

Using Content-Based Image Retrieval for Accessing Images on the Web for Children

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Abstract - Children are among the most frequent and important users of Internet. The children can search any type of data in any digital forms in the digital libraries, web directories, or in many other media repositories. However, one possible limitation of searching these digital artifacts is that the young children have great difficulty in writing, spelling, and explaining their ideas during Internet search (lack of query formulation); this will limit expressing their intention. Language of the Internet are English, thus imposes problem for non-native children. In addition, miss-annotation of images on the Internet could expose children to porno images and sites. Thus, this paper reviews existing search engines for children and proposes a new concept to unify and for easy searching designed for children of various languages by using image search instead of keyword search. In our proposed idea, we shall use Content Based Image Retrieval (CBIR) technique to retrieve all relevant images to image queried by a child, this is a promising approach that will remove all of the above difficulties faced by the children and protect them from get the unsuitable results. This idea is part of an on-going research to build CBIR-based Image Search Engine.

Index Terms – CBIR; Internet; children search; search engine; query formulation.

I. INTRODUCTION

Children are one of the largest groups of Internet and computer users [1]. One of the most important activities of the Internet of all different groups of users are searching and browsing [2]. Allison et al.[3] explain that children frequently used computers and Internet since in the early age. Some questions have been asked on what are the difficulties for these children in searching the Internet. The answer are as follow: i) typing words on the keyboard is difficult because they are not good in writing and spelling; ii) retrieved results do not contain all queried words; iii) it is difficult to write proper words in the query's box. Therefore recently, searching and browsing the web by children are the most important challenges [3-5].

Images are important tools in education and learning for children and at the same time, each child has diverse imagination from one to another. Some researchers [6-7] discuss the importance of visualization to children in learning process: i) images are regarded as a significant material of teaching young children ii) images can develop children's cognitive abilities and improve this skills iii) learning process requires virtual and visual environment as effective

environment in learning. Also, Chang [8] identifies the characteristics of successful image from learning and teaching perspective. So, images are one of the most enjoyable and important tools in learning for children since it represent thousands of words [9]. Facilitating the search process using image query for the children shall overcome the difficulties of searching and browsing the web using keyword.

In recent years, vast digital image collections (libraries or repositories) are built due to the availability of digital cameras and storage spaces. Moreover, the spread of Internet around the world allows these digital image libraries to be published on the Internet. It becomes a necessity to organize (including browsing, searching, indexing, and retrieving) these digital images. In order to do image search in digital library, there are two techniques in general [10]: Firstly, it depends on metadata associated with each image and use traditional query techniques to retrieve images from database by keywords [10-12]. In this approach, it requires annotation of all images in the database which is a laborious and time consuming process [10].

Furthermore, annotating process is usually inefficient because the user does this process in an unsystematic way that different user use various words to describe the same picture based on their perspective or understanding, which will lead to reduced efficient of text-based image search [10]. The second technique is based on the content of the image where many features can be extracted from. This approach uses a new query method to search on images, which gives the system an image to search on and the system will try to find all similar images in the database. This method is also known as query by example (QBE). In such systems, features such as color, texture or shape of each image in the database are extracted into features' vector and all images are then indexed based on this features' vector. QBE systems will use this extracted features' vector for searching and retrieving the images in the database. These systems are called Content-based Image Retrieval systems (CBIRs) [10, 13-15]. The main advantage of CBIR systems is that feature extraction of images is automatically performed without any image annotation.

The rest of the paper is organized as follows: Section II explains some related search engines for children available on the web. Section III describes the conceptual framework of the proposed approach. Section IV and V display research

motivation and aims. In section VI, the summary and future work is discussed.

II. RELATED WORKS

We review related studies and discuss them in three sections: i) children's searching and browsing with their challenges; ii) existing children's search engines; and iii) benefits of CBIR applications.

A. Children's Searching and Browsing

Children face many difficulties and frustrations when searching on the Web. Some studies explain that the success search by children in information retrieval systems (IRs), such as web directories, digital libraries, or CD-ROM databases (encyclopedia), is ranged from 10% [16] to 88% [17]. Some studies conducted on the behavior of children during searching in these IRs, discover that children have many problems during their searching in finding the correct search terms and vocabularies, or that they do not understand the working nature of these IRs [18].

Children's search strategies are different - depending on the search task, child's study stage, domain, and design structure of IRs [17, 19-20]. Bilal [21] claimed that most children failed in their search tasks because of their lack of information on how to use the search engines, the engines do not support syntax checking, or they used either too general or too specific vocabularies.

In a study of primary school students, Schacter et al. [22] show that most children depend on browsing facilities on the Web to refine their queries instead of using synonyms of their keywords. In addition to that, Kafai and Bates [23] explained that children need assistance and instructions to perform successful search because of their vocabularies, typing, spelling, logic skills, and query formulation limitation. So, Bilal [21] emphasizes that we may have great frustration when we see children use well structured search engine but fail to reach their aims because of the limitation of their knowledge, cognitive ability, and skills.

B. Children Search Engines

In this section, we will explain some characteristics of existing search engines designed for the children and illustrate their weak points.

1) *Search-22* (<http://www.search-22.com/kids/>) engine provides keyword-based search. The searching process will be performed by some other search engines and the results will emerge as direct links to the site of concerned. One major weak point is that it highly depends on keywords-based interface.

2) *Ipl2* (<http://www.ipl.org/div/kidspace/>) also depends on keywords. Browsing is based on interesting and useful categories for children such as sport, fun, math, computer, Internet and other topics. Each of these categories allows us to discover many other related links to the chosen topic category in order. The weak point of this technique is also using keywords. On the other hand, it is offering a browsing tool as an alternative tool for searching.

3) *KidGrid* (<http://www.kidgrid.com/>) has many categories which a child can surf easily and in different languages (Deutsch, Portuguese, Italian and others as well as English). Although this search engine comes in multi-languages, its search is also based on keywords.

4) *KidsClick!* (<http://www.kidsclick.org/>) contains many search tools (such as picture search tool, sound search tool, and others). Each tool will lead you to local databases (off-line libraries) where each one contains images. For example, the picture tool is related to certain categories within the database. However, it employs keyword-based search in specific category or in all categories.

5) *GoGooligans.com* (<http://www.gogooligans.com>) is one of the safest search engines for children with some properties and weak points identified as follows:

- It has advanced technique including visual keyboard for multi languages.
- When children type their keyword, it suggests some semantically similar words to help children to complete their query.
- It prevents children from accessing porno sites by preventing search on some words like 'sex' but it is applicable to English language only.

Besides the above search engine, there are many other search engines that can be found on the internet including surfing the net with children (<http://www.surfnetkids.com/>), Yahoo children (<http://kids.yahoo.com/>), Ask Kids (<http://www.askkids.com/>), Quintura Kids (<http://www.quinturakids.com/>) which has keywords' samples to be clicked on to start search instead of writing these keywords, UptoTen (<http://www.uptoten.com>), Funbrain (<http://www.funbrain.com/>), and 4kids.org (<http://www.4kids.org/>).

From the mentioned search engines, we found that all of these search engines depend on keywords search and most of them operate on English keywords only (this is difficult for non-native speakers). In this paper, we propose a search engine that depends on image to unify language of searching and to overcome miss-annotation of images on Internet. Hence, we propose searching using image content, CBIR, as the base for the image-based searching.

C. Content-Based Image Retrieval (CBIR) Application

Studies on image indexing and retrieving began during 1970's, it started from a simple annotation method which depends on keywords associated with images as a base for retrieving images from a database. However, this method has limited efficiency in large databases. While research on CBIR started in 1990's where the content of visual information of the image, such as color, texture, and shape are needed to index and retrieve images [25].

CBIR has been used in wide applications [26] including (i) crime prevention such as fingerprint and face recognition, (ii) medical where doctors or specialists use CBIR on X-ray, MRI, ultrasound and other medical scanned images, (iii)

fashion and graphic design for viewing all previous design photographs, graphics or catalogs (iv) publishing and advertising, where pictures are widely used to illustrate books and articles in newspapers and magazines for faster and accurate retrieval and searching.

Image searching can be seen in many popular image search engines including Yahoo, MSN, and Google. This search engines depend on metadata (textual description) of the images or the name of these images. Those search engines basically do not analyze image based on its content [24]. Few image search engines depend on image content and are used for general purposes therefore they did not have accurate retrieving results [13-14].

III. RESEARCH MOTIVATION

Searching and surfing on the Internet expose children to a huge number of web sites, images, and other types of media in vast topics. Recently, search engines are popular among children. Nowadays, it is popular that children, as young as three or four years old, begin to use the Internet with their parents, siblings, or teachers [3]. By nature, children are interested and curious of new and prohibited things, so computers and internet are potential information providers that they could use to search for anything they are interested to know more about. This scenario is due to their surrounding environment where computers and Internet are common tools.

Young children at primary school or lower are not good in writing and weak in explaining their ideas to express what is on their minds. So, they need easy and simple tools that could help them to express these ideas without writing them. Also, they prefer browsing instead of searching [3]. Most of the time, the images are used as entertainment media for children and they also serve as vital media for learning and education. Jalongo in [7] regarded pictures as appropriate for young children because they understand the pictures better than text in learning and teaching. Hence, many researchers prefer story books with illustrations [27-28].

Gamble and Yates [29] describe that the most commonly affected images in children's fiction are animals and toys; they also describe some effects of images on children. The increase of porno media (sites, video, and images) on the Internet which is unsuitable for most cultures and faith especially in Islamic countries, and conservative societies, limits parents to allow their children from accessing the Internet. However, children who are good in writing, spelling, and expressing ideas in their mother language could mistakenly use unsuitable words in English as most media on the Internet are annotated in English language. Therefore, we can use images as the base of search instead of keywords because most children in the age between 4-10 years old need less cognitive load than novice adult users required to formulate complex text query [18]. It's worth mentioning that this method may help parents instead of their children in case that they have no idea about the internet or that their English usage is less competent.

The interest of using Internet for most of these children is influenced by their family, friends or teachers. On another

hand, most of these children are unable to write and spell to a level that explains their ideas. This scenario damages the children's learning process where many parents or older siblings may not have time to teach them how to write or spell using the computer's keyboard.

Images are the most interesting media and the most important tools for educational and learning for children. However, most images on the Internet are unannotated or annotated in incorrect way; this will lead to undesirable results when they try to search on some interesting sites or images on the net. So, children may be exposed to porno sites and images when surfing and searching on the Internet. Suitable search engine that depend on image content (CBIR-based Image search engine) are indispensable for children.

IV. RESEARCH AIMS

This research is aiming to propose a design framework that overcomes the weakness of children in writing, spelling, and expressing ideas by using images as query to base their search on instead of keywords. At the same time, this system must be appealing and easy to use for children and their parents as guide for them on searching the Internet. Accordingly, in this paper we propose image search engine based on image content especially for children to narrow scope of the engine to get accurate results and promising attempt for children to remove all the aforementioned problems.

At the same time the project can protect children from undesirable sites and images by providing the system with sample images as query to find similar images depending on its content, using CBIRs. This will keep them from undesirable search images which are caused by missed annotated images.

V. PROPOSED APPROACH

We propose a search engine framework that depends on image content instead of traditional keyword-based techniques. The main architecture of the proposed engine can be divided into two main phases namely; off-line and on-line processes as shown in the Fig. 1 and Fig. 2 respectively.

1) Phase 1: Off-line processes

- Images and web addresses retrieval: in this phase images and its web addresses from the Internet are retrieved and then save in database to fast matching and retrieving later in searching process in on-line phase. This process will repeat automatically through specific time quantum to retrieve new images that are added to the Internet.
- Feature extraction and indexing of database's images: In this process, the framework extracts proposed features from all images saved in a database and sorts these features using specific indexing method for faster retrieval. This process will repeat for all new images that have been added to the database.

2) Phase 2: On-line processes

- Browsing, Viewing and Query Formulation: Children or their parents can access this web site and have many groups of images; they can surf and view these groups

(categories) of images. Then, they can formulate their query as follows:

- Query by Example (QBE): this query can be performed using two ways: i) selection from a group of images (specific category) and then select one image from this category as a base for their search in QBE or ii) upload a image and use it as the base for the search.
- Query by Sketch (QBS): Children can express their ideas in drawing but with some restrictions; i.e. must use available tools at the site such as drawing simple square, circle, and other instead of drawing random lines. At the same time they can choose a template or provided tools to avoid randomness of sketch.

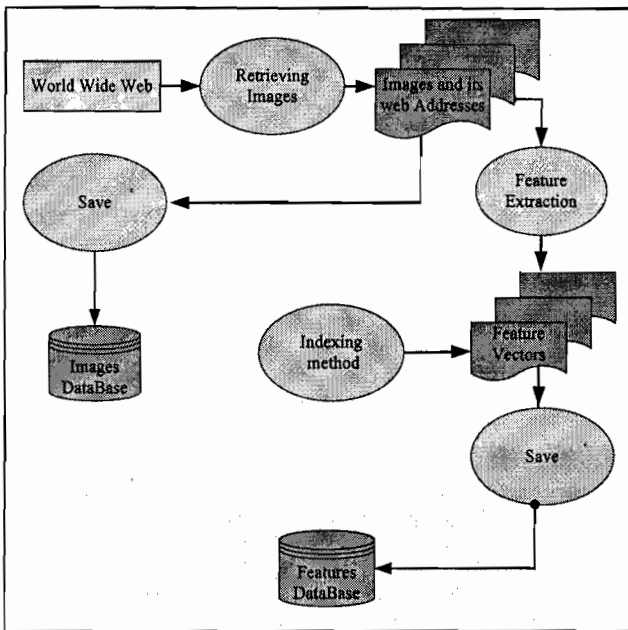


Fig. 1: Phase 1 - Off-line process of proposed system framework

- CBIR-based search process: This procedure contains two main sub-processes: i) feature extraction of a query image - extracting proposed features from a query image or sketch to use it as a base in searching for similar images; and ii) searching process - search on similar images to the query image, where images with high ranking (i.e.: images that have lower measuring distance to the query image), is depending upon the features extracted from the query image, and indexing method is used for fast retrieval of these images and its sites.
- Display the search result: This is last part of the on-line phase of the proposed framework. The search result shall be displayed as images and when you click on these images, the corresponding sites shall be displayed.

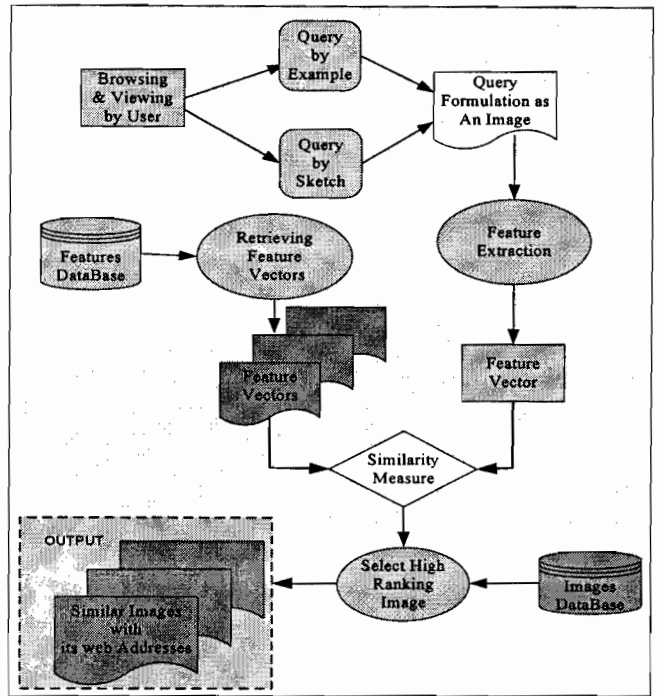


Fig. 2: Phase 2 - On-line process of proposed system framework

VI. SUMMARY AND FUTURE WORK

Query formulation by children in online searching is challenging tasks because children are weak in writing, spelling and explaining their ideas. Most of the web interfaces sites are in English, which causes problems for young children of non-English speakers. Therefore, a common understandable method for children is chosen, i.e. using images. Images are selected to be as query instead of keyword, but the lack of annotation of images or miss-annotation of images on the Web causes a problem. Thus, we propose a search based on the content of the images rather the annotation of it. Our proposed framework will be focused on search engine for children based on CBIR. The proposed framework is different from other children's search engine as it is able to unify all type of languages by using images. The framework also viewed as having the potential to protect the children from accidentally accessing porno web sites/images through wrong keyword-based search which is caused by random search by children or missed annotation of images. The expected result of this work shall be web sites and images that are similar in content to the query image.

This work is a part of on-going research to develop a CBIR-based image search engine. Therefore, this CBIR-image search engine requires feature extraction (the heart of the engine of CBIR) and image indexing. Hence, we identify four directions of future works to be implemented further in this study: i) to find new features to be extracted (such as color, texture, and shape which are already used numerously but with poor results) to enhance the results; ii) object recognition method that recognizes objects and serve as query images [26]

as well as similarity measure in retrieving process; iii) applying image mining, machine learning, and image understanding approaches to learn and train of the images, which enable the system to recognize images similar to these samples; iv) proposing new indexing method to speed the searching and retrieving process.

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