktop Computer

Hardware Component	Asus Zenphone 5	PC
Processor	1.6GHz dual-core	Intel-i5 Processor
Memory	2 GB	8 GB
WLAN	Wi-Fi 802.11 b/g	N/A
OS	Android 4.4.2	Centos 6 with Virtualization Enabled

C. *Result of the Use case:*

Here, the user was assigned a random image and was asked to find the desired image on their mobile phones and the average time was noted. This was repeated for four different data sets as shown in figure 7. The same query was given using keyword and results were retrieved by searching and retrieving an image from remote cloud using intent based search algorithm and time was calculated. The results clearly show that as the number of images on phones increases it becomes difficult for the user to search for a desired image on their mobile phones as shown in figure 7. It is time consuming, and inefficient to search for an image on a mobile phone if the number of images on a mobile phone is large.

For data set I where the user was asked to search for an image out of 50 images on a mobile phone manually and time was noted as shown in table 2. Similarly the same image was searched and retrieved from remote cloud using Intent based searching algorithm and the time was noted as shown in table 2.

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Table 2. Time taken (Sec) to search for an image on mobile VS remote cloud

Datasets	No of images	Time for Searching on mobile (Sec)	Time for searching on a remote cloud (Sec)
I	0-50	15.2	23.2
II	51- 100	35.0	32.0
III	101- 150	48.8	34.3
IV	151-200	65.9	37.1

Fig. 5 & 6 shows the time (ms) taken to search and retrieve the desired image as requested by user from remote cloud. The start represents the start time (ms) when the user requested for an image by entering a keyword to retrieve an image and end represents the time (ms) it took for searching and performing Intent based searching algorithm to retrieve the image back to the user's mobile phone. So the total time required is the end time- start time. The same process is repeated for a data set III & IV as shown in table 2

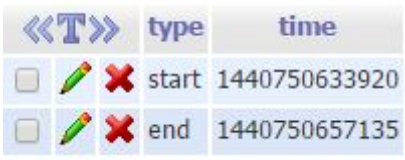

Fig. 5. Time (ms) taken to retrieve for data set I

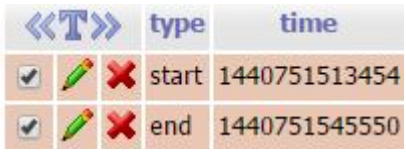

Fig. 6. Time (ms) taken to retrieve for a data set II

Figure 7 represents a performance comparison based on different data sets. X-axis represents the total number of images given to the user to search for a query image on a mobile phone and on the remote cloud whereas Y-axis represents the time taken (in Sec) to retrieve a desired image from mobile phones and on a remote cloud. The result verifies that retrieving a desired image using intent based search algorithms from remote cloud performs in a faster and efficient way as compared to searching for a mobile phone.

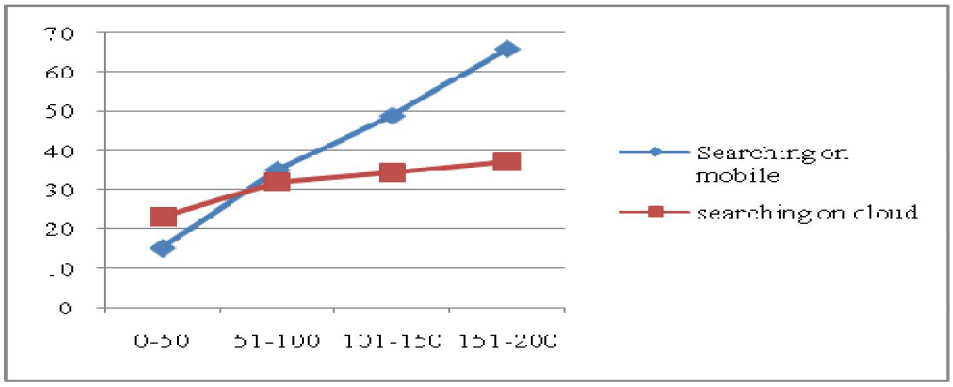

Fig. 7 Performance comparison based on different data sets.

V. CONCLUSION

The result shows that searching for an image locally on a mobile phone can be reduced if offloading is performed. With more images it becomes difficult for a user to search for a desired image on the mobile phone in quick time as compared to searching on a remote cloud.

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For retrieving an image from the cloud, Intent based searching algorithm is proposed which will retrieve desired images requested by the user from the cloud with a single click and as per user's intention. This will ensure faster searching and retrieving of images which the user is expecting.

In short, we have proposed a complete application which will provide storing, searching and retrieving of images in a convenient and efficient manner, thereby overcoming the limitations associated with mobile phones of limited processing speed, storage space and faster retrieval of the desired image.

REFERENCES

[1] A. Rudenko, P. Reither, G. J. Popek and G. H. Kuenning "*Saving portable computer battery power through remote process execution*", Mobile computing and Communications Review Newsletter, Vol. 2, no. 1, 19-26 (1998).
[2] B. G. Chun, P. Maniatis,"*Augmented Smartphone Applications Through Clone Cloud Execution*", 12th conference on Hot topics in operating systems, 8-8 (2009).
[3] K. Kumar and Y.-H. Lu, "*Cloud Computing for Mobile Users: Can Offloading Computation Save Energy*?" *vol. 43, no. 4, pp.* 51–56, April 2010.
[4] E. Cuervo, A.Balasubramanian, D.-k. Cho, A. Wolman, S. Saroiu,R. Chandra, and P. Bahl, "MAUI: Making Smartphones Last Longer with Code Offload," in *Proceedings of the 8th International Conference on Mobile Systems, Applications, and Services (ACM MobiSys '10). San Francisco, CA, USA: ACM, 2010*, pp. 49–62.
[5] Chintan Shah, Aruna Gawde, "*Service Based Offloading From Mobile Devices Into The Cloud"*, Proceedings of 6th IRAJ International Conference, 15th December 2013, Hyderabad, India. ISBN: 978-93-82702-47-4 .
[6] Dejan Kovachev, Tian Yu and Ralf Klamma, "*Adaptive Computation Offloading from Mobile Devices into the Cloud "*, *IEEE 2012.*
[7] https://www.eucalyptus.com/eucalyptus-cloud/iaas
[8] Xiaoou Tang, Ke Liu, Jingyu Cui, Fang Wen, and Xiaogang Wang, "*IntentSearch:Capturing User Intention for One-Click Internet Image Search*", in *IEEE transactions on pattern analysis and machine intelligence ,vol.34 no.7 year 2012.*
[9] A.Ramesh Kumar, D.saravanan," *Content Based Image Retrieval Using Color Histogram* ", International Journal of Computer Science and Information Technologies, Vol. 4 (2) , 2013, pp.242 – 245.
[10] Ms. Pallavi H.Dixit 1, Dr.Uttam L. Bombale 2 , Mr. Vinayak B.Patil, "*Comparative Implementation of Cryptographic Algorithms on ARM Platform*", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, Issue 10, October 2013 .
[11] Performance Analysis of Data Encryption Algorithms, www.cse.wustl.edu/~jain/cse567-06/ftp/encryption_perf/
[12] http://blog.infotrends.com/?tag=cam-era-phone
[13] Image Tagging API, online at www.clarifai.com