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A Frame Work for Query Results Refinement in Multimedia Databases

Humaira Liaquat, Nadeem Iftikhar, Shaukat Ali, and Zohaib Zafar Iqbal

***Abstract*—**In the current age, retrieval of relevant information from massive amount of data is a challenging job. Over the years, precise and relevant retrieval of information has attained high significance. There is a growing need in the market to build systems, which can retrieve multimedia information that precisely meets the user's current needs. In this paper, we have introduced a framework for refining query results before showing it to the user, using ambient intelligence, user profile, group profile, user location, time, day, user device type and extracted features. A prototypic tool was also developed to demonstrate the efficiency of the proposed approach.

***Keywords*—** Context aware retrieval, Information retrieval, Ambient Intelligence, Multimedia databases, User and group profile.

I. Introduction

CURRENTLY the users are in great need to have a system which can precisely meet their need(s) in terms of information retrieval. This is one of the major challenges researchers are facing now a day. Contextual information retrieval has become today's market need. Growing diverse information sources and richer context elements demand retrieval systems that can take into account contextual factors of user, like, environment, profile, preferences, geographical location, time, and even his gestures.

The context aware information retrieval process involves, either, building refined queries that can retrieve most relevant and precise information or refining retrieved results before displaying matching user's needs.

In this paper, we have proposed a framework that refines query results using many factors like ambient intelligence, user profile, group profile, location, device, day, time and extracted features such as color, texture, and dominant objects. All these will help in retrieving specific and relevant information.

The rest of the paper is organized as follows: Section 2 discusses related work in the field, Section 3 provides details of our proposed architecture, Section 4 discusses user scenario, which is related to the flow of user query, Section 5 presents experimental results, and Section 6 concludes the paper and discusses future plans.

Authors are with the Mohammad Ali Jinnah University, Jinnah Avenue, Blue Area, Islamabad, Pakistan, tel: ++ 92 51 111 87 87 87
e-mail: {humaira, nadeem, shaukat, Zouhaib } @jinnah.edu.pk).

II. Related Work

A lot of efforts have been put for context aware retrieval of textual data rather than multimedia data retrieval. In this section we focus on the discussion of context aware retrieval of multimedia data along with ambient intelligence which has been in the lime light for quite some time. Westerveld.T introduced a new approach to image retrieval, which combines content and context into one semantic space [1]. Amores.J et. al. presented a framework for characterizing and retrieving objects in cluttered scenes [2]. Hong. I.J proposed an infrastructure for context aware computing [3]. Another approach is proposed in case based user profiling in a personal travel assistant architecture [4]. Context aware personalized service delivery explores the potential of recommendation systems in an environment where users can access a variety of services from different locations [5]. Applications of video content analysis and retrieval, is a survey of technologies and applications for video-content analysis and retrieval [6]. Chai.W et al proposed XML like language to describe user sharable model [7]. Another paper defines a framework for context aware computing and categorizes applications developed in spatial and temporal contexts, which utilize the services from this framework [8]. Brown.J.P et al have identified two basic types of CAR (Context aware retrieval) in their paper [9]. Another context aware multimedia computing in the intelligent hospital is proposed by Mitchell.S et al, which is built on QoS DREAM middleware platform [10]. A generic framework is presented by Morikawa.D et al in which, use of user profile and other various factors is done [11]. Another generic architecture for context prediction is proposed by Mayrthofer.R [12]. Tazari.R.M, contributes towards filling in the gap in semantic web by context management. He introduced CORD as a service, satisfying requirements, based on semantic web technologies [13]. Key block is a framework for content-based image retrieval. A generic approach for text based information retrieval in image domain [14]. A generic architecture for context aware retrieval of multimedia objects is proposed by Iftikhar.N,, which combines the text based and context aware retrieval of multimedia objects. Main focus of their architecture was refinement of query results [15]. Another framework is proposed by Dogac.A, for handling context information in ambient intelligence environments [16]. In "Context, Ontology and Portfolio: Key Concepts for a Situational Awareness Knowledge Portal" the author relates knowledge

portals with context, ontology and portfolio. The paper discusses that the Knowledge portals within an environment require techniques and tools to access relevant information from diverse sources. In this paper, a knowledge framework is presented using Context, Ontology, and Portfolio [17].

dynamic power management [20].

III. Framework Overview

Our proposed architecture is an effort towards refining query results before displaying, using many factors. The architecture is depicted in the figure 1. From left to right the figure shows

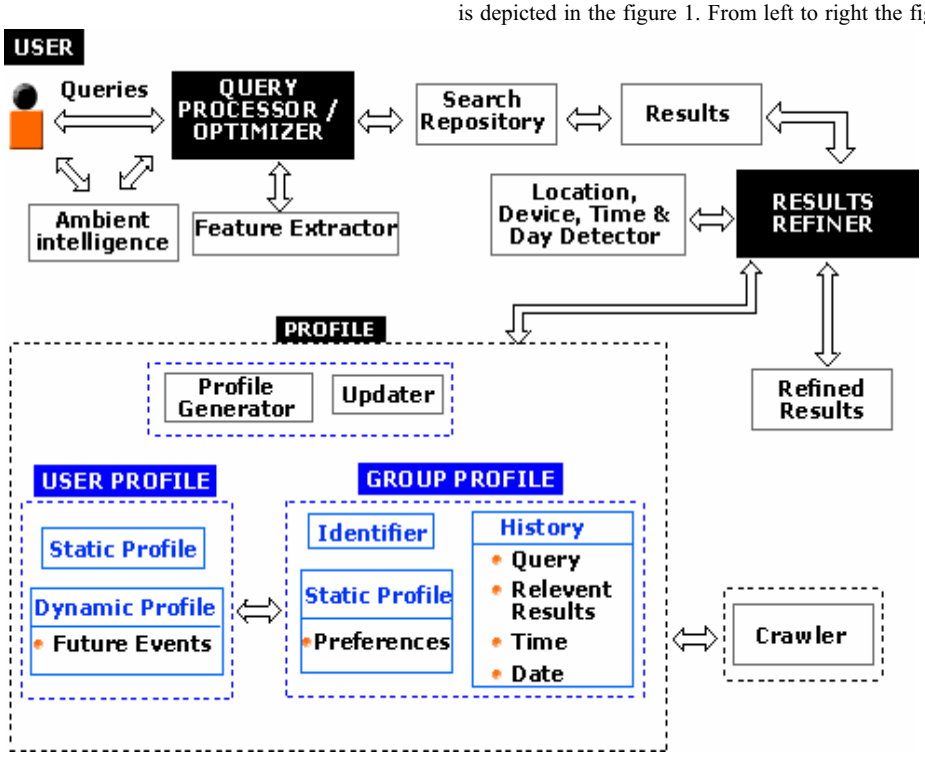

Fig. 1 Proposed Framework

Preuveneers et al discussed in his paper that to realise an Ambient Intelligence environment, it is necessary for the applications to provide information about the context in which they operate, in a very general manner.For this purpose various types of information should be assembled in a way which is commonly understandable. In this paper an adaptable and extensible context ontology for creating context-aware computing infrastructures, ranging from small embedded devices to high-end service platforms is been proposed [18]. Till date Ambient Intelligence vision is abstract. Lindwer. M. et al discusses that its social benefits cannot be realized unless a number of requirements regarding mixed-technology design have been met. This involves integration of nano- and opto-electronics [19]. In "Adaptive Data Partitioning for Ambient Multimedia" author discusses that in near future, Ambient Intelligence (AmI) will become part of everyday life. So combining feature-rich multimedia with AmI has the potential of changing the way we perceive and interact with our environment. They proposed a method for mapping multimedia applications on systems with very limited resources by combining adaptive data partitioning with

the course of a user query, retrieval of results and their refinement process.

A. Query Processor/Optimizer

This component processes and optimizes the user query for best optimal plan. This plan would eventually be used to search the repository.

B. Search Repository

This component contains the data. The repository may be distributed. Relevant results are retrieved.

C. Results refiner

This is the most important component of the framework. This component takes in the query results as an input and refines the results using: user and group profile, user location, device, day and time. All these factors help in determining the query context which would eventually help in jotting down the results.

The output of this module is the refined results which are tossed in front of the user. Ambient intelligence is used to judge the user response.

D. Profile

This component as a whole has several sub components such as User Profile, Group Profile, Profile generator, Profile Updater, and Profile Identifier.
User Profile has subcomponents like static user profile, preferences and interests, and dynamic profile. Static user profile would include his/her name, profession, gender, qualification, etc. Dynamic profile includes future events defined by the user, event name, day, and time of the events to occur.

Group Profile has subcomponents like identifier, which helps in identifying the group to which a user belongs at a particular time of the day. Static Group profile component includes group preferences, which uniquely identifies the groups. Each group maintains history including refined query, relevant results, and cluster information, object's information, date, and time.

Date and time in the history are used to discard results after some time period. This would avoid over use of memory space.

I. Crawler

Crawler is responsible for crawling the relevant results, which are stored in the history module of Group Profile. This is done periodically. Main function of this module is to keep the history module updated.

IV. User Scenario

User poses a query to the user interface. Query could be text based or image based. Feature extractors extracts Image features if the query is image based. We are assuming that our Feature extractor is capable of extracting objects from the image. However text based query bypasses the feature extractor module. Query is processed and optimized by the Query processor / optimizer module. The query is then searched through the repository for relevant results. These results are then inputted to the Result Refiner module. This module refines the query results using user and group profile, user location, device, time and day detectors
Profile component finds the user profile and his/her group(s). Similar results and similar User query is searched in the group(s). Query search could be based on simple string matching. Similar queries are relevant results are retrieved and user query results are modified accordingly. Since the queries found in the group history are tagged with their respective cluster information, eventual identification of related result(s) cluster is also possible.

Results are then modified. Modified and refined results are then passed to the user. An ambient intelligent device uses sensors to judge user gestures in response to these results. Use of Ambient intelligence will help Result Refiner to refine the results again. Relevant results, respective query, time, date, results cluster information and Objects are stored or updated in the Group profile. The knowing of relevant user results would be possible by getting user feedback and also using ambient intelligence.

V. Experimental Results

For the proof of concept, we have developed a prototypic application. Client interface was provided to the users though JSP pages. Application was hosted on the Apache Tomcat Servlet container (version 3.2). Queries were posed through web interface. A sample database in MS Access was maintained on the server. Database was populated with 1000 pictures of different aero planes in different environments. Ten different people were randomly selected for the experiment. Each user was asked to pose 10 different queries to the databases for each of following options, i.e., without profile, with user profile, with group profile, and combined profile. Results were collected and summarized in table 1:
The overall experiments show queries with combined results always give better result then other options, i.e., queries using only user profile, and with group profile, and with out profile.

However, there are few threats to our current experiments. First of all the experiment was conducted on a database that contain only pictures of aero planes. Similarly experiment was conducted with only 10 users who posed 40 queries with different options. Experiments are required to be conducted on databases with diverse kind of pictures and with large number of queries.

TABLE I
EXPERIMENTAL RESULTS

User No	Without Profile	User Profile	Group Profile	Combined Profile
1	2	4	5	8
2	1	2	4	7
3	3	3	6	5
4	2	5	4	8
5	3	3	5	6
6	2	4	6	8
7	3	3	6	6
8	2	4	5	7
9	1	2	4	6
10	2	3	5	9

The results are graphically shown in figure 2.

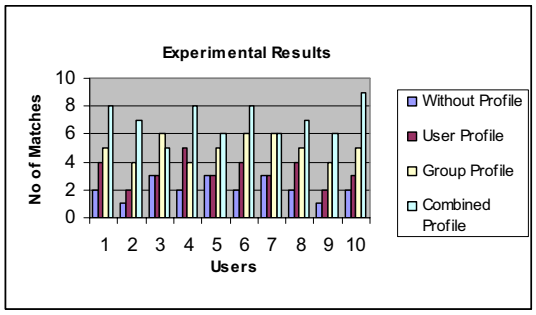

Fig. 2 Experimental Results

VI. Conclusion and Future Work

In this paper, we have proposed a generic architecture involved in the refinement of user query results, using many factors. It is discussed that in order to have better precision

and low recall, appropriate background knowledge, related group knowledge if any, future activities, and expressions play a vital role.

Individual components of the architecture are discussed along with a user scenario discussing technical flow of the user query.

Our future work includes building a prototype in order to compare the performance of our proposed architecture with the existing frameworks.

Also future work would include an idea related to the same concept using a different approach. The approach would include modification and refinement of user query before posing it to the repository. The focus of the approach would be to modify and refine user query using different factors instead of refining the results. An enhanced prototype would be build in order to compare the two approaches. The comparison would help in formalizing a view of to which approach is better, efficient and precise.

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