

Hybrid Pattern Matching With Normalization For Image Retrieval

Ms. Neha Malhotra, Dr. Geeta Rani

Article History: Received: 11 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021;
Published online: 10 May 2021

Abstract. Retrieval and querying of image in an efficient way is needed in order to access the visual content from large databases. Pattern matching plays a very critical role in identification of the images from a database lot. Since the performance of overall process of identification depends upon pattern matching techniques, the selection of appropriate pattern matching technique becomes more crucial. In this paper, a hybrid pattern matching technique is proposed. The proposed technique is based upon color, texture and radial symmetry jointly which is more effective in dealing with the problem of image retrieval in terms of accuracy and efficiency. It is based on three pattern matching techniques where area selection is performed individually while removing redundancies. The experiments are performed in different scenarios using MATLAB and results so obtained give healthier accuracy. The proposed technique shows 68%, 42% and 11% improvement in comparison to existing colour, texture and radial based techniques.

1. INTRODUCTION

Pattern matching is a phenomenon in which the unknown patterns or the reference patterns can be extracted out of an image in order to mention and extract similarities for identification and other purposes [1]. The whole process of pattern matching depends upon different types of pattern matching techniques used, which can be done for image restoration or extraction of an image from a lot. An image lot is referred to as a group of images from which the image is retrieved. This whole process of matching and identification of patterns in the image from the image database is very difficult if the images are distorted or damaged in some way [2].

2 MS. NEHA MALHOTRA, DR. GEETA RANI

In order to remove this difficulty from the process there is a need to make the process robust so that the distortions and the damages created on the image cannot affect the overall process of matching the images and retrieving them from a lot. Pattern matching can be done on the basis of many parameters out of which colour based pattern matching, text based pattern matching and radial symmetry based pattern matching are considered in this research [3].

Colour based pattern matching, as clear from its name, matches the different patterns of the colours oriented in different shapes and indefinite locations of the image. This is the most basic and the common type of pattern matching that can be done upon the images for extraction of the same from a lot. As it is evident, the colour based pattern matching is easier to implement, but the difficulty which comes with colour based pattern matching is, that it is very susceptible to the damage and orientation problems in the pattern matching process which can distort the accuracy of the results of the retrieval process from the lot and hence degrading the quality of the tool which is using this type of pattern matching. But in some basic scenarios colour based pattern matching is very important because this forms the very basis of the pattern matching process [4]. All the improvements and other supportive matching techniques require the colour based pattern matching which ensures that the colour based pattern matching cannot be ignored because of its qualities and simplicity that it adds in the overall pattern matching process of the images.

The second type of pattern matching that is being used in research is the texture based pattern matching. Texture is a much more robust method of pattern matching than the colour based pattern matching because in texture based pattern matching different shapes in the images are used for retrieval of the image from the lot. In texture based pattern matching the values of the pixels in regards to particular shapes and areas in the image are used, not only from the colour point of view but from their statistical appropriateness [5]. In this context, the image and the kernels of the pixels that are present locally are considered. The overall approach of the texture based pattern matching is very different from the colour based pattern matching because colour matching is based on the local behaviour of the image with comparison to the local behaviour of the other images but the texture based pattern matching is not just the local behaviour of the image but also the context of the statistical parameters.

Third and the last type of pattern matching that is being used in the current research is the radial symmetry based pattern matching in which the symmetry of a point in all directions going radially out or in is considered in comparison to different points in the retrieval image which is having similar patterns of radially inward or outward pixels [6]. This pattern matching technique is very robust because it does not have the problem of the being directional and being bogged down by the changes and the problems that occur in the

image in some areas because the radial outward/inward matching will reduce the effects of any distortions or damages present.

HYBRID PATTERN MATCHING

3

Finally the research goes on to develop hybrid technique of pattern matching based on the color, texture and radial symmetry based pattern matching methods for removal of effects of the size and the orientation of the image from the pattern matching process by using the hybrid technique which is cascading of all the above techniques along with the normalization process to make the system more efficient.

2. PREVIOUS WORK

In this paper [7] it is being proposed that for presenting texture feature of an image, the general approach in an environment which is compact and interrogative is to be governed by a technique called dominant texture descriptor. It draws inspiration from dominant colour descriptor. The basic analogy of the technique is based upon the clustering of the features which are at the local level in the image and identification of the dominant components along with the spatial distribution of them in an image. Even more detailed scenario of the above mentioned technique is present which encodes the special discrimination of the pixel present within the image and hidden each and every component of the image. In this technique it is illustrated that this method is applicable on couple of famous descriptors which are MPEG-7 Edge Histogram and Gabor texture. During the analysis of the performance for the technique proposed and illustrated it was used to classify a group of about 900 images which the experimental results, demonstrating that the values which were achieved for pretty much comparable to the traditional approaches. It also came up that this representation is much more practical and compact and can be improved further to give 10 to 20% improve results especially in the case of those integers which are on-homogeneous in texture

Another research [8] presented that one of the key components while the identification of the image according to the human perception is the texture and while designing the system for image retrieval it is very important that actually is given due importance. This piece of work during the research combined the perceptual texture features and Gabor wavelet features for the retrieval of the image. Experimentation was done it was seen that the new texture features which were the improved ones according to the human visual perception perform better than the traditional methods because of the features which were including like directionality contrast coarseness in the wavelet domain. The method was tested by using the Brodatz texture database and the results as said were promising results which can be improved in the future for even more accurate results.

In a research [9], new content-based image retrieval (CBIR) scheme is proposed in NS domain. For this task, RGB images are first transformed to three subsets in NS domain and then segmented. For each segment of an image, colour features including dominant colour descriptor (DCD), histogram and statistic components are extracted. Wavelet features are also extracted as texture features from the whole image. All extracted features from either segmented image or the whole image are combined to create a feature vector. Feature vectors are presented for ant colony optimization (ACO) feature selection which selects the most relevant features. Selected features are used for final retrieval process.

4

MS. NEHA MALHOTRA, DR. GEETA RANI

In another research [10], a new technique called CBIR which was content based image retrieval was presented. In this technique the normal RGB images are first transform into three subjects in the domain of NS after which they are segmented. For every segment which is present in image many features like the colour feature and the colour descriptor etcetera are found and extracted to perform the function. The wavelet features are also extra extracted from the image so that image can be categorised on the whole after which all the feature which are extracted from the segmentation and other processes taken as the total set of features in the image. Finally the classification of the image is done after the Optimisation then using the Ant Colony Optimisation which gives out the relevant images.

In this research [11], it presented new face recognition method for the images based upon the additive location of the images which has human faces. The technique which is being proposed uses the boosting of the components representing the colours of the image which transform them into two small models which can further be used to identify the subsets in the images. This process is done to identify the best FR performances and FR peak in the image. In addition to that for the advancement of the effect of the colour components and the feature which are selected for the identification of the image all the features are combined with proposed weighted feature fusion scheme. Effectiveness of the current method has been proved very efficiently and successfully many databases have been used for the identification of the images which further prove that the method is called Universal if used for different database in the industry. Experimental results found also supports the theory that the performance of the proposed method is impressive and better than the results of the other state of the art methods for identifying different challenges including highly controlled illumination,

moderate force variation and small resolution face images which can be really big problem for the identification of the images while the retrieval is to be performed.

Another research [12] the work is done using the artificial neural networks which have been proved as a very successful technique to be applied in the cases where the spectrum of complex analytical problems are to be solved with computational ability because the computational intelligence is present in the classification algorithms like neural network is use as compared to the other conventional method. In the process of the technique which was been used to identify the images in the Computer aided Diagnostics it proved to be very difficult to perform the automatic Diagnostic differentiation in the images which had the management issues and their dedication of them was very difficult. The presented technique makes the task comparatively easier because a large database is being explored for different features and different areas of the feature in the subset of the images are found which are then classified using the neural network technique.

HYBRID PATTERN MATCHING

This research presents the method of pigment is identification in the skin present based on the radial features around the Kernel of the images which has the area of interest and making out of the final list of the features for it to be classified using artificial neural networks.

In this paper [13], it is concerned with the Restoration of the images by retrieving them using the RBF which is the radial basis function in which this feature is being introduced as the image comparator in the 2D images for performing competitions on then to convert them to 3D implicit surface to solve the problem which otherwise would have been very difficult. During some experiments which were performed it was found that the proposed method performed better than the other conventional method.

In this technique [14], which is performed in the research the convolution neural networks are being used which proved to be verify effective in the Diagnostics and the classification of the images because in the images which are very noisy the data classification task is very difficult but the communication networks sales are based upon the hidden layers are able to identify images with noise which improve the accuracy of the system. The method which is produced using the convolution neural networks works as a system in which speech signals are used as input data and D model off the noise is found after which the task is completed by deciding the spectrum of uncertainty resented. This research is important because same method can be applied to the spatial data of the image.

In this research [15], an automatic weak learner selection process based technique is proposed which is used in the pattern recognition method. In the cycle of pattern recognition the weak learners has an important role to play for differentiating between different features. The approach is based on analysis of the weak learners by the method of probability density functions which are very appropriate tool for or making the computer vision applications in the domain of image retrieval. In this work new measurement of the common surface is being computed for the valuation of the soccer goals in the video. The results of the experiments which were achieved show that the approach is very promising and has superiority on the other comparative techniques which are present currently in the market

In this paper [16], new unique approach which is used for the logo recognition is proposed using the deep convolution neural networks. Accurate recognition of the logo is very important in the industry for the copyright infringement and other control systems to perform the corporate mechanism correctly for the companies. It is also very important to enhance the efficiency of the company's in detecting the copyright material that the others are producing by copying their items and other products and services. Classification method called support vector machine work trained and used for the classification of the images but after that the fine tune models were employed in the parallel structure to make the identification of the logos more efficient and further enhance the detailing of the classification. The tests which were conducted show that the database of logo which was used was correctly detected up to 98.4% which is a very promising result. During the experimentation the comparative analysis of the presented method and the other method was also done which also showed that the proposed approach has greater efficiency.

6 MS. NEHA MALHOTRA, DR. GEETA RANI

In this paper [17], the author tells that the usage of deep learning approaches for the identification and retrieval of images is a slow process because of the repeated-ness of the elements which is high temporal redundancy and huge data of the video frames.

It is also told that one of the best solutions for increasing the efficiency is to measure the optical flows. In general scenarios extracting the motion features is also very time consuming that is why traditional identification methods are not suitable for the real time measurement of features on the other hand the compressed videos available in many scenarios specially when using the small devices like tablets and mobiles.

In this paper the author [18], shows concern about the content based image retrieval because in that the focus is on making a hidden semantic concept Discovery methodology e2c the effectiveness of the semantic intensive image retrieval. In the proposed method every image in the data set is segmented into different subsets linked

with the smooth colour texture and their features. By using the regional statistic data in each image and each subject and implementing a vector quantization method uniform and sparse region based representation is achieved.

3. PROPOSED WORK

In this work the proposed method uses the union of all three pattern matching techniques used. Here are the key steps which are taking place in the process of pattern matching, starting from colour and ending up with hybrid method.

- First of all, the probable matching areas of the two, to be sample images are drawn and queued in order of the region labels.
- Then the images are set in order to retrieve the contents of the regions in the area of the image.
- Images are compared for colour based pattern matching in the first round. In the second round the images are similarly scanned and swept for texture based for all regions. Lastly the radial symmetry based pattern matching is done.
- It is to be noted that regions which are matched with previous method are not swept again to save. Similar process is done for radial symmetry based matching.
- After all of that is done the method counts the credits of the matching and take the decision of matching based retrieval.

7. HYBRID PATTERN MATCHING

Pseudo code for the proposed method

```
Step0:Start Procedure
Step1:img1=getimage(sample);
Step2:img2=getimage(imgfromset);
Step3:getprob=retriever_prob_regions(img1,img2);
Step4:forgetprob 1 to n;
Step5: if matched colour based
Step6:mark region and eliminate from getprob;
Step7:end if
Step8: if matched texture based
Step9:mark region and eliminate from getprob;
Step10:end if
Step11: if matched radial based
Step12:mark region and eliminate from getprob;
Step13:end if
Step14:end for
Step15:Cr_img1=countcredits(img1);
Step16:Cr_img2=countcredits(img2);
Step17:com_credit=comparecredits(Cr_img1,Cr_img2);
Step18: if credit threshold meet
Step19:Draw image from lot
Step20:else
Step21:Reject Sample;
Step22:end if
Step23:end procedure
```

4. TECHNIQUES USED AND EXPERIMENTS



FIGURE 2.The lot image



FIGURE 3. The sample image distorted with white distortions but the color based pattern matching giving the match of a single key point.

The colour based pattern matching technique, as evident from the result shown in figure 2 and figure 3, is matching can only the colour patterns which are available in the image. This type of pattern matching is only suitable for the uniform colour palettes and the regions of uniform colour which are present in the image. Even though there were two other very uniform colour patterns but due to the distortion, pattern could not be matched.



FIGURE 4. The lot image



FIGURE 5. The sample image distorted white distortions but the texture based pattern matching giving the match of a single key point

Texture based pattern matching technique, as evident from the results in the figure 4 and figure 5 shows that the pattern of the region was matched which goes one step ahead of the colour based pattern matching but still the distortion could not be covered and accounted for. Hence the scope for further improvement in the texture-based pattern matching is there which is covered by radial symmetry based pattern matching.

9. HYBRID PATTERN MATCHING



FIGURE 6. The lot image



FIGURE 7. The sample image distorted white distortions but the radial symmetry based pattern matching giving the match of a single key point

Going above the colour based pattern matching and the texture based pattern matching in figure 6 and figure 7, the radial symmetry based pattern matching technique allows the retrieval to go beyond the distortions in the image. It is also matching the most difficult parts of the image in the lot, which proves the effectiveness of the pattern matching with radial techniques. The only thing that is needed to be improved in the pattern matching of the radial symmetry based pattern matching is the range because it restricts itself to the small range in the areas of missing information.



FIGURE 8. The lot image

10 MS. NEHA MALHOTRA, DR. GEETA RANI



FIGURE 9. The sample image distorted white distortions but the hybrid pattern matching giving the match of a single key point each by using normalization along with hybrid technique

The hybrid technique mentioned in figure 8 and figure 9 goes on to remove the problems with all the three (colour, texture and radial symmetry) mentioned techniques and discovers the distorted regions which were left behind by the colour and the texture based pattern matching techniques and along with that it removes the range problems of the radial symmetry based pattern matching technique. With the help of normalization, the size and orientation problems in the images can also be solved.

5. RESULTS

The results from an image lot show that the accuracy of the pattern matching from the hybrid technique is better in comparison with the pattern matching techniques of the individual colour based matching, texture based matching and radial symmetry based matching.

TABLE 1. Number of images retrieved

Technique	Color	Texture	Radial Symmetry	Hybrid
Accuracy	6	7	9	10

11. HYBRID PATTERN MATCHING

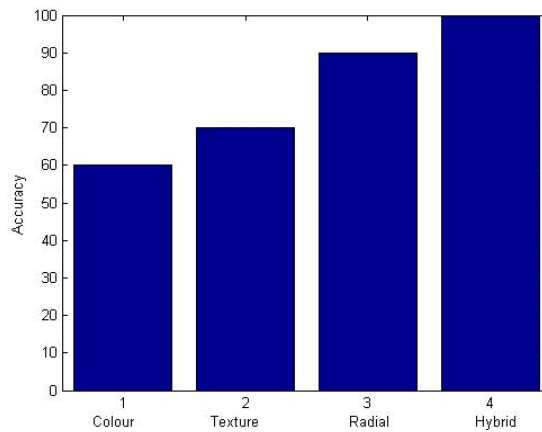


FIGURE 10. Comparative accuracy

Figure 10 shows the corresponding comparative accuracy in accordance with the results obtained in Table 1. The comparative accuracy is of the number of images identified out of the instances or test runs. Since the hybrid method identified all ten images in test, it came out to be 100% accurate in our initial experiments. Accuracy=Images identified/Total test runs

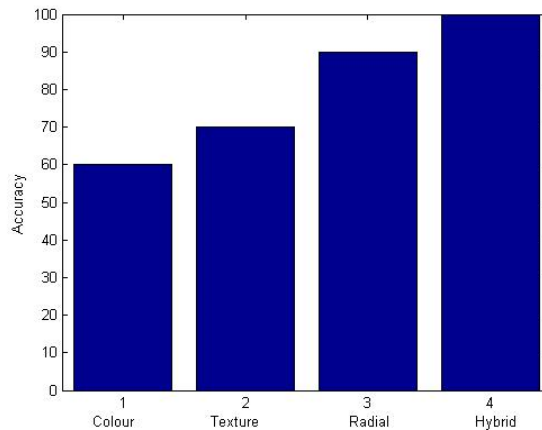


FIGURE 11. Percentage improvement

Figure 11 shows the percentage improvement of the hybrid method when compared to the previous individual method of the colour based, texture based and radial symmetry based pattern matching.

6. CONCLUSION

In this work the experimentation regarding the implementation of the colour based pattern matching technique; texture-based matching technique and radial symmetry based pattern matching technique were performed. It was found that the colour based pattern matching is only able to determine the patterns in the smooth and the uniform regions of the image. Technique

12 MS. NEHA MALHOTRA, DR. GEETA RANI

The texture-based pattern matching techniques perform better than the colour based pattern matching technique but it still cannot remove all the problems with colour based pattern matching technique. Radial symmetry based pattern matching technique performs better than colour and texture base techniques but still it has some problems in the range that it can cover in the limiting regions of the image. The hybrid pattern magic technique performs better than all of them and gives 100% accuracy of detection when used with normalisation. In future the hybrid technique can be used to identify more distorted images in a bigger database.

REFERENCES

1. Landau, G. M., & Vishkin, U. (1994). Pattern matching in a digitized image. *Algorithmica*, 12(4-5), 375-408.
2. Bae, J. S., & Song, T. L. (2008). Image tracking algorithm using template matching and PSNF-m. *International Journal of Control, Automation, and Systems*, 6(3), 413-423.
3. Bae, J. S., & Song, T. L. (2008). Image tracking algorithm using template matching and PSNF-m. *International Journal of Control, Automation, and Systems*, 6(3), 413-423.
4. Dondi, R., Fertin, G., & Vialette, S. (2011). Complexity issues in vertex-colored graph pattern matching. *Journal of Discrete Algorithms*, 9(1), 82-99.
5. Armi, L., & Fekri-Ershad, S. (2019). Texture image analysis and texture classification methods-A review. arXiv preprint arXiv:1904.06554.
6. Jennings, B. J., & Kingdom, F. A. (2017). Searching for radial symmetry. *i-Perception*, 8(4), 2041669517725758.
7. Pattanaik, S., & Bhalke, D. G. (2012). Efficient content based image retrieval system using mpeg-7 features. *International Journal of Computer Applications*, 53(5).
8. Manjunath, B. S., & Ma, W. Y. (1996). Texture features for browsing and retrieval of image data. *IEEE Transactions on pattern analysis and machine intelligence*, 18(8), 837-842.
9. Rashno, A., & Sadri, S. (2017, April). Content-based image retrieval with color and texture features in neutrosophic domain. In 2017 3rd International Conference on Pattern Recognition and Image Analysis (IPRIA) (pp. 50-55). IEEE.
10. Rashno, A., Sadri, S., & SadeghianNejad, H. (2015, March). An efficient content-based image retrieval with ant colony optimization feature selection schema based on wavelet and color features. In 2015 The International Symposium on Artificial Intelligence and Signal Processing (AISP) (pp. 59-64). IEEE.
11. Rahman, M. H., Bashar, M. A., Rafi, F. H. M., Rahman, T., & Mitul, A. F. (2013, May). An automatic face detection and gender identification from color images using logistic regression. In 2013 International Conference on Informatics, Electronics and Vision (ICIEV) (pp. 1-6). IEEE.
12. Er, M. J., Wu, S., & Lu, J. (1999, December). Face recognition using radial basis function (RBF) neural networks. In Proceedings of the 38th IEEE Conference on Decision and Control (Cat. No. 99CH36304) (Vol. 3, pp. 2162-2167). IEEE.
13. Uhlir, K., & Skala, V. (2006). Radial basis function use for the restoration of damaged images. In *Computer vision and graphics* (pp. 839-844). Springer, Dordrecht.
14. Browne, M., & Ghidary, S. S. (2003, December). Convolutional neural networks for image processing: an application in robot vision. In *Australasian Joint Conference on Artificial Intelligence* (pp. 641-652). Springer, Berlin, Heidelberg.
15. HYBRID PATTERN MATCHING
16. Zanganeh, A., & Jampour, M. (2019, March). Automatic Weak Learners Selection for Pattern Recognition and its application in Soccer Goal Recognition. In 2019 4th International Conference on Pattern Recognition and Image Analysis (IPRIA) (pp. 240-245). IEEE.
17. Wolfshaar, J. (2015). Deep Convolutional Neural Networks and Support Vector Machines for Gender Recognition (Doctoral dissertation, Faculty of Science and Engineering).
18. Károly, A. I., Elek, R. N., Haidegger, T., Széll, K., & Galambos, P. (2019, October). Optical flow-based segmentation of moving objects for mobile robot navigation using pre-trained deep learning models.

In 2019 IEEE International Conference on Systems, Man and Cybernetics (SMC) (pp. 3080-3086). IEEE.

19. Feng, L., & Bhanu, B. (2015). Semantic concept co-occurrence patterns for image annotation and retrieval. IEEE transactions on pattern analysis and machine intelligence, 38(4), 785-799.

DEPARTMENT OF COMPUTER APPLICATIONS, UNIVERSITY SCHOOL OF
MANAGEMENT STUDIES
RAYAT BAHRA UNIVERSITY
TEHSIL KHARAR, DISTT. MOHALI, KHARAR, 140104,
PUNJAB, INDIA

nehamalhotra588@gmail.com

DEPARTMENT OF ENGINEERING AND TECHNOLOGY
CHITKARA UNIVERSITY, RAJPURA,
140401, PUNJAB, INDIA

mailto:geeta@gmail.com