Intelligent Fashion Wear Recommendations System using Hybrid-CBIR with Advanced Caching

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Abstract: Image plays a crucial role in our daily life. Generally Content-based image retrieval (CBIR) technique provides better similarity estimation among images by using their features i.e. color, texture and shape; in comparison to Text-based image retrieval (TBIR) which is based on meta-data. But in some situation CBIR gives poor result in comparison to TBIR where properties of images (meta-data) is considered such as size, price range, type, category and specific features (if any) etc. In this paper, we have proposed an intelligent fashion wear recommendations system using Hybrid-CBIR with Advanced Caching which is a Hybrid-CBIR caching based system. The proposed system is considering and combined the CBIR as well as TBIR for better result in compare to general CBIR or general TBIR systems. The proposed system has an advanced caching system for reducing server side load. In the novel system, we have assumed that the fashion wear recommendations is based only on selected item, where the item's image(s) features and meta-data both are considered. On the basis of comparative experimental results the proposed Hybrid-CBIR caching based system is giving satisfactory in comparison to other normal CBIR and TBIR systems.

Keywords: Fashion Wear Recommendations, Content-based image retrieval (CBIR), Text-based image retrieval (TBIR), Image Features, Similarity Measures, Hybrid-CBIR, Caching

I.   INTRODUCTION

Image plays a great significant role in our daily life. Human brain is image based, so the brain coordinates the things very well with the things which is image based context in comparison to text based context such as making understanding and memories. That why,someone said that a single image can convey thousands of words. Human brain could stores and relates new images with old images from past memories very fast with high accuracy. That means human brain could do Image-based image retrieval very fast and very well. But today's conventional computer's computation system is binary based and it works opposite to the human brain means it works very well with numbers (text based context) in comparison to the images. So, it can't be used for Image-based image retrieval directly. Therefore, image has to be converted into some kind of numerical context for computer based image retrieval.

For this purpose, IBM developed the first commercial context-based image retrieval (CBIR) and introduced as IBM's Query by Image content (QBIC).

CBIR [4]-[7] first extract image's features vector (i.e. properties such as color, texture and shape) in numerical vector form. For computer based similarity measurement among images, their computed extracted features vectors [8], [9] are used for getting the best similar image possible matches.

CBIR could be used in following fields: (i) Retail catalogues, (ii) Intellectual property, (iii) Textiles Industry, (iv) Military Photograph archives, (v) Art collections, (vi) Medical diagnosis, (vii) Geographical information and remote sensing systems, (viii) Architectural and engineering design, (ix) Nudity-detection filters, (x) Face Finding, (xi) Crime prevention and so on.

Artificial intelligence (AI), is the future of IT world and always try to simulate human brain computation system into computer computation system. And human brain is image based, therefore by default AI is also image based.
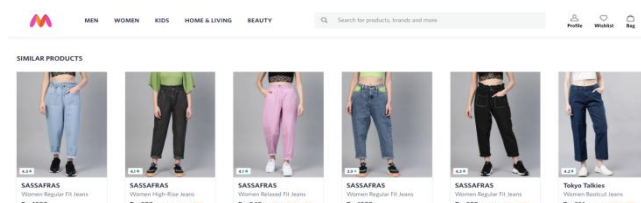

Fig 1. Conventional TBIR based e-commerce recommendation results which is based on meta-data
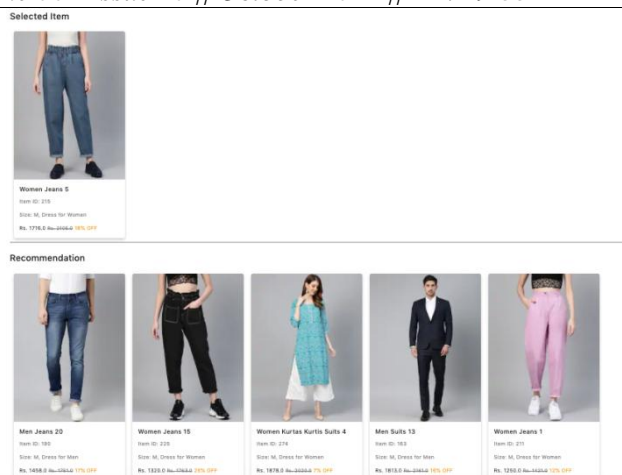
Fig 2. General CBIR based e-commerce recommendation results which is based on only image features

Generally Content-based image retrieval (CBIR) technique provides better similarity estimation among images by using their features i.e. color, texture and shape; in comparison to Text-based image retrieval (TBIR) [12] which is based on meta-data. But in some situation CBIR gives poor result in comparison to TBIR where properties of images (meta-data) is considered such as size, price range, type, category and specific features (if any) etc.

In a physical fashion wear shop or e-commerce, images (visible entity) plays a crucial role because customers first see fashion wear type or category which he/she want to buy, fashion wear images; including color, texture and shape; and further size, price, quality and so on.

In a physical fashion wear shop, when customer visits and he/she select some fashion wear and ask to sales person for further show similar fashion wear, then the sales person try to show fashion wear of similar color, texture or/and shape within a particular type or category of fashion wear for particular gender, age, size and price range and further brand, quality maybe considerable.

E-commerce platforms are virtual simulation of physical shops but conventional fashion wear e-commerce even branded, are recommending similar items on the basis of text based only meta-data (i.e. price, name, brand, category, size etc.); and color, texture or/and shape is/are not considered (as shown in Fig. 1). And second thing in e-commerce platforms is that it's have lots of items (products) with lots of multiple items' photos so general CBIR implementation is not suitable because it maybe be slow down the server speed and it may recommends wrong items for example, items of similar color, texture or/and shape but different in meta-data such as size, type or category, gender, brand and so on (as shown in Fig. 2).

In this paper, we are proposing an Intelligent fashion wear recommendations system using Hybrid-CBIR with Advanced Caching which is a Hybrid-CBIR caching based system which will consider and combined the CBIR and TBIR both for the better result in compare to general CBIR or general TBIR systems and implement an advanced caching [13], [14] system for reducing server side load.

In the novel system, we are assuming that the fashion wear recommendations is based only on selected item, where the item's image(s) features and meta-data both are considered.

For the achievement of the aim, our objective is to use selected item's meta-data and images extracted features and apply TBIR for filtering items on the basis of meta-data and further implement Euclidean Distance as similarity measurement among other items' images' features (CBIR); which has been filtered by TBIR; and implement an advanced caching system for reducing server side load and giving faster result.

In this paper, firstly we will discuss literature survey of different of research papers, in section II where we will use these papers methodologies in the proposed model or for comparison of their results with the proposed model results in experimental evaluation, further in section III we will discuss about different kinds of methodologies and formulas which are used in our research work and other standard methodologies which are compared by our research result in experimental evaluation. In section IV problem formulation and proposed model has been discussed. In section V experimental result & discussion has been discussed after that conclusion and future scope has been discussed in section VI. Finally, literature references are mentioned.

II. LITERATURE REVIEW

In literature survey we found many research scholars are working on Image processing, Pattern recognition and Content-based image retrieval (CBIR) [10]-[12].

[1] PalwinderKaur et al. In this paper, we have studied about Content-Based Image Retrieval using Machine Learning where we have found that many time it gives different result for the same input and it required lots of data for training the ANN.

[2] V. Ramya et al. In this paper, we have studied that the combination of three primary features i.e. color, texture and shape, provide a robust feature set for image retrieval for achieving higher efficiency.

[3] S. Rubini et al. In this paper, we have observed that color features provides approximately similar results with very less processing time if we compare with individual approach.

In the literature review we observed that all research scholars are focusing on either TBIR or CBIR method for similarity measurement but none of them are considering and combining the CBIR and TBIR both for the better result in compare to general CBIR or general TBIR systems.

In this paper, we are proposing an Intelligent fashion wear recommendations system which will consider and combined the CBIR and TBIR both for the better result in compare to general CBIR or general TBIR systems and it will use an advanced caching system for reducing server side load.

III. METHODOLOGIES

A. *Content-based image retrieval (TBIR)*
Get the items as per selected item's meta-data by applying TBIR via database (SQL or No SQL) query.

B. *Content-based image retrieval (CBIR)*
Color description as image feature.

C. *Euclidean Distance*
Euclidean Distance:

$$d(p,q) = \sqrt{\sum_{i=1}^{n}(q_i - p_i)^2} \qquad (1)$$

p, q = two points in Euclidean n-space
q_i, p_i = Euclidean vectors, starting from the origin of the space (initial point)
n = n-space

IV. PROPOSED SYSTEM

E-commerce platforms are virtual simulation of physical shops but conventional fashion wear e-commerce even branded, are recommending similar items on the basis of text based only meta-data (i.e. price, name, brand, category, size etc.); and color, texture or/and shape is/are not considered. And second thing in e-commerce platforms is thatits have lots of items (products) with lots of multiple items' photos so general CBIR implementation is not suitable because it maybe be slow down the server speed and it may recommends wrong items for example, items of similar color, texture or/and shape but different in meta-data such as size, type or category, gender, brand and so on.

In this paper, we are proposing an Intelligent fashion wear recommendations system using Hybrid-CBIR with Advanced Caching which is a Hybrid-CBIR caching based system which will consider and combined the CBIR and TBIR both for the better result in compare to general CBIR or general TBIR systems and implement an advanced caching system for reducing server side load and giving faster result.

In the novel system, we are assuming that the fashion wear recommendations is based only on selected item, where the item's image(s) features and meta-data both are considered.

A. Data Gathering

Gather fashion wear items' meta-data such as size, price range, type, category and specific features (if any) etc., categories, keywords, tags and images.

We have gathered fashion wear items details, categories, keywords, tags and images from Myntra.com website for experimental demonstration only.

B. Pre-Processing

Setup database, resize images, extract images features from items' images (i.e. color, texture and shape). Save items meta-data (such as name, description, category, RequiredData etc.) and extracted features of images on database and save images on file.

C. Select Item

Retrieve selected item meta-data (i.e. Category and RequiredData) and their images meta-data and extracted features.

D. Check Cache for Recommendation

In cache table query for sort other similar items according to their priority (lower value higher priority) for the selected item.

If there is no result found then

follow section V (E) i.e. Recommendation (If not in Cache) and
further follow section V (F) i.e. Rendering

else

follow section V (F) i.e. Rendering.

E. Recommendation (If not in Cache)

1) **Content-based image retrieval (TBIR)**

Retrieve other similar items from database which has same matching meta-data (i.e. Category and RequiredData) and their images meta-data and extracted features.

2) **Content-based image retrieval (CBIR)**

Step 1) Sort k-other similar items according to their images features similarity measurement value (lower value higher priority) on the basis of the selected item by using (1); which comes from the result of TBIR method [12].

Step 2) In cache table insert other similar items according to their priority (lower value higher priority) for the selected item.

F. Rendering

Step 1) Query for getting item's and their images' meta-data from item and image table (as per item and sorted similar item id).

Step 2) Render meta-data of the selected item and the recommended/similar items with the image of most similarity to the selected item.

V. EXPERIMENTAL RESULT AND DISCUSSION

A. Experimental Setup

Gather fashion wear items' meta-data such as size, price range, type or category and required data (specific features) etc., categories, keywords, tags and images.

For the performance and accuracy evaluation of the proposed technique we have gathered fashion wear items details, categories, keywords, tags and images from Myntra.com website for experimental demonstration only (as shown in Fig. 3).

Setup database, resize images, extracted images features from items' images (i.e. color, texture, shape and …). Save items meta-data (such as name, description, category, RequiredData etc.) and extracted features of images on database and save images on file.

In the novel system, we have assumed that the fashion wear recommendations is based only on selected item, where the item's image(s) features and meta-data both are considered.

In this paper, we are proposing an Intelligent fashion wear recommendations system using Hybrid-CBIR with Advanced Caching which is a Hybrid-CBIR caching based system which will consider and combined the CBIR and TBIR both for the better result in compare to general CBIR or general TBIR systems and implement an advanced caching technique for reducing server side load, which is giving faster result in comparison to others.

B. Experimental Evaluation

In CBIR using Machine Learning [1] where we have found that many time it gives different result for the same input and it required lots of data for training the ANN which not occur in the proposed Hybrid-CBIR system and the proposed system is faster than the Machine Learning approaches.

Conventional TBIR based e-commerce recommendation results which is based on meta-data (as shown in Fig. 1) gives bad result in the sense of color, texture and shape in comparison to the general CBIR [2], [3] (as shown in Fig. 4) and the proposed Hybrid-CBIR (as shown in Fig. 5 and Fig. 6 respectively).

General CBIR based e-commerce recommendation results which is based on only image features(Result Time Duration: 0.280 sec)[2], [3] (as shown in Fig. 4) give bad result because it doesn't consider meta-data which is important in some places such as dress for specific gender is considerable. The proposed system gives better result in sense of accuracy and speed i.e. proposed system recommendation none cached results (Result Time Duration: 0.047 sec) as shown in Fig. 5 and proposed system recommendation results from cache (Result Time Duration: 0.011 sec) as shown in Fig. 6.

On the basis of comparative experimental results the proposed Hybrid-CBIR caching based system is giving satisfactory in comparison to other general CBIR or general TBIR systems. Proposed advanced caching technique is giving faster result in comparison to others [1]-[3].
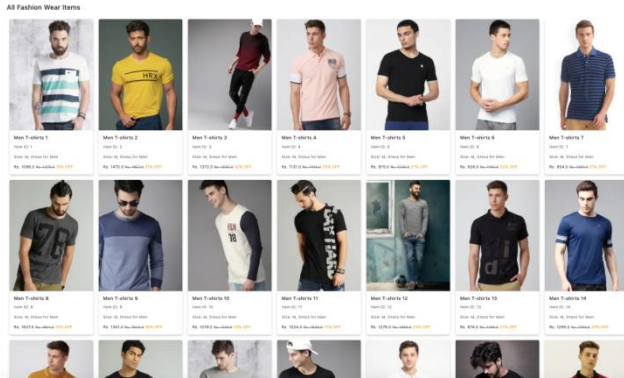
C. Experimental Results
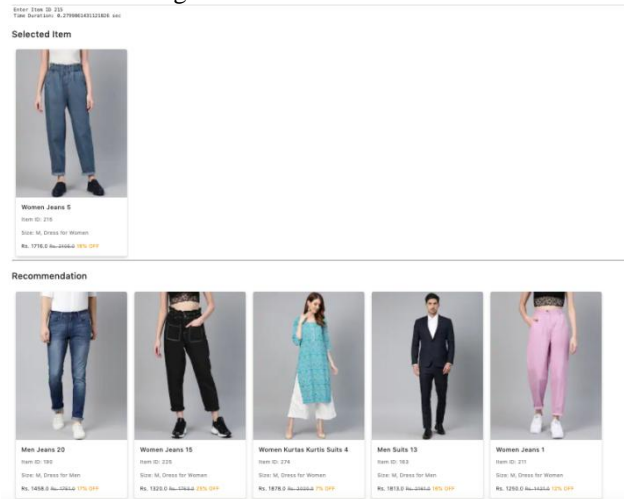

Fig 3. All Fashion wear collects

Fig 4. General CBIR based e-commerce recommendation results which is based on only image features (Result Time Duration: 0.280 sec)
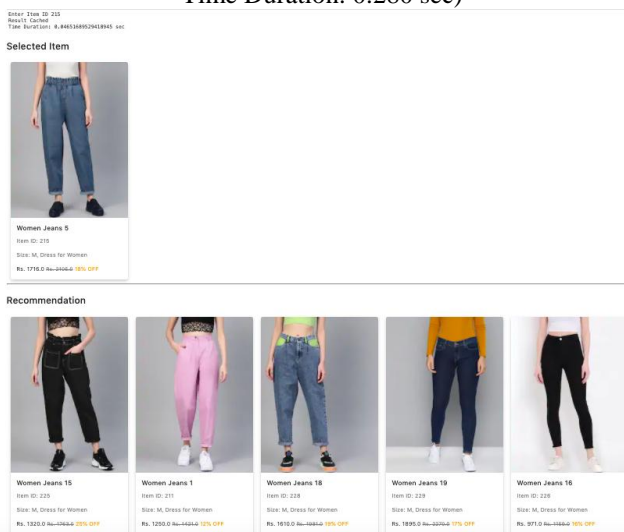

Fig 5. Proposed system recommendation none cached results (Result Time Duration: 0.047 sec)
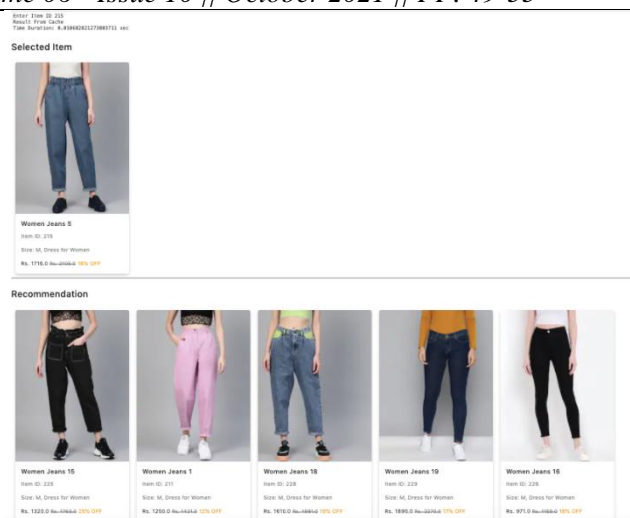
Fig 6. Proposed system recommendation results from cache (Result Time Duration: 0.011 sec)

We have applied pre-processing to gather relevant data using 'Python Programming Language'. On the basis of comparative experimental results the proposed Hybrid-CBIR caching based system is giving satisfactory in comparison to other general CBIR or general TBIR systems. Proposed advanced caching technique is giving faster result in comparison to others [1]-[3].

D. Uniqueness of the Work
The uniqueness of the work is that the proposed system is considering and combined the CBIR as well as TBIR for better result in compare to normal CBIR and TBIR systems. And second is it has an advanced caching system for reducing server side load, handle more requests and give faster result.

VI. CONCLUSION AND UPCOMING WORK
In this paper, we are proposing an intelligent fashion wear recommendations system using Hybrid-CBIR with Advanced Caching which is a Hybrid-CBIR caching based system which will consider and combined the CBIR and TBIR both for the better result in compare to general CBIR or general TBIR systems and implement an advanced caching system for reducing server side load.

In the novel system, we are assuming that the fashion wear recommendations is based only on selected item, where the item's image(s) features and meta-data both are considered.

For the achievement of the aim, our objective is to use selected item's meta-data and images extracted features and apply TBIR for filtering items on the basis of meta-data and further implement Euclidean Distance as similarity measurement among other items' images' features (CBIR); which has been filtered by TBIR; and implement an advanced caching system for reducing server side load and giving faster result.

On the basis of comparative experimental results the proposed Hybrid-CBIR caching based system is giving satisfactory in comparison to other general CBIR or general TBIR systems. The proposed advanced caching technique is used for reducing server side load, which is giving faster result in comparison to othersgeneral CBIR or general TBIR systems.

We will extend this research work by applying new CBIR techniques for feature extraction, similarity measurement or applying more advanced caching technique.

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