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Multimedia Answer Generation and User Queries Mining with Markov Chains for Annotation Based Image Retrieval

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Abstract—An approach that allows community members to post queries and answer the questions is the community question answering (cQA) service. This service has gained popularity over the past few years. It also enables general users to seek information from a comprehensive set of well answered questions. But however existing cQA system provides the user with only textual answers, these may not be informative enough for many questions. In this paper, we propose a scheme that is able to enrich multimedia data in addition to only textual data. This approach helps to automatically determine which type of multimedia data should be added to the textual answer. Here we also propose a new method for automatic indexing, annotation and annotation-based retrieval of images. The new method, Markovian Semantic Indexing (MSI), is presented in context of online image retrieval system. User queries are used to construct an Aggregate Markov Chain (AMC) by which it helps to define the relevance between the keywords seen by the system. This approach is built based on community contributed textual answers and therefore is able to deal with more complex queries.
Keywords—annotation; automatic indexing; Markovian Semantic Indexing; cQA; Aggregate Markov Chain.

I. INTRODUCTION

Since the community question and answering services are getting widely emerged in present days, so it is become necessary to develop an effective question and answers which would analyze the intention of the user's queries and provide appropriate answers to the users. QUESTION ANSWERING (QA) is a technique for automatically answering a question posed by the user [1]-[4]. As compared to existing keyword-based search systems, it greatly facilitates the communication between humans and computers by naturally stating user's intention in plain sentences. It also avoids the browsing of a vast quantity of information contents returned by search engines for the correct answers. There is a necessity of the automatic QA system to deeply analyze the complex questions and the sophisticated syntactic, semantic and contextual processing to generate answers. In existence, the automatic QA approach doesn't provide the user with accurate answers. In general, users usually post URLs that link to supplementary images or videos in their textual answers which will be inefficient for the automatic QA. Hence the existing systems have the drawback for supporting the multimedia answers along with the textual answers. In order to overcome the multimedia data problem for automatic answering system, we propose a novel approach which can enrich community textual answers in cQA with appropriate media data. In case of online image retrieval we introduce the Markovian Semantic Indexing (MSI), a new method for automatic annotation and annotation based image retrieval. The properties of MSI make it particularly suitable for ABIR tasks when the per image annotation data is limited.

II. RELATED WORK

A. Beyond Text QA: Multimedia Answer Generation by Harvesting Web Information

This paper proposed a model that is able to enrich textual answers along with multimedia data. However annotation based image retrieval based on probability calculation during the search of large number of images was not supported here[5].

B. Mining User Queries with Markov Chains: Application to Online Image Retrieval

It provided a novel approach presented in context of online image retrieval system. Markovian Semantic Indexing was used to construct an Aggregate Markov Chain through which the relevance between the keywords seen by the system is defined[6].

C. Automatic Set Expansion for List Question Answering

The system aims to develop set expansion SE algorithms to mine textual resources to produce an extended list including additional members of the class represented by the seeds. Here it explores the hypothesis that a noise-resistant SE algorithm can be used to extend candidate answers produced by a QA system and generate a new list of answers that is better than the original list produced by the QA system. It further introduce a hybrid approach which combines the original answers from the QA system with the output from the SE algorithm[7].

D. Structured Use of External Knowledge for Event based Open Domain Question Answering

To develop the framework that face the major problems in question answering (QA) is that the queries are either too brief or often do not contain most relevant terms in the target corpus. In order to overcome this problem, our earlier work integrates external knowledge extracted from the Web and Word Net to perform Event-based QA on the TREC-11 task. Here the aim is to perform event based QA by uncovering the structure within the external knowledge. The knowledge structure loosely models different facets of QA events, and is used in conjunction with successive constraint relaxation algorithm to achieve effective QA[8].

E. Soft pattern matching models for definitional Question Answering

It propose two soft matching models one based on bigrams and the other on the Profile Hidden Markov Model (PHMM). Both models provide a theoretically sound method to model pattern matching as a probabilistic process that generates token sequences. This method demonstrated the effectiveness of the models on definition sentence retrieval for definitional question answering. Here it showed that both models significantly outperform the state-of-the-art manually constructed hard matching patterns on recent TREC data. A critical difference between the two models is that the PHMM has a more complex topology. We experimentally show that the PHMM can handle language variations more effectively but requires more training data.

F. Active learning in Multimedia Annotation and Retrieval

This paper focused mainly on a machine learning technique that selects the most informative samples for labeling and uses them as training data. It has been widely explored in multimedia research community for its capability of reducing human annotation effort. It provides a survey on the efforts of leveraging active learning in multimedia annotation and retrieval. We mainly focus on two application domains: image/video annotation and content-based image retrieval. To categorize the

existing sample selection strategies used in multimedia annotation and retrieval into five criteria: risk reduction, uncertainty, diversity, density and relevance. It then introduce several classification models used in active learning- based multimedia annotation and retrieval, including semi supervised learning, multi-label learning and multiple instance learning.

III. PROBLEM DEFINITIONS

The existing automatic question and answering system is efficient only for textual answers, here the answers retrieved from the cQA will be only in the form of text without any additional multimedia data. The textual answers raised by the users are inaccurate since it doesn't analyze the real intension of the question. The existing system analysis the queries based on the key patterns without analysing the pattern of the questions. Our proposed approach in this work does not aim to directly answer the questions raised by the user instead we enrich the community-contributed answers with multimedia contents. The multimedia data which is enhanced with the cQA answers will be depending on the type of question raised by the users. Hence this strategy splits the large gap between question and multi-media answer into two smaller gaps, i.e., the gap between question and textual answer and the gap between textual answer and multimedia answer. In our scheme, the crowd-sourcing of community member's intelligence helps in bridging the first gap, and thus we can focus on solving the second gap. Therefore, our scheme can also be viewed as an approach that accomplishes the MMQA problem by jointly exploring human and computer. We use Markov Chain method for image retrieval which aims to improve user satisfaction by returning images that have higher probability to be accepted by the user.

IV. SYSTEM DESIGN

The proposed system architecture shows the conceptual model of the application. End user is going to post the question and based on the keyword it will fetch the answer from the database. Image and video information are given at the same time to the end user. Markovian semantic indexing is calculated for each image and the probability that image is selected by next user is calculated. Following are the list of modules:

Answer Category Selection

In this method for an given pair of QA, the system will predict whether the user should be provided by textual answers only or it should be enriched with multimedia data along with the textual data, it will also analyse which kind of textual data should be enriched. Specifically it is categorized into four classes: text, text+image, text+video, text+image+video. It means that the scheme will automatically collect required images, videos or combination of both to enrich the original textual data.

Query generation for multimedia search

In order to collect multimedia data, we need to generate informative queries. Given any QA pair, this component will extract three queries from the question, the answer and the QA pair respectively. The most informative query will be selected from a three class classification model. Here we evaluate the query generation and selection approach.

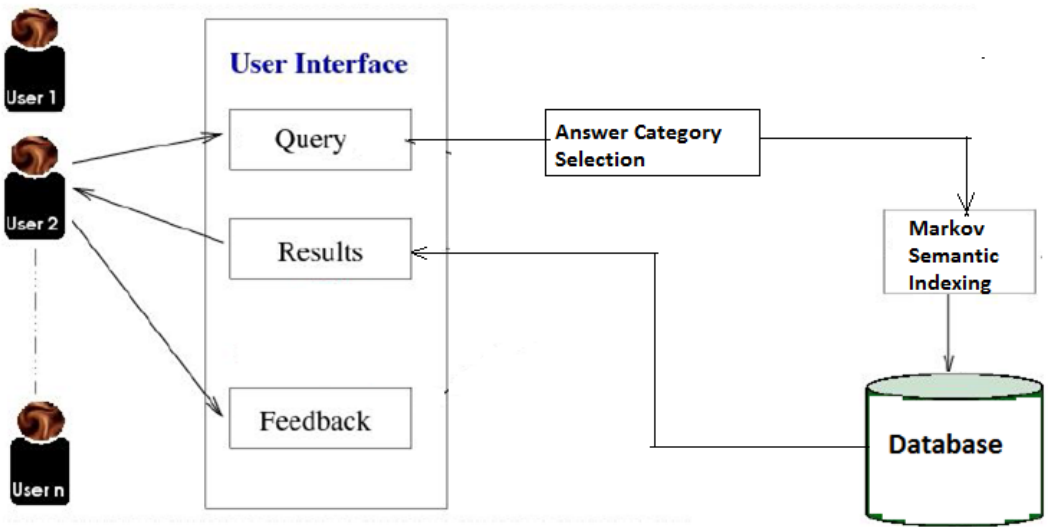

Fig: System Architecture

Training Phase

The proposed approach will be presented in the framework of an online image retrieval system (similar to Google image search) where users search for images by submitting queries that are made of keywords. The queries formed by the users of a search engine are semantically refined, the keywords representing concise semantics when compared to text in documents or other vocabulary related presentations. The aim is to improve user satisfaction by returning images that have a higher probability to be accepted (downloaded) by the user. The assumption is that the users search for images by issuing queries, each query being an ordered set of keywords. The system responds with a list of images. The user can download or ignore the returned images and issue a new query instead.

Image Retrieval System

The methodology proposed in this work encompasses a novel (alternative) probabilistic approach for Annotation-Based Image Retrieval that, compared to LSI and pLSI, is better suited to sparsely annotated domains, like in image databases where, the per image sparse keyword annotation is also limited. It addresses in a more natural way the zero frequency problems, defined as the fact that the probability to find common keywords even in closely related images is typically small because the images are not annotated with exactly the same keywords. This problem is addressed here by means of an explicit relevance link between keywords that carries a probabilistic weight. We show that assigning logical connections between keywords by means of a Markovian model, permits better generalization over a sparsely annotated domain hence the proposed approach raises the reasoning aspect next to the numerical aspect of probabilities. The key idea behind the approach is to compensate for the sparse data by incorporating an annotation procedure of probabilistic qualitative reasoning that will propagate partial beliefs regarding connections between keywords. A mechanism that gains performance from mining the structure of the existing data rather that incorporating new data, as it happens with traditional models is hence introduced.

IV. CONCLUSION

For a given QA pair, this scheme first predicts which type of medium is appropriate for enriching the original textual answer. Following that, it automatically generates a query based on the QA knowledge and then performs multimedia search with the query. MSI helps to get better retrieval results. The proposed system is dynamically trained with queries of the same user that will be served to the system. Consequently targeting is more accurate, compared to the other system that use external means of non-dynamic or non-adaptive nature to define keyword relevance. Finally, query adaptive re-ranking and duplication removal steps are performed to obtain a set of images and videos for presentation along with the original textual answer.

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