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Research Article

Factors in Re-Finding the Personal Photographs: Review and Possible Research Directions

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Abstract: Factors effecting re-find personal photographs are often difficult to define, given its inexpressible numbers. Literature review highlights the role of human behaviors in personal photographs lifecycle such as capturing, keeping, managing and re-finding personal photographs exaggeratedly without any progress to handle all factors and so forth. Moreover, personal photographs management systems are becoming widespread, which can help people to rapidly re-find their photographs that have been seen before. Yet some research gaps remain in these systems. This study aims to clarify most possible factors, which could influence re-finding personal photographs as with strengths and weaknesses points in existing photographs management systems. It also provides propose directions for future research in this domain. A review of existing studies highlights some gaps in the literature on the role of personal photographs lifecycle, which is followed by questions for future research. Given the richness of personal photographs re-finding domain, the authors believe that the proposed questions offer avenues for scholars to explore and develop greater understanding of the role of personal photographs lifecycle in difficulty of re-finding personal photographs. The authors acknowledge that there are certain limitations to this study, namely, focusing on the review of personal photographs and not on other forms of personal information. The review presents the role of personal photographs lifecycle and its use in the context of re-finding personal photographs. Finally, this study proposes only future research directions that are far from being exhaustive, rather than presenting experimental study results. Reviewing the current literature uncovers a number of gaps regarding the difficulty of re-finding personal photographs.

Keywords: Personal behavior, personal factors, personal information management, personal photographs lifecycle, photographs re-finding

INTRODUCTION

In the current global landscape, new technologies like digital video, digital cameras and mobile camera phones have made it easier to create a huge amount of personal photographs at an increasing pace. Moreover, the huge memory capacity of hard disks space encourages people to fill it up in these collections (Cohen, 2005; Whittaker *et al*., 2010; Bell *et al*., 2010). Consequently, people tend to keep and store too many photographs. However, when managing photographs, people tend to use basic methods, to organize and manage their photographs, which results in stacks of files (Kirk *et al*., 2006; Whittaker *et al*., 2010; Rodden and Wood, 2003). Despite the existence of desktop search engine, the re-finding process currently relies on manual methods such as; seeking or browsing as opposed to retrieve based on special keyword about the targeted photograph (Elsweiler, 2008). Dumais *et al*. (2003) have shown that, users rarely use desktop search engine query logs based on date. Moreover, the desktop search engine provides few other alternatives for people to indicate the information that they are looking for, such as; collections of photographs which has not been viewed for some time (Elsweiler *et al*., 2005). However, attempting to appreciate difficulty of re-finding personal photographs from such a viewpoint is obviously less than adequate for understanding personal photographs lifecycle such as capturing, keeping, managing and re-finding personal photographs.

Fundamental to the in-depth exploration of difficulty of re-finding personal photographs is the need for greater clarity of its significance and application in personal photographs retrieval domain. These include the impact of types of capturing photographs and the methods that people use to manage and re-finding them, role of amount personal photographs and the impact of classification and re-finding strategies, role of managing and maintaining strategies, browsing via searching strategies, role of human memory to remember specific metadata about the photographs and

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finally novice and expert people and their ability to re-find their personal photographs (Elsweiler *et al*., 2005; Kirk *et al*., 2006; Rodden and Wood, 2003; Whittaker *et al*., 2010; Jones, 2008; Whittaker, 2011). It is also widely recognized that scholars have shown that, re-finding personal photographs is a task which can be relatively straight-forward, but often, whoever, it can be extremely challenging, time-consuming and frustrating (Whittaker *et al*., 2010; Rodden and Wood, 2003; Kirk *et al*., 2006).

Many works has been done in the field of Personal Information Management (PIM), in order to understand user's behaviours, however, most of the researchers have focused on some aspects that make the process of re-finding photograph difficult (Elsweiler *et al*., 2011). This study aims to clarify most possible factors, which could have an impact to make re-find personal photographs difficult. Therefore, in this study, seven factors that could influence re-finding personal photographs are discussed followed by the importance to grip all of them, by discussing current human behaviors in capturing, keeping, managing and re-finding personal photographs and strengths and weaknesses points in existing personal photographs management systems to handle them. Hence, merely discussing difficulty of re-finding personal photographs is not only remarkable but also venerable; what is encountered and more desirable in the information retrieval and how re-finding personal photographs may be better made use of. To that end, the authors aim to provide some useful research directions in this study.

The existing literature provides sufficient evidence to support the importance of information re-finding in general and personal photographs re-finding in particular and many studies have been conducted in this regard. This study aims to clarify most possible factors, which could influence re-finding personal photographs as with strengths and weaknesses points in existing photographs management systems. Following on, the authors argue there is a significant gap with regards to the study of re-finding personal photographs in IR domain and a number of pertinent questions are presented for future research inquiry into the understanding what makes re-finding personal photographs difficult. Therefore, there are lacunas in the literature which will be uncovered through an extensive review in the following sections including how personal photographs re-finding is perceived in the literature and what its relevance is in personal photographs lifecycle.

MATERIALS AND METHODS

This study has been designed based on diverse existing literature that focuses on PIM and the main factors which can affect on re-finding personal photographs. This review is based on a lot of published studies in academic journals and conference proceedings related to human factors and information re-finding in general and personal photographs in particular.

Why personal photographs: The technological advancements, of late, especially in the domain of information management that constitutes capturing, storing, retrieving and distributing of information have drawn the attention of researchers towards a novel concept called 'digital memories'. This has eventually enabled us to store the vital digital information such as, x-rays, scan reports, photographs albums and videos for future use (Gemmell *et al*., 2006). However, among these, the photographs are generally considered as the catalyst that makes one to travel down the memory lane. Photographs generally reveal one's culture, attitude, life style, relationship and etc., (Frohlich, 2004).

Of late, the amount of personal information is increasing exponentially, whereas the capability of our brains remains limited (Plant and Schaefer, 2010; O'Hare *et al*., 2006). New technologies have made it easier, to create a huge amount of personal photographs. As well as, there is significant research interest in this area at the moment (Suh and Bederson, 2007). However, not many studies have been conducted in the field of photographs re-finding so far. At the present, most of studies focus on content based retrieval rather than personal photographs lifecycle factors which can make re-find them difficult. In addition, photograph is like any other information that people always create, keep and manage for re-using and re-finding later on, based on special needs and purposes. Therefore, it involves many characteristics of other information based on the users' needs and their behaviors.

Moreover, the latest technologies have paved way for employing new methods for capturing, keeping, managing and retrieving photographs. It is now possible to group and label photos automatically in a hierarchical structure (Suh and Bederson, 2007; Kang *et al*., 2007). The concept of automatic labelling of photos has a great influence in fields of face recognition and object detection (Cui *et al*., 2007). Ultimately users can verbally annotate photographs or record the accompanying audio (Kuchinsky *et al*., 1999). It is noteworthy that most of the developed systems have not been evaluated in terms of the difficulty of PIM evaluations (Elsweiler and Ruthven, 2007) and hence the problems remain unsolved that may affect the re-finding of information in general and photographs in particular. Most the researchers used their thoughts, knowledge and some previous theories to build their systems, which resulted in making the modern PIM tools widespread but not effective in term efficiency of re-finding personal photographs.

Factors in re-finding personal photographs: In the past 30 years, huge progress has been made in developing novel Personal Information Management (PIM) systems and ideas. Unfortunately lot of these attempts ended in futile due to a lot of factors (Voit *et al*., 2009). A majority of PIM systems have common functionalities such as, storing, organizing and re-finding personal photographs. In contrast, PIM and re-finding are difficult to study and require a variety of experimental approaches to explore. Therefore, several contributing factors and elements for effective re-finding personal photographs have been identified from the literature. This section discusses the significance of studying human behaviours and existing personal photographs management systems, before focusing more on the development of new systems of PIM. This study will deal with personal photographs life cycle such as creating, keeping, managing and re-finding process that people use and how influential factors affect these processes to make re-finding personal photographs difficult, additionally this section also provides the strengths and limitations of the existing systems to handle them.

This section will carry out the factors in personal photographs lifecycle processes, the people behaviours of these processes and how these factors affect in re-finding the personal photographs.

Types of personal photographs: The process of capturing personal photographs is disputed issue between researchers. Some researchers believe that capturing is one of the processes of personal photographs lifecycle (Kirk *et al*., 2006). However, Boardman (2004) believes that the capturing occurs outside the personal photographs lifecycle and he has proved that many of the information are created outside PIM system. Recently, this justification was approved by Whittaker (2011). Yet, there is no explicit evidence about the processes of personal photographs lifecycle.

Every day people capture, create and resaving a lot of personal photographs, these photographs come from different sources and have different aspects and psychological perception to deal with it. In most cases people prefer to capture their photographs for memories (long term purposes), however, in many other cases, they tend to take photographs based on compulsion for personal use (e.g., damaged car after an accident, to report the damage to the police). These classified of capturing have been to two types; Affective and Functional (Lux *et al*., 2010). Datta *et al*. (2008) has shown the results on the use of cameras of mobile phone. They defined five taxonomies based on two main dimensions: "function vs. affection" and "sharing vs. closed group sharing vs. individual use". In their study, people showed (41%) captured photographs because of personal reflection and reminiscence (affection/individual). Other research, Kindberg *et al*. (2005) presented that the affective and functional have fuzzy borders and also the three classes of sharing intentions is a complex to be differentiated easily. All the previous researches have been focused about the types of personal photographs in perspective of sharing them. Therefore, it is worth to understand role of re-finding process before focusing about sharing stage and how these types of personal photographs could affect in keeping, managing and re-finding processes.

Nowadays, digital cameras make easily to create a lot of types of personal photographs. Ito and Okabe (2003) showed how digital cameras able to add meaning to the mundane objects in our lives. Moreover, some types of personal photographs may be difficult to categorize, may have unclear purposes and may be out of domain personal photographs categories (Kindberg *et al*., 2005). Conversely, people who capture photographs for important reasons (functional) prefer to use special managing strategies to re-find them easily in future. Many scholars have observed managing and re-finding behaviours for functional photographs. People prefer use piling photographs in a meaningful location in order to makes it easier to re-find when it is needed as a reminding behaviour. This provides time reminders that, these photographs are available to perform specific tasks which have been associated with its.

Nowadays, reason of capturing personal photographs is becoming an important factor which plays an important role in influencing methods that people use to keep, manage and re-find their photographs. In contrast, people still have many weaknesses and limitation to re-find their personal photographs. According to Whittaker *et al*. (2010) people have experienced a lot of challenges to re-find their affective photographs. Personal photographs are highly valued resource (Suh and Bederson, 2007; Petrelli *et al*., 2008) and people attend to store quite old photographs as a treasure. Moreover, keeping photographs of low volume increases the difficulty of re-finding. Thus, new systems need to give opportunity to people to deal with their affective photographs effectively similar to functional ones, in order to enhance the re-finding. People take a lot of affective photographs and yet, they still have a lot of limitations in re-finding them. Beads on our knowledge, to date all researcher deal with all kind of personal photographs as one type (affective), therefore new researches have to give more attention about different types of personal photographs and the relation to make re-finding them difficult.

Keeping strategy: Based on literature, storing or keeping information is a very difficult task (Whittaker, 2011). Every day people receive new emails, create new files and folders and browse new web sites. Some of this information is considered as short term, but other information is considered as long term, which is very

important and critical in future. As we have mentioned before, photographs are highly valued resource and people prefer to keep a lot of photographs, because they are sure that, they will not find them anywhere else. Whittaker *et al*. (2010) have stated that, people keep on an average around 5 digital photographs per day. Consequently, people will deal with thousand of photographs collections just during few years, these collections refer to different events different sources and it becomes too difficult to handle them over time. The over capturing and accumulation of photographs are due to a lot of aspects such as; inexpensive gadgets for capturing photographs and availability of huge memory capacity of hard disks space.

Although, there are many theories existing to improve the operations of keeping information, these theories have not improved the efficiency of retrieving information for later use. For example; in Keeping Found Things Found (KFTF) project, which has a particular attention in previous researches such as (Jones *et al*., 2001; Bruce, 2005); the researchers have investigated ways and methods which users perform to keep their information to find it in future. Gemmell *et al*. (2006) have discussed the limitation of this theory that, users will be overwhelmed of amount of data, which they have kept and also the delete operation will be more costly, because the users will spend a lot of time to re-find these information later on. Boardman and Sasse (2004) have established that, keeping irrelevant information causes guilt about being disorganized, which will lead to make re-finding information difficult. Moreover, Whittaker and Sidner (1996) have proved that, more the information kept more the retrieval time will be.

Based on the above discussion, amount of the photographs that people keep, is one of the most important factor which can impact the process of re-finding photographs (Whittaker *et al*., 2010; Kirk *et al*., 2006). Moreover, the earlier works related personal photographs collections (Rodden and Wood, 2003), the respondents have expressed that they take more photographs with digital camera, than they had done with physical ones. Nevertheless, at the time of recovery, they have understood the consequences of having huge volumes of photographs, which resulted in huge difficulty in re-finding specific photographs. Although people sometimes prefer to delete photographs with poor quality, however the percentage of this stage is too small number, which is 17% of total amount of captured photographs (Whittaker *et al*., 2010).

It is noteworthy that, people preserve a lot of photographs from different sources, because they feel them as treasures and must be kept for the future generations to know the history. As mentioned earlier, keeping huge amount of photographs makes re-finding too difficult. Moreover keeping a lot of photographs means that, people need more time and effort to manage and re-find them. For managing costs, we need to organize photographs, if we want to get value from it. The more we keep, the more management effort is required. Some visions of new technology suggest that, in the future our information will be organized automatically, but these technologies are not yet in place (Whittaker, 2011). Keeping too many personal photographs can be distracting if manually browsed. Nevertheless, some feel that future retrieval system will be entirely search based, reducing exploitation costs regardless of how much we keep. Probably, the inclination of developing classification framework is to generate precise categories to manage instances as these. An improved remedy is to illustrate photographs by a collection of groups and also features, such as sources, purpose and dates of photographs and offer superior interfaces for manipulating these features. The employment of faceted metadata, offers a functional resolution for issues related with navigation of rigorous hierarchies (Yee *et al*., 2003). The foundation of this technique is the usage of a specific system for grouping the documents in the collection. The faceted classification employs evidently described, reciprocally unique and collectively comprehensive features of a class or particular topic.

Another method to handle this problem is to reduce the efforts, which people need to file and annotate personal photographs, to make it easier to classify and organize events. The main idea about annotation is that, people are capable of manually or automatically assigning a good description about their information (Gong *et al*., 1994). In the fact, people prefer to annotate physical information as normal way to help them remembering and thinking about their tasks and this is due the fact that, physical information do not need a lot of effort to annotate (Marshall, 1997). However, the main problem with annotation is that, people less often like to annotate digital documents, because natural interaction is lost by using the computer screen (Price *et al*., 1998). Many creative photograph management systems have been designed to reduce the time and efforts in annotating process. Few good examples for this systems are Photo File (Kuchinsky *et al*., 1999) and Photo Finder (Shneiderman and Kang, 2000), which facilitate people to annotate quickly. The idea from this system is use priori set of pre-defined metadata attributes to describe common characteristic for one or more photographs such as, date of creation, event, location, people associated with photographs and description.

Nevertheless, there are a lot of progresses in systems, which have been created to help people in classification and annotation process, in particular in photographs (Kang *et al*., 2007) for more review), where a lot of systems try to automatically (Sinha and Jain, 2008) or semi-automatically (Mota *et al*., 2008)

classify and annotate newly stored photographs. The idea from semi-automatic classification and annotation is using some keywords from re-finding attempts to annotate photographs and others to segmented groups of photographs based on their contents; all of these processes need verification from the users. Wenyin *et al*. (2001) have designed a good system to support this process, this system combines keyword-based and content-based and people feedback, to confirm the process of annotating photographs. Shen *et al*. (2000) have tried to use web page contents as automatic annotations, but the main disadvantage of this idea is that, usually people deal with photographs that do not have any surrounding information, which can be used in annotations.

In case of fully automatic annotations, users do not have any verification or perform to change the categorization and annotation process. Ono *et al*. (1996) have tried to use photographs content analysis to automatically choose good annotations keywords for photographs. On the other hand, their evaluations for annotations and photographs models used were limited.

Nowadays, there are a lot of progresses in systems, which have been created to help people in categorization process, especially in photographs, where a lot of systems try to automatically or semi-automatically categorize newly stored photographs. However, there are some limitations with these systems; firstly, they add some complexity to the system, users may yet avoid performing categorization and annotations for their collections by these systems, second problem is that, people basically do not trust automatic classifications. Moreover, these systems still have a lot of bugs; this is because there is a lack of evaluation to approve the percentage of errors associated with these systems. Researchers have agreed that, people tolerate with 5% of error, ultimately the qualities of classifications of these systems are still obscure and it may not be accepted by people (Whittaker, 2011).

Moreover, using voice to annotate photographs is well recommended and used form literature in order to enhance re-finding personal photographs too. Rodden (1999) asked his participants if they like to use their voice to annotate their photographs. Kudhinsky *et al*. (1999a) in FofoFile system used it as one method to make re-find photographs efficient. Voice annotation is good way to enhance photographs re-find but, however, this positive also has a negative outcomes, people feel self-conscious about speaking to a computer and still it has many computing recognition voice match errors with prior voice which could effect on re-finding tasks (Brown *et al*., 1997).

The various approaches for facilitating annotation and categorization indicate the amounts of efforts needed by people. Ultimately, users would annotate each and every object by themselves by getting the understanding the advantages however, based on our knowledge as of now, people are not likely to do this. On the other hand, fully-automatic systems, eliminate the need for users to annotate or categorize objects, because these systems automatically perform these activities, however, these systems have a short fall as well, where the annotations or categorizations made, may perhaps or might not exactly reflect the user's own mental model. This means that, even though such classifications could be appropriate for a lot of people, it does not essentially mean that they are appropriate for absolutely everyone. Another concept outlined in literature (Elsweiler, 2007) was the significance of personalization and auto-biographical experience in PIM systems, to obviously enhance the storage of information and people name objects as they wish and to define their own spatial.

Management strategies: From the literature, it is noted that, there are two types of organizing information: filing and piling strategies (Malone, 1983). Filing is constructing an exhaustive, hierarchical taxonomy and it contains related items stored in distributed files. Piling is more complex and usually it contains unrelated items, which are stored in one place. Personal photographs are quite different from other data files; this is because, it tends to be self-generated. Moreover, they are very important and irreplaceable. In the contemporary era, storing and organizing information for future use is a noteworthy predicament. Therefore, managing is a critical issue in personal information with respect to personal photographs because it directly affects in re-finding information (Whittaker, 2011).

According to Lansdale (1988), people employ piles to recompense the complexity of classifying (filing) things. Lansdale has stated that, to avoid the process of classification, user puts objects in a particular place. With this he/she forgoes the opportunity to retrieve the document by any simple classification-based search. It is very hard to produce and preserve an efficient, instinctive hierarchical categorization method (or taxonomy) for information. Bälter (2000) have studied the association of various management methods and the time required to employ a particular method based on mathematical model and depending on keystroke-level analysis.

Moreover, people are constantly keeping the information, hence, there are huge amount of data accumulation. Again, Whittaker (2011) has states that, people will actively save around 120 thousand personal photographs during their life. Hence efficient management of the huge amount of photographs is vital for effective re-finding.

Previous studies have shown that, people refer to manage their photographs by rudimentary structures. The participants in their studies showed weaknesses in managing their collections, by having very little

hierarchical structure, which seem to be more like piles than files. Furthermore, participants showed that, they have folders often containing heterogeneous data, containing photographs that relate to multiple events (possibly because they were uploaded their photographs at the same time and never subsequently reorganized) (Whittaker *et al*., 2010; Kirk *et al*., 2006; Rodden and Wood, 2003).

In contrast, Whittaker *et al*. (2010) have identified the false familiarity as a related factor to manage strategy, where the participants of their study have a strong (however erroneous) trust that, their participation in the events will help them to successfully retrieve the photographs related to those events, without ensuing efforts to methodically categorize those photographs. Furthermore, the participants have responded that, even, creating meaningful labels will not be useful always, as they tend to forget those tags while attempting to retrieve the photographs. Precisely, even though people have realized the value of the their photographs, mostly they do not spend much time accessing or organizing their collections, therefore, the difficulties associated with the organizing and accessing remain undiscovered.

One good solution for this is problem could be to facilitate many filing classifications, based on event with gives the ability to the people to search between two views of personal photographs collections (the first one can show photographs as a folder or events and another can show photographs in a temporally ordered stream). Perhaps, each view can be filtered by more than one shared attributes as in Cutrell *et al*. (2006) and then increase the interaction with photographs with keeping the folders benefits.

Nowadays, online system like Facebook (http://www.facebook.com), offer for the people to browse their photographs in two methods of organization, one page for piling photographs and other for filing photographs as album or events. This system is good, because it offers to the people the two strategies, but the problem will be for huge volume of photographs. Yet, this system still provides a method of searching, which is browsing rather than retrieving, people will spend a lot of time to pick the desirable photographs.

Maintaining personal photographs: In terms of personal information, it is evident that, preserving collections might consist of re-organizing items to better facilitate novel functions; trashing the stored objects or modifying information of the objects that are stored, are no longer required. For online information, the regular modifications of information probably confuse a lot of the aspects that influence re-finding. The results of search process modifies as new Web resources are revealed. In general, the online news stories will change regularly and similarly the list of emails in inbox will change, as soon as new emails come in. However, these changes will enable users to get better search results, in terms of new emails and recent news stories. These changes are summarized if the information has been moved, modified or deleted and how the re-finding would be difficult in future. Teevan (2004) has shown that, people face many problems when they try to re-find online information, which has been changed (moved, modified or deleted). He has observed that, people would like to know what has happened to the information and determine the reason for changing the information.

However, electronic information and in particular computer files with respect to personal photographs, can be very dynamic. For example, photographs folder arrangement change, when new files are kept, these files also can be changed when they are moved to another physical place on the computer or other device as backup (Whittaker *et al*., 2010) and editing the name of the folder or labels will give different impression to the user. All these changes still keep the photographs for later use; however, it could be problematic if the photographs were deleted.

Regarding to this factor, recent study related to personal photographs (Whittaker *et al*., 2010) have identified a lot of challenges in terms of re-finding photographs, which have been moved, where again participants were asked to re-find their photographs; eventually the participants struggled to find what there were looking for, because the items have been moved to another devices. After some of time of browsing, the participants have realized that, they themselves have already moved the photographs to other devices and they forgotten to which devices they moved their photographs.

A number of methods are obtainable over the counter, to support in maintaining collections; however, based on the review about PIM behavior has revealed that, the realistic utilization of these tools is minimal. A lot of systems have been designed to synchronize the changes made between file system segments or directories, apart from personal photographs, Backupmagic (http://www.moonsoftware.com) and File Mirror (http://www.imosoo.com) are typical examples for these systems. They help users by making sure that, they do not need to make the same changes to various organizations again and again. The Concurrent Versioning System (CVS) (http://cvs.nongnu.org) is typical a good example of maintenance system, which enables users to keep track of all works and changes in a set of files. Despite the fact that these systems keep distinct versions of objects, there is still a necessity for the user to recall when a change was made to accomplish re-finding. So far, to our knowledge, no researcher has tried to design a system that helps people, to synchronize the changes made between their photograph collections.

In the following section, we have explained few systems, which support changing process for personal photographs. Even though a number of systems exist for this purpose, still there is a lack of research in this area. Subsequently, assessments in terms of using changing process in PIM systems have been too minimal. Nevertheless, few studies have focused on the issue of changing factor and how that can improve re-finding information with respect to personal photographs.

Role of human memory: The last time that photographs have been seen before is related to human memory and the main characteristics that people able to remember about their photographs (place of storing, folder name which photographs stored on before and name of photographs as well). Thus, human memory is the most important factor of this topic; this is because, a lot of factors rely on it. The behaviours associated with PIM are directly related to human memory and the limitations that people have with PIM are associated to the weaknesses of human memory, as long as with PIM system to handle these weaknesses. According to Elsweiler (2007) in case of users forgetting vital information, it is significant to understand how they want to be reminded about it.

Elsweiler *et al*. (2005) has showed the relationship between the time period that photographs have been seen and how the re-finding would be difficult in future. They have discovered that, people forget many details about their photographs after 6 months of keeping them. But at the same time, people will be able to remember approximately when the photographs was kept, what the photographs was about or why it was kept and they also able to remember other people associated with the photographs. However, Kirk *et al*. (2006) has claimed that the photographs that have been stored in recent times can easily be retrieved. Here, we need to indicate about the time of archiving that people need to make re-find photographs effective. Czerwinski and Horvit (2002) have proved in their study that people forget a lot of things in their computing tasks after one month, but when they see a video or photograph they will remember many things about what they had been doing.

One more technique to enhance re-finding tools is to customize the design to help certain advantages of human memory. For instance, a number of groups have developed tools to assist episodic memory and research endorsing temporal recollections. For example, Lifestreams (Fertig *et al*., 1996) was proposed as a substitute to the typical desktop search tool. The system arranges documents depending on the time that they were created, received, or modified; it presents them as a chronologically ordered stream. The starting point of a stream consists of the older documents, while the ending of a stream consists of most recently created documents. This system also has "reminding" function, which helps users to set time-based reminders, because documents are only apparent at times following their position in the stream. The time-based reminders offer an alternative to piling, without including the negative outcomes, which result from piling. Few other studies have stated that even though thumbnail images are important in the beginning, after some time users are able to operate as effectively with the thumbnails removed, indicating that, performance benefits are mostly accomplished due to the exploitation of human 3D spatial memory (Czerwinski *et al*., 1999).

Photo Memory (Elsweiler *et al*., 2005) helps users to minimize the burden placed on the human memory when searching for personal photographs. Photo Memory allows users to get the photographs that they are looking for, by remembering information about the photographs. When the user starts searching about for the photograph, he/she will see some contextual information about the photograph (s). This contextual information may lead to remember of some information about the photograph such as, individuals in the photograph or the time at which the photograph was taken. Moreover, when filters are applied, images that match the criteria grow, while the remainders shrink. By pointing the mouse over the image, the image appears in big size with its annotation to increase remembrance about the image, which the user is looking for. Photo Memory focuses on limited concepts of personal information management. A limitation of this system is that, the participants had little practice time with the memory oriented interfaces. Also the user interfaces were different from anything that the user had seen or used before (Al Nasar *et al*., 2011).

Re-finding strategies: Lot of studies have suggested that, people frequently require re-finding and re-using information they have accessed in the past (Cutrell *et al*., 2006; Dumais *et al*., 2003). Re-finding is the heart of PIM (Whittaker, 2011). If people fail to re-find the photographs which they have kept, then keeping and managing activities will end in futile. Hence the question arises about the effective ways for re-finding photographs? The process of re-finding clearly is related to keeping and managing process. For that, new technologies must be at the hand to help people during this process (Elsweiler *et al*., 2011). Of late, search engines have started providing tools to help users, particularly in re-finding, this indicates that, the demand of re-finding tools has been started recognized. But unfortunately, not many efforts have been expensed to comprehend the behaviours of users in keeping, managing and re-finding photographs; this will eventually lead to design the appropriate re-finding tool.

Based on the literatures, there are two main methods that can be used to exploit information with

respect to personal photographs: Seeking refers to navigate through information structures, which user has and involves incremental manual traversal of these structures. Searching is a more specific way to find information, where the user generates query-based that refer to the name or characteristic of information item, one of its attributes or its contents. Each technique has advantages and disadvantages. Seeking offers progressive assistant, by giving feedback to the users in each stage of access (Barreau, 1999), but in the case of complex folder hierarchies, seeking can be difficult and strenuous, because of the multiple levels to traverse. Search is potentially more flexible than seeking; giving users to specify more than one property of the target file (Lansdale, 1988). However, it is reliant on being able to remember salient properties of the target item in order to generate appropriate search terms (Elsweiler, 2008). Many studies have claimed that, majority of people use seeking, more than searching in photographs re-finding, due to limitations of desktop search engine (Whittaker, 2011; Elsweiler, 2007).

Moreover, to come out with successful search engine based on a query-based system, user should remember many details about their photographs, with the need to re-find, in order to form a query. However, psychological researches have showed that people are not good to remember exact details about their photographs.

Numerous strategies have been introduced to improve the process of re-finding information. Kim *et al*. (2004) have suggested that, the process of searching personal information could be enhanced by employing document and query extension with the thesaurus features of Wordnet. This might help people to get rid of the need to remember precise terms, which appear in documents while constructing re-finding queries. Even though no testimonials about their systems have been published, the results of other researchers have revealed that, such an approach is inappropriate for personal information. For instance, Dumais *et al*. (2003) have indicated that, the most well-known query terms for personal information objects are named entities that would be inappropriate for extension with a thesaurus. We have described earlier, how annotation (metadata attributes) can help people to categorize their photographs, hence using query expansion by showing available different annotation (people and places) could help people to more effectively re-find their photographs. Firstly, People have to avoid grammatical error comparison with their prior annotated and then give them a list of suggestions of related or alternative query terms as guide based on their query. Generally, the phrase term expansion is employed to systems, which advocate substitute wordings. Frequently the usability studies are beneficial, due to the efficiency of term-suggestions, while users are not needed to make relevance conclusions and do not have to select form a lot of terms.

Merging the searching and browsing processes is the other technique, which enhances the search tools. For example, Yee *et al*. (2003) has proposed Flamenco system, to enhance the conventional browsing facilities by including a theoretical foundation, by which users can navigate. Comparative analysis of this system has revealed that, ninety percent of the users have preferred Flamenco as against the conventional search facilities, ninety seven percent of the respondents have said that, it helped them to learn more about their collection, seventy-five percent have found it more versatile and seventy-two percent of the respondents have stated that, they were convenient in using the Flamenco system than the standard system. The outcomes of the analysis are very encouraging, which indicates that, there could be huge advantage in incorporating the searching and browsing approaches. Nevertheless, the system was not analyzed with personal information, but on a collection of images, for which a comprehensive classification scheme persisted. It is ambiguous that, if such a pre-defined, semantically detailed scheme might be available for personal objects or users would be prepared or capable of maintaining the classification, because of the versatility needed in personal information collections.

Novice and expert people: The other problem that has been discussed in the literature by information retrieval community is related with novices and experienced users in comparison with the amount of information collections. Novice users lack the honed strategies that more experienced users had developed over time. On the other hand, many studies have emphasized the relationship of the computer literacy of novice and experienced users with the difficulty of information re-finding. Elsweiler *et al*. (2011) have revealed that, this factor is insignificant to make the email re-finding difficult. In contrast some other study has stated the importance in this factor to influence the finding of information (Natarajan and Bhakta, 2008). Hence, it is clear that, we have to focus on the above mentioned relationship, which might create essential changes in designing PIM systems.

Regarding to this factor with personal photographs re-finding, many studies have been conducted with different groups of novices and experts people whom have familiarity of computer literacy and the relation to the ability to make re-finding photographs easier. Rodden and Wood (2003) interviewed twelve people from different age and different computer literacy. They were ranging in age from 24 to 62, approximately all of them regarded themselves as familiar with using computer. The aim of this study was to study how people manage and re-find their photographs collections and how new photographs systems could

help them to re-find their personal photographs based on their opinions about a number of features. We agree that this study was a good attempt to create new personal photographs management systems while usage of the computers and digital cameras were not popular. However, participants show many weaknesses to re-find their photographs regarding too many issues which have been discussed before. Other study by Kirk *et al*. (2006), almost have used same sample size and same study purpose of Rodden and Wood (2003), with more focusing on early stage of capturing photographs behaviours. Again, their participants showed the same limitations to re-find the older photographs collections because the same discussed factors.

Recent study which has been conducted by Whittaker *et al*. (2010) which have been aimed to study parents of young families in comparison with long term retrieval. The sample size was 18 parents, whom have age between 38-43 years old and they have medium to high' computer skills. Again, participants showed poor performance and failing to re-find 40% of their personal photographs. Even though with all these studies, personal photographs management systems still have lacked to handle the novice and expert people. Participants in all mentioned study have shown many failure and frustration to re-find their personal photographs.

In summary, existing studies on re-finding personal photographs in certain topics of PIM literature reviewed in this study is predominantly empirical. Moreover, there is need to new empirical studies in the future to examine the factors that make re-find personal photographs difficulty, especially in the context of individuals (novice and expert), yet even fewer studies exist examining the types of personal photographs and how could effect in re-finding process. Based on a wide-ranging review of the literature presented in this section, the authors identify the following research issues that require further inquiries in the role of personal photographs lifecycle in re-finding process; and as such in the next section propose a number of questions (i.e., possible research directions) in the study of re-finding personal photographs.

RESULTS AND DISCUSSION

In terms of understanding the process of re-finding personal photographs, as reviewed earlier, many studies have examined one factor, which could impact the re-finding of photographs and very few studies have investigated the other factors that could affect in one study. Fundamentally, the question of, what makes re-finding personal photographs difficult may be codified as one that, distinctly requires further clarification. In the current literature with reference to ''re-finding'', scholars have defined different types of factors such as, managing strategies and role of human memory, to name a few; so the critical inquiry to undertake is, on the processes of personal photographs lifecycle and the potential areas to explore are:

RQ1: If re-finding personal photographs can be sometimes difficult, how often can such factors still be considered as "effective"?
RQ2: To what extent can re-finding personal photographs be difficult?

Perhaps, one of the most interesting unexplored research issues with regard to re-find personal photographs and particularly is in the capturing process, is impact of the types of capturing photographs (Lux *et al*., 2010). Advocates and critics suggest the influence of re-finding personal photographs support affective photographs, rather functional photographs. Yet, there are many evidences in the current literature that presents the use of photographs systems, to support the affective photographs and re-find them; therefore the following questions could be useful to examine:

RQ3: How do the affective and functional photographs impact the re-finding process?
RQ4: How do keeping, managing and re-finding, affective and functional photographs through personal photographs management systems, could support process of re-finding?

Arguably, one of the main of PIM in general and re-finding process in particular, is the amount of personal information with respect to personal photographs. There are strong evidences in the literature related to the amount of personal photographs and difficulty to re-find them (Whittaker *et al*., 2010; Rodden and Wood, 2003). The methods and strategies are also noted to have an effect on categorizing and annotating of re-finding process (Whittaker, 2011). Thus, will the automatic, semi-automatic or voice recognition systems, to categorize and annotate personal photographs actually improve the re-finding process? For the aforementioned rationale, the following research questions can be examined:

RQ5: What is a best method to be used among, manual or automatic or semi-automatic or voice categorization and annotation personal photographs?
RQ6: What is the accuracy to categorize and annotate automatic, semi-automatic or voice recognition to categorize and annotate personal photographs?
RQ7: What is the percentage of people's acceptance to use these methods?

As reviewed earlier, studies indicate that, managing strategy that people use, is an important factor to make re-finding personal photographs easier.

A lot of studies have shown that, the basic strategy to manage personal photographs is filing (Whittaker, 2011; Kirk *et al*., 2006). Other scholars (Elsweiler *et al*., 2005) have claimed that, piling strategy is a good method to enhance photographs re-finding. However, the influence of managing strategies, in re-finding personal photographs, is not adequately evident in the literatures. Based on the above, the following research questions can be considered to drive further research in this area:

RQ8: How does filing or piling strategies of personal photographs can enhance re-finding personal photographs capability?
RQ9: Which one of these is a good strategy (filing or piling)? And what are its benefits in the process re-finding personal photographs?

There is a lack of PIM literature that directly discuss the difficulty of re-finding information, which have been changed, one such study by Teevan (2004) has investigated how people return to information in a dynamic information environment. Where, people have expressed difficulty in re-finding information, because of the changes to the information or its environment. This approach was fundamentally developed from studies, primarily based in web pages re-finding. However, the applicability of this strategic dimension in other kind of information with respect to personal photographs needs further examination. Therefore the key questions to investigate are:

RQ10: How can maintain personal photographs influence re-finding process?
RQ11: What are implications for designing systems to support re-finding personal photographs, which have been changed in current people environment?

Actually, two variables were proven as substantial aspects in literature, which highlights the significance of memory and recollections towards the process of re-finding. Memory has been examined in the PIM community e.g., Lansdale (1988) and Elsweiler (2007). On the other hand, there is still much to understand, with regards to the role of memory and how it impacts the behaviour of users and in fact, how behaviour impacts memory. It is intriguing to further ascertain assessment, therefore the questions to examine are:

RQ12: What are the connections between memory and re-finding personal photographs?
RQ13: Is there any clear mapping between recollection and re-finding personal photographs? If so, how can we enhance this relationship?

There is much research in the information retrieval literature, discussing strategic approaches to re-find personal information; these comprise models, theories and frameworks on information retrieval strategies. Especially, in the context of the re-find strategies of personal photographs, there is a very limited evidence in the literature, for personal photographs; one such study by Elsweiler *et al*. (2005) introduces the concept of supporting human memory on PIM topics and exactly for personal photographs. This approach was fundamentally developed from studies, which are primarily based in human memory; however the applicability of this strategic dimension in other factors, such as, amount of photographs, managing strategies and novice and expert people and how these factors could affect the retrieval methods that people use to re-find personal photographs, needs further examination. Therefore the key questions to investigate are:

RQ14: How does implementation of information retrieval strategies influence the amount of photographs and/or managing strategies and/or novice and expert people?
RQ15: How do retrieval strategies influence the amount of photographs and/or managing strategies and/or novice and expert people towards effective personal photographs re-finding?

Arguably, one of the main thrusts of PIM is improving the process of re-finding personal information. However, there is a lack of evidence in the literature, regarding personal photographs re-finding between novice and experts. The composition of people's behaviours is proved to have a possibility of re-finding personal information; for the aforementioned rationale, the following research questions can be examined:

RQ16: How does computer literacy attributes (e.g., prolonged use of computer, using mouse, using keyboard, ability to navigate around windows) enhance their ability to make re-finding personal photographs easier?
RQ17: What are the relationships between people's dependent factors (e.g., age, gender, educational background, experience) and the difficulty of re-finding personal photographs?

Precisely, considering the above research questions in future studies can enhance the understanding and conceptual clarity, which are presently less evident in the literature of PIM in general and re-finding personal photographs in particular.

CONCLUSION

This study has reviewed the existing literature on the factors which could effect in re-finding personal photographs. The authors have highlighted how re-finding personal photographs can be influenced by personal photographs lifecycle of personal photographs

such as types of capturing personal photographs, keeping strategy, personal photographs management strategies, maintaining personal photographs, role of human memory, retrieving strategies and computer literacy for novice and expert people. In reviewing the extant literature, the study uncovers a number of possible directions for research in the domain of re-finding personal photographs. The authors articulate that these directions are pertinent to the relevance of re-finding personal photographs in different areas of the Personal Information Management (PIM) domain. In keeping with this direction, the authors argue the need for future studies examining the relationship between types of capturing personal photographs and how could that effect in re-finding them. Moreover, following on research questions are suggested in the factors effecting in personal photographs re-finding, the role of keeping strategy for a lot of personal photographs, classification and annotation benefits to make re-finding personal photographs easier, the influence of managing strategies in re-finding personal photographs, how providing awareness for any maintaining and changing in personal photographs could help to make re-finding them efficient, the role of human memory and how it influences user behaviour and indeed how behaviour influences memory, provide retrieving strategies to make re-finding faster; and the role of novice and expert people with regard to re-find personal photographs. The authors acknowledge that there are certain limitations to the study, beginning with exclusively restricting to the examination of the existing literature on personal photographs and not on other forms of information. Furthermore, despite the fact that this study assessed certain areas in PIM such as capturing, keeping, managing and re-finding personal photographs and so forth, the authors have only reviewed the factors which could effect in re-finding personal photographs specifically in such contexts. Finally, the study proposes only future research directions here, rather than providing research (or empirical study) results per se and these possible research inquiries are not exhaustive in nature.

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