

IMPROVING TAG BASED IMAGE SEARCH WITH SOCIAL RE-RANKING STRATEGIES

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Abstract— Social media sharing websites like Flickr allow users to upload images and describe them using free tags. These tags help in organizing images and improving web-based image search. Tag-based image search has become an important method for finding images shared by users on social networking platforms. However, it is still difficult to ensure that the top search results are both relevant to the query and diverse in content.

In this paper, we propose a social re-ranking system for tag-based image retrieval that considers both the relevance and diversity of images. The system re-ranks images by analyzing their visual information, semantic information, and social clues. The initial search results usually contain images uploaded by different users, and each user may contribute multiple images.

First, we apply inter-user re-ranking, where users who contribute more relevant images for the given query are ranked higher. After ranking the users, intra-user re-ranking is performed within each user's image set, and only the most relevant image from that set is selected.

To improve the speed of the search process, an inverted index structure is constructed for the social image dataset. Experimental results on the Flickr dataset show that the proposed social re-ranking method is both effective and efficient.

Keywords—Tag based image search, Social re-ranking, Image retrieval, Machine learning, Flickr dataset, Multimedia.

1. INTRODUCTION

With the rapid growth of Web 2.0 technologies and social media platforms, a huge number of images and videos are uploaded to the internet every day. This continuous increase has created new challenges in multimedia storage, indexing, and retrieval. Among the different techniques used for searching images, tag-based image search has become widely popular on social media platforms because users can easily label or describe images using simple tags. These tags help search engines identify and retrieve related images when users enter a query. However, traditional tag-based search methods often produce results that are not always relevant and sometimes lack diversity. To overcome this limitation, researchers have explored re-ranking techniques that improve search results by considering additional factors such as visual features, semantic relationships, and information related to user contributions.

2. PROBLEM STATEMENT

Tag-based image search systems face several limitations because they rely heavily on user-generated content. The tags assigned by users are often subjective, incomplete, and inconsistent, which can lead to inaccurate or irrelevant search results. In many cases, the system also lacks a proper understanding of the semantic meaning of tags and does not consider the social context in which images are shared. As a result, the overall performance of the image retrieval system may be reduced.

Key challenges include:

- * Handling noisy and ambiguous tags
- * Identifying relevant images among large datasets
- * Utilizing social interaction data efficiently
- * Improving ranking quality without increasing system complexity

3. LITERATURE SURVEY

Many research studies have been carried out in the area of image retrieval and tag-based image search systems. In the early stages, image retrieval systems mainly depended on low-level visual features like color, texture, and shape to identify and retrieve images. Although these techniques worked in certain situations, they were not able to represent the actual semantic meaning of images effectively.

Later, tag-based image retrieval became more common because it is simple to use and requires less computational effort. Users could easily assign tags to images, which made searching more convenient. However, researchers identified several problems with this approach, including tag ambiguity, synonym issues, and the absence of standard tagging rules. Because of these problems, relying only on tags often resulted in lower accuracy in search results.

More recent research has focused on using social information to improve image retrieval systems. Social re-ranking methods take into account factors such as user interactions, image popularity, and community behavior to refine the ranking of search results. These approaches have shown that incorporating social factors can significantly improve the relevance of results and overall user satisfaction.

Even though many improvements have been made, several existing systems still struggle to effectively combine tag relevance with social context in a scalable way. This project builds on previous research and proposes a balanced and efficient social re-ranking

approach to enhance the performance of tag-based image search systems.

4. PROPOSED METHODOLOGY

4.1 Machine Learning

Machine Learning (ML) is a subfield of computer science that enables computers to learn from data and improve performance without being explicitly programmed. The term was introduced by Arthur Samuel in 1959. ML evolved from pattern recognition and artificial intelligence and focuses on developing algorithms that can identify patterns, learn from data, and make predictions or decisions.

Instead of following fixed instructions, machine learning systems build models using training data and use these models to predict outcomes for new data. ML is widely used in many applications such as spam filtering, optical character recognition (OCR), search engines, recommendation systems, and computer vision.

Machine learning is closely related to computational statistics and data mining, where statistical methods and optimization techniques are used to improve learning algorithms. In data analytics, machine learning helps researchers and analysts discover hidden patterns, make predictions, and support decision-making based on historical data.

4.2 Types of Machine Learning Tasks

Machine learning problems are generally classified based on the type of feedback or learning signal available.

Supervised Learning

In supervised learning, the algorithm is trained using labeled data, where both input and output values are provided. The goal is to learn a mapping function that can predict correct outputs for new inputs. Examples include email spam detection and image classification.

Unsupervised Learning

Unsupervised learning works with unlabeled data, meaning the algorithm must discover hidden patterns or structures on its own. It is often used for clustering, pattern discovery, and feature extraction.

Reinforcement Learning

Reinforcement learning involves an agent interacting with an environment and learning through rewards and penalties. The goal is to maximize long-term rewards by selecting the best actions. Examples include robot control and game playing systems.

Semi-Supervised Learning

Semi-supervised learning combines both labeled and unlabeled data. It is useful when only a small portion of the dataset is labeled, while the rest remains unlabeled.

4.3 Machine Learning Approaches

Decision Tree Learning

Decision trees are predictive models that map input

features to output decisions using a tree-like structure. They are commonly used for classification and prediction tasks.

Artificial Neural Networks

Artificial Neural Networks (ANNs) are inspired by the human brain's neural structure. They consist of interconnected artificial neurons that process data and learn complex relationships between inputs and outputs.

Deep Learning

Deep learning is an advanced form of neural networks that uses multiple hidden layers to process complex data. It is widely used in speech recognition, computer vision, and natural language processing.

Support Vector Machines (SVM)

Support Vector Machines are supervised learning algorithms used for classification and regression tasks. They work by finding the optimal boundary that separates data into different classes.

Clustering

Clustering is an unsupervised learning technique that groups similar data points into clusters based on their similarities. It is commonly used in data analysis and pattern recognition.

Bayesian Networks

Bayesian networks are probabilistic graphical models used to represent relationships between variables and to calculate probabilities for predictions.

Reinforcement Learning

In reinforcement learning, an agent learns optimal behavior through trial and error, receiving rewards for correct actions and penalties for incorrect ones.

Genetic Algorithms

Genetic algorithms are optimization techniques inspired by natural selection and evolution, using processes like mutation and crossover to find optimal solutions.

4.4 Modules

A module is a part of a software program that performs a specific function. A complete system is usually divided into several modules so that each module can be developed and managed independently. These modules are later combined together to form the complete program. A single module may contain one or more routines that work together to perform a particular task.

The proposed system is divided into two main sections: Offline Section and Online Section.

Offline Section

1. Inverted Index Structure Construction for Image Dataset
2. Feature Extraction

Online Section

3. Keyword Matching

4. Inter-User Re-Ranking
5. Intra-User Re-Ranking

1. Inverted Index Structure Construction for Image Dataset

In this module, an inverted index structure is created for the image dataset. The main purpose of this structure is to improve the speed of image retrieval. It organizes the tags and related images in such a way that the system can quickly locate images that match the user's search query.

2. Feature Extraction

In this stage, different types of features are extracted from the image dataset. These include:

- Visual features – characteristics such as color, texture, and shape present in the image.
- Semantic features – meaning-based information obtained from the tags associated with images. It refers to the co-occurrence of query tags and image tags.
- View information – the number of times an image has been viewed by users.

These features help the system better understand the images and improve search accuracy.

3. Keyword Matching

When a user enters a query, the system performs keyword matching to retrieve the initial set of images. This step compares the query keywords with the tags associated with images in the dataset. The results obtained at this stage form the initial retrieval results, which will later be refined using re-ranking methods.

4. Inter-User Re-Ranking

In this module, images are ranked based on the contributions of different users. The system evaluates how relevant each user's uploaded images are to the given query. Based on this analysis, users are ranked, and images from more relevant users are given higher importance in the search results.

5. Intra-User Re-Ranking

The intra-user re-ranking process focuses on ranking images within each user's image collection. A regularization framework is used to determine the relevance of each image by combining visual features, semantic features, and view information.

4.5 System Architecture

The system architecture of the proposed tag-based image retrieval system is divided into two main sections: Offline processing and Online processing. These two stages work together to retrieve and re-rank images efficiently based on user queries.

Offlinephase

In the offline phase, the system prepares the image dataset before the search process begins. All images stored in the image database are processed to build an inverted index structure, which helps in faster searching.

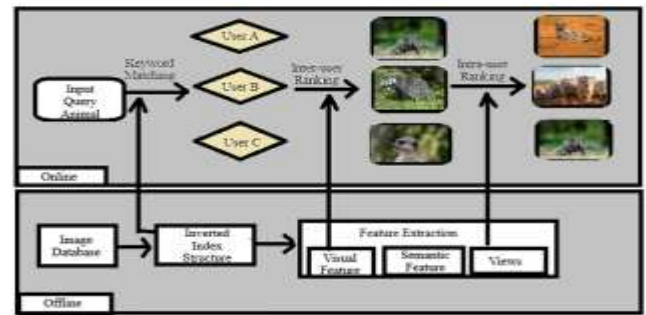


Fig 1 Architecture Diagram

After that, feature extraction is performed on each image. During feature extraction, different types of information are collected such as visual features, semantic features, and the number of views of the image. These extracted features are stored in the system and later used during the image retrieval process.

Onlinephase

In the online phase, the user enters a search query in the form of a keyword or tag, such as "animal". The system performs keyword matching with the tags stored in the database and retrieves a set of related images uploaded by different users (for example User A, User B, and User C).

Once the initial results are obtained, the system performs inter-user re-ranking. In this step, users who contribute more relevant images to the given query are ranked higher than others. After ranking the users, the system performs intra-user re-ranking, where images within each user's collection are ranked based on their relevance.

Finally, the most relevant images from each user's collection are selected and displayed to the user. This two-level ranking process helps improve both the relevance and diversity of the retrieved images.

4.6 Class Diagram

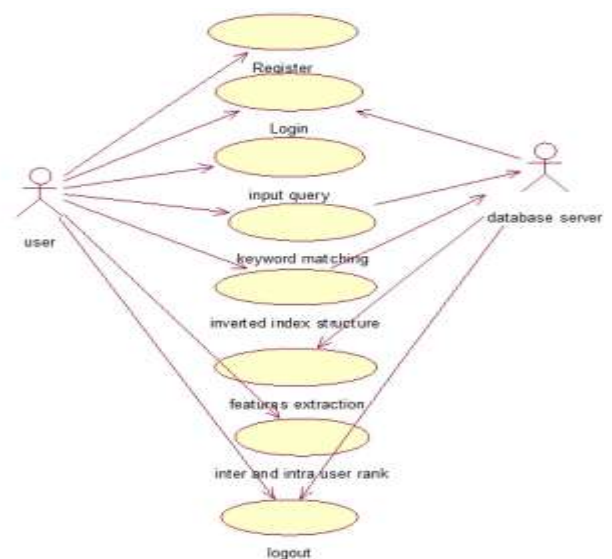


Fig 2 Class Diagram

The proposed system enhances tag-based image search by applying social re-ranking techniques. This approach improves the quality of search results by considering both

the relevance of images and the contribution of different users. The system processes the image search through several steps, which are explained below.

Steps Used in the System

1. Image Collection

Images are collected from social media platforms such as Flickr. These images usually contain tags, user information, and view statistics, which are useful for improving the search process.

2. Tag-Based Search

Users search for images by entering text-based tags or keywords. The system retrieves an initial set of images whose tags match the query provided by the user.

3. Inter-User Re-Ranking

In this step, users are ranked based on how many relevant images they contribute to the search query. Users who provide more relevant images are given higher priority in the ranking process.

4. Intra-User Re-Ranking

After ranking the users, the system examines each user's image collection and selects the most relevant images related to the search query.

5. Final Result Generation

Finally, the selected images from different users are combined to create the final set of search results that are displayed to the user.

This approach helps improve both the accuracy of image retrieval and the diversity of the results, ensuring that users receive more meaningful and varied images for their search query.

5. RESULT AND DISCUSSION

The developed system was implemented to demonstrate the functionality of the tag-based image search and social re-ranking framework. **Sample Output**



Fig 3

The system consists of several modules that allow users to interact with the application through different interfaces such as registration, login, image upload, search, and verification.



Fig 4



Fig 5

6. CONCLUSION

In this paper, a social re-ranking method for tag-based image retrieval is presented. The proposed system uses both inter-user re-ranking and intra-user re-ranking techniques to improve the quality of retrieved images. By introducing user information into the ranking process, the system is able to enhance the diversity of the search results. In addition, the number of views of social images is integrated into the regularization framework to improve the relevance of the retrieved results.

The experimental analysis shows that the proposed method is effective and also reduces the time required for retrieving images. However, during the inter-user ranking process, only the contribution of users is considered, while the similarity between users is not taken into account. Furthermore, several useful details available in the Flickr dataset, such as title information and time stamps, are not fully utilized. These aspects can be considered for further improvements in future work.

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