Chapter 41
The Recapitulate Analysis of Image Mining Techniques Applications and Challenges Associated

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41.1 Introduction

Images are by far the most widely used data form [1]. Image mining comes from a diverse field of data mining. Data mining means resolving useful or unproductive data/information. This has become one of those fields which have caught the attention of many of the scholars; a lot of work has been done in this field, and it is reflected in the research work. The mechanism of restoring suitable images from the data repository is called image mining [8]. This has evolved into advancements in automation, for example, in image data processing, its storage, and transmitting the information [3]. Contextual image classification and recouping systems are the extensive subjects of multimedia mining research works in the former years [2]. To describe an image, recurrently used characteristics are:

- Color attribute feature
- Texture attribute feature
- Shape attribute feature
- Spatial attribute feature

Images stored are procured, and the solution is claimed with respect to the inquired objective. This process is done by utilizing the existing image whose features are extracted in a particular pattern which matches the objective, and then the required information is displayed [4–6]. The intention of the process in image mining is to elude all the substantial patterns having no insight on the information of

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the image as mentioned before this can be done by different patterns that can be used for extracting the images which are description patterns recognition, correlation patterns recognition, temporal patterns recognition, and spatial patterns recognition. Multimedia image mining deals with the physiognomy of bulky image databases which includes indexing methods, image storages, and image retrieval, all related to an image mining system. The conferred paper deals with the surveying of discrete image mining methods and gives an insignificant tabloid for further research and its advancements.

41.2 Literature Review Based on

1. Image Characteristics/Features Used For Mining
2. Image Mining Framework
3. Image Mining Techniques

41.2.1 Image Characteristics/Features Used for Mining

There are primarily three features of the image that are utilized to extract and store into a database for coordinating with query-request. These are color-shading, shape, and surface texture.

- Color attribute feature: A computer image is a matrix of pixels that are represented in the form of 0 s/1 s. Each pixel's value corresponds to the brightness of each analogous point in the scene. Color images are illustrated by three intensity components. These components generally correspond to red, green, and blue (RGB) or sometimes yellow, cyan, and magenta (YCM). An integer value can be incorporated in the image with each pixel that can be used as an index to a table that holds the intensity of each color component. The histogram is used to plot the number of pixels with an accurate brightness level against the predefined brightness level. For 8-bit pixels, the brightness ranges from zero (black) to 255 (white). The operations based on color characteristics include histogram normalization, histogram equalization, and thresholding.
- Shape or edge feature: Edge is simply a huge change in frequency. Many techniques of image analysis are based on edges since interpretation based on edge detection is unresponsive to change in the overall radiance level. Edge detection highlights image contrast. Detecting contrast, which is a difference in intensity, can highlight the boundaries of features within an image.
- Texture feature. The texture is defined as the proximity characteristics as a region or a block. The variation of each pixel with respect to its adjacent pixels defines texture. Texture feature is an important subsided feature in the image; it can be

used to describe the contents of an image or a region in addition to color features as just these features are not sufficient to identify the image since different images may have similar histograms.

41.2.2 Image Mining Framework

- Image processing includes a domain-associated application where we focus on extricating the most important image attributes from an information knowledge bank. This is useful in getting to know the collaborative properties between high-level state human impressions of images and low-level highlights [3].
- Image mining generally refers to the extrication of image data relationships or other blocks of patterns that are not easily visible or recognizable to the user in the images. The dire need to preprocess images in image mining is to upscale the quality of images. These pictures experience different changes so as to grow essential attributes from the pictures. With these created highlights, mining is done utilizing data mining methods to investigate noteworthy examples. The then coming about examples are approved and translated to get the last learning, which is connected to applications [7].
- As of today, two of the most functional frameworks are as follows: (a) function-driven structure (b) and information-driven frameworks. It can be noted that most of the image mining process architectures fall under the category of function-driven frameworks. The goal of the function-driven framework is to build and clarify the roles and duties that ought to be carried out throughout image mining. Information-driven framework is an effective way of establishing low-level and pixel representation that is contained in a raw image that can be processed to identify high-level objects.
- Content-based image retrieval (CBIR) systems are being used in many commercial sites. The primary work of the CBIR system is to search for images in an image dataset according to the query being given by the user or the operator. They also aim at searching and going through large image libraries based on few automatically derived image features [10, 12].
- There are several ways to approach the image mining framework, but the process discussed in the paper is one of the most efficient ways to go by. We can see from results that advances in image acquisition and store technology have resulted in tremendous growth in the image mining and processing industry.
- The need for tools with proper analysis capabilities is very much important. Systems which can automatically retrieve data are the one with the highest demands. Here in this paper, we are discussing one such system which has the capability to do the same (Fig. 41.1).

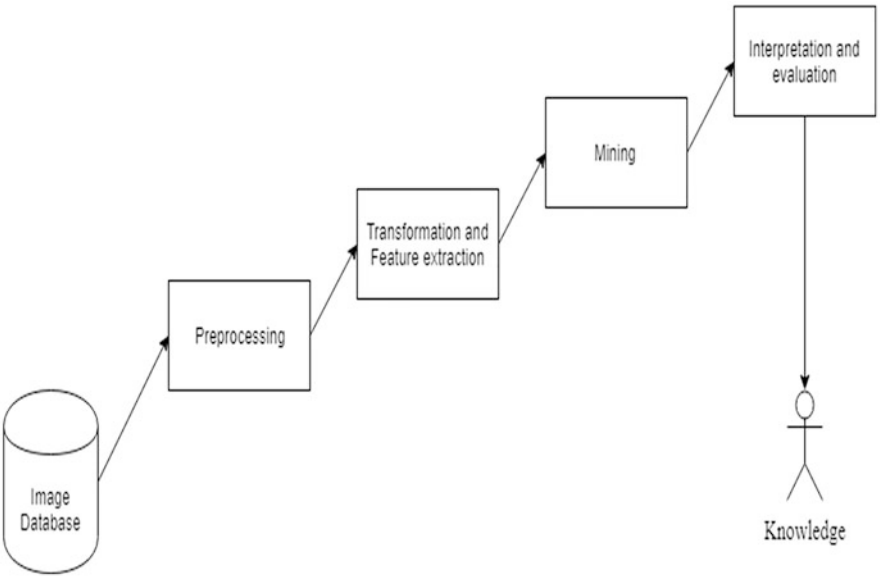

Fig. 41.1 Image mining framework

41.2.3 Image Mining Techniques

Image mining techniques can be broadly divided into object recognition, image indexing and retrieval, image classification and clustering, association rules mining, and neural networks [9, 11, 13, 14].

- *Object Recognition*
  Object recognition has been a dynamic field of the center with regard to picture processing. The process of object recognition programming identifies the different items from the test picture. This is a stage that prompts the fragmentation of pictures. The key concentration here is to recognize objects in a picture and part a picture into smaller zones which would then be able to be dissecting and process the pictures independently. This likewise may be alluded to as a controlled labeling issue as per the models of known things
- *Image Retrieval*
  Keeping in mind, the end goal to recover pictures from a database is we have to file them legitimately. For that, we require a legitimate ordering/indexing programming that does the activity for us. The motivation behind image mining is to recover pictures according to the particular prerequisite of the client. Necessities determination of a client can be named: (i) low-level highlights – shading, shape, or the spatial area of the picture component; (ii) high-level state highlights, recognize objects and bigger shapes in picture; and (iii) logical highlights, singular items or individual.

- *Image Indexing*
  Utilizing an effective ordering plan is fundamental to enhance the image recovery rate and characterization. A portion of the regularly utilized indexing plans is decreasing dimensions or ordering high-dimensional data. This may likewise incorporate the naming/indexing of pictures as indicated by a specific plan.
- *Image Classification*
  The motivation behind image clustering is to order pictures in view of key properties that are related to the picture. It might center on the distinguishing purposes of a picture which influences it to emerge from the others. Today image classification is the most looked into the area. The most part utilized techniques for image characterizations are (a) supervised classification and (b) image grouping.
- *Association Rules Mining*
  Association mining rules are produced just when the support and confidence are more noteworthy than preset limits. Similar works in two sections: (i) in the initial step, all significant item sets that match the support threshold are distinguished by the rule mining calculation. (ii) The second step creates decides that match the confidence edge.
- *Neural Network*
  Neural systems imply the correspondence of a few neurons. These neurons are characterized as straightforward handling units that are isolated into different separated layers with either full or fractional associations set up. The essential undertaking of a neuron is to get the yield that is passed on from the previous neuron and process and produce a yield that will be transmitted to the last neuron. The neurons speak with a few different neighbors keeping in mind the end goal to gather data required for additional preparation.

41.3 Applications

Explicitly analyzing images can reveal significant information to the user. Today, the process of image mining is widely used across various fields. Some of the most popular real-world applications are:

(a) Diagnosis and categorization of medical conditions like tumors: Systematic diagnosis is important for the successful treatment of tumors. Content-based medical image retrieval (CBMIR) can assist the radiologist in the investigation of brain tumors by recovering analogous images from the medical image dataset. Magnetic resonance imaging (MRI) is the most frequently used procedure for imaging of tumors [10, 12].
(b) The satellites revolving around the earth are regularly collecting data in the form of images. There is a huge amount of images being clicked every second;

therefore an efficient methodology is required to mine and store the images. Image mining comes of great help when it comes to satellite cloud imagery [19].

(c) Natural scene recognition: Natural scene recognition refers to the procedure where an agent (such as a human being) visually intakes and interprets scenes (images) that it typically encounters in natural modes of operation (e.g., busy streets, meadows, living rooms). This process has been described in several differentiated ways that are guided by different concepts based on preset rules [17, 18].

(d) Agriculture field: The image mining concepts can be used in order to detect the diseased stem, leaf, fruit, or flowers. It can also be used to define the degree of severity of the diseased part. It can also be used for the classification of different kinds of agricultural produce [15].

(e) Industrial work: The mining process can be carried out in the fields of space imagery or in the coal industry or say remote sensing which includes working with different kinds of sensors, mainly the camera sensor which is used for capturing images to be compared with the already existing images in the image repository [16, 19].

41.4 Challenges

Although image mining is a boon for human users, it possesses a few challenges considering the fact that it is a relatively new and emerging concept. They are as follows [7, 9, 14]:

1. The automatic classification and clustering of images are still not a cent percent accurate, and a lot of work still has to be done in the field of image mining.
2. There is a need for the unification of a clustering query language that can work with both textual and pictorial data format.
3. World Wide Web (WWW) is a huge database of unlabeled images. Whenever a need for images arises, the retrieval and classification of images become a tedious task for the processor.
4. The need of the hour is to come up with a self-sufficient indexing method which standardizes procedures to index and retrieves knowledge from the indexed images.
5. Image mining has problems related to interfaces that often require the involvement of both domain and technical experts. This might lead to wasteful time consumption and may also put extra load on the operators/experts [9].
6. Real-life images are not clean; there might be a lot of added external noise, or maybe the image can be overexposed or underexposed, or maybe the image is defocused [7].
7. There is a very rare scope of the software for image mining being reused as the software is mainly designed for a specific use or utility [3].

8. Bottleneck maintenance is not such a feasible process; therefore work has to be put in, in order to make advancements in the same [16].
9. The researches might solve the theoretical problem aspects, but the industry demands issues to be solved related to the practical aspects [16].
10. There is still a gap in the client-server technology when it comes to image mining, and this can be solved using other techniques like NLP, machine learning, AI, etc. [3, 4].
11. To distinguish influenced locale from woods fire, fire blazes, and fire conduct from wind course, expectations of flame spread [15].

41.5 Future Scope

Summarizing, image mining is an exciting field for examination and introspection. Image mining research is still in its early stages, and numerous issues stay inexplicable. In particular, image mining research in order to advance to another stature, the accompanying issues should be explored at a future scope [7, 9]:

(a) Propose new portrayal plans for visual examples that can encode adequate relevant data to take into account significant extraction of helpful visual qualities.
(b) Devise productive substance-based image ordering and recovery methods to encourage quick and successful access in vast image databases.
(c) Design semantically capable question dialects for image databases.
(d) Explore new revelation systems that consider the exceptional attributes of picture information.
(e) Incorporate new representation systems for the perception of image patterns.

41.6 Conclusion

Image mining is an advanced field that falls into the broader field of data mining techniques. The ulterior motive of image mining is to retrieve meaningful information hidden in images in accordance with the needs of the user. The intent of this paper is to understand the concept of image mining and its process, techniques, applications, and challenges that are explained in the paper. The notion of image mining is beneficial to human users. However, there is a huge scope for further research to be carried out in this emerging field of data science. To conclude, we have provided a brief review of current text and web mining research and discuss the issues and challenges in existing research methods. We observe that multimedia mining based on the extraction of complementary resources like overlay text for a specific domain can be very much useful for digital media assets management like annotation of image search.

Compliance with Ethical Standards All author states that there is no conflict of interest. We used our own data.

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