Turkish Journal of Computer and Mathematics Education Vol.12 No.9 (2021), 2046 - 2053

Research Article

An Analysis on Medical Image Retrieving Techniques

Koteswaramma N[a,b], and Murali Mohan Babu Y[c]

[a]Research Scholar, ECE Dept., JNTUA, A.P., India
[b]Assistant professor, Vignan Institute of Technology and Science, Deshmukhi, Telangana, India
[c]Professor,ECE Dept., Tirumala Engineering college, Narsaraopet, Guntur, AP, India.

Article History: Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 20 April 2021

Abstract: The images that are the critical and important images which contain visual, useful and meaningful information that cannot be observed by an ordinary person are medical images. Medical images are usually saved for the future purpose. The retrieve process is the method that brings the similar images from a database. The main objective of Image retrieving techniques is to bring out the maximum nearest image to the input query image based on some standard features. In this paper, it is analysed the state of art image retrieving models in the area of medical image processing

Keywords: Image processing, Retrieve, Machine learning, Medical Image.

1. Introduction

The field of Computer Vision and its vast extend, presents great challenges for research, but shows in parallel great potential for real-world applications and innovations. In the domain of image recognition, research effort focuses on finding models to detect and identify objects that appear in digital still images or frames of video sequences. The classification of real-world objects given a picture of them is a common image recognition task that usually includes supervised learning of the models, during which multiple images are used as the representing samples of a given class. A more challenging task is to search inside a collection of images for occurrences of an object, given only the picture of the object or parts of its picture. A set of corresponding images will be retrieved and returned by the system, regardless of their labels and based on visual relevance.

That is directly equivalent to searching into a collection of text documents using a combination of keywords or an entire sentence, in order to retrieve relevant documents. This analogy can bring the image recognition problem into the domain of Information Retrieval. Content-based image retrieval can be defined as an image recognition task, during which the detection of key visual elements inside a collection of pictures returns a set of visually relevant images. Existing methodologies for text-based retrieval can be utilized on visual information, provided that we can create a language to represent it. In a written language the characters representing vowels and consonants and the diacritical marks which indicate breathing and vocal shaping, can be all considered as values for features of the spoken language. In equivalence, the visual features that might refer to color, texture or shape can form visual words that describe a region of a picture, used in a visual document which describes the whole picture. A simplified breakdown of this problem would be: a) Extract the proper visual features from an image. b) Create a language that will describe them. c) Index the collection of images exactly like a collection of text documents.

2.Literature Review

A database of Medical image retrieval using a low-level feature and a high-level semantic feature is studied in(Salahuddin Unar,2019; Khawaja Tehseen Ahmed,2019). This work includes two main parts: image preprocessing and the machine learning. The input picture is represented by a division tree structure, where the root speaks to the entire image; hubs closer to the root speaks to the entire image, hubs closer to the root speak to huge locales, while their children hubs capture littler inserted points of interest. The division calculation is utilized to re-segment the image. The hubs are coordinated by machine learning strategy. The semantic comment of the therapeutic recovery framework is realized by the machine learning strategy. The machine learning strategy utilized is the support vector machine, which is utilized to optimize the Network parameters by which move forward the impact of semantic explanation and acknowledgment rate. The exploratory test comes about appear that the clinical pictures demonstrate the possibility of the recovery framework and support the hypothesis displayed.

Content-based medical image retrieval for early detection of lung cancer nodules from the computer tomography images is explored in (B A Ahmad Hassanat,2016; Y.Muralimohanbabu,2018). In this, feature extraction is performed by combining texture and grayscale resolution methods. The texture features are extracted using Co-occurrence matrix representation. The feature set is stored in the form of the feature vector in a feature database for the database images and the query image. Comparison of the feature vector of the inquiry image is

performed with those of the database. Based on the comparison, images that are closely comparable to the inquiry picture are recovered from the databases and shown. Support vector machine classifier is used for diagnosis whether a query image supplied to the system is cancerous or non-cancerous. The support vector machine learns from the diagnosis rules generated from the database images. Then the classifier will be able to classify whether an image provided is cancerous or non-cancerous.

A medical image retrieval system based on image content for a web collaboration system is proposed in (R. Usha ,2015). In this research, an image retrieval system using image content called Archimedes is developed, that enables the users to transfer their feature sets and have a comparison of their method with the stored feature sets. In this framework, a number of radiologists can clarify a specific picture beneath distinctive conditions. This medical image content-based image retrieval system allows storing, annotating and retrieving data and image. To focus on a particular type of characteristics of a specific disease, feature extraction from a large set of images is the main challenge. This problem is eliminated in this proposed system by allowing users to store the extracted features in the system for comparison along with the images from which they were extricated.

Image features descriptor based on the neighborhood diagonal extrema design for computer tomographic image retrieval is proposed in (K.Radhika,2018). The local diagonal maxima and minima are extracted by making use of first-order local diagonal derivatives. Additionally, the measurement of the proposed descriptor is not influenced by any parameter. Tests were performed over two computer tomographic image databases affirmed the capacity of the descriptor for effective computer tomographic image recovery assignment.

Content-based medical image retrieval making use of shape descriptors is studied in (M B Suresh,2017; Tushara, D.B,2016; K.Radhika,2018; Fu-ping Yang,2017; Bindu Tushara,2015; D. Chandraprakash,2017). In this, the shape feature is used to index the image database. The image retrieval process includes several steps such as; image enhancement, shape extraction, the formation of the feature vector, building feature database, similarity comparison of entries of feature database and that of the query image, indexing, and retrieval. The shape signatures that are selected are complex coordinates, curvature, and cumulative angular function. These shape signatures are commonly used in Fourier descriptor implementations and are suitable for general shape representations. The outline features of similar shapes are considered in shape retrieval systems, whereas the position, size, and rotation of the shapes are not considered. For shape comparison, the shape representations must not vary with translation, rotation, and scale. Shape invariance is easy to obtain for the Fourier descriptors. Experiments were conducted with medical images and the precision and recall were estimated, which produced promising results.

Content-based image retrieval with multi-feature classification using the back-propagation neural network is investigated in (Somnath Mukhopadhyay,2013; P.A.Harsha Vardhini,2020). In this research work, several extracted features of an image like color and texture are used with the back-propagation feed forward neural network for classification of the image. The query image is segmented using region-growing based segmentation. The color descriptor is uniform for scaling, translation, and rotation of the image. The color features are extracted by using RGB histogram having a number of bins equal to 3, so 27 color features are extracted. Texture or gray-level features portray the visual patterns in an image and illustrates how the patterns are spatially located. GLCM method is used to extract 22 texture features from segmented query image. The region in an image is represented by the shape features. Zernike Moments is applied to the segmented image to get the amplitude (A) and phase (phi) value of the moment. Appropriate selection of the extracted features is very important in pattern recognition problems. Feature selection is very effective for classification as it excludes the redundant and inappropriate information. Relief filter method is used to compute the required quality of features by estimating how their values differentiate between the instances. Back Propagation Feed-forward Neural Network is used for classification.

3. Analysis of different medical image retrieving techniques

Medical images can be retrieved from a data base when it is required. This process may be useful to new doctors to follow. The new doctors in the field or the doctors who are dealing new cases can be used these type of retrieval images along with analysis of those images for better treatment. Figure 1 shows medical query image and its best 5 retrieval images with different medical image retrieving techniques. It means the feature selection in a retrieval process gives the result.

Figure 2 shows a query image and its nearest possible retrieval images (1 to 5). By changing the required retrieval number of images, the process gives the result. Figure 3 shows the top ten retrieved images from the given query image.

The general noises that are disturbed the medical images are speckle, gaussian, rician, salt & pepper, etc. Figure 4 shows the medical image, noisy image, denoised image and processed image. It is a mandatory process in image processing, if the image is mixed with unwanted noise. These are the steps that involved in a denoising of medical images, if it is combined with any noise in the process. The images that are generally used in medical field are MRI, CT, X-Ray, etc. Figure 5 shows a database that contains different medical images.

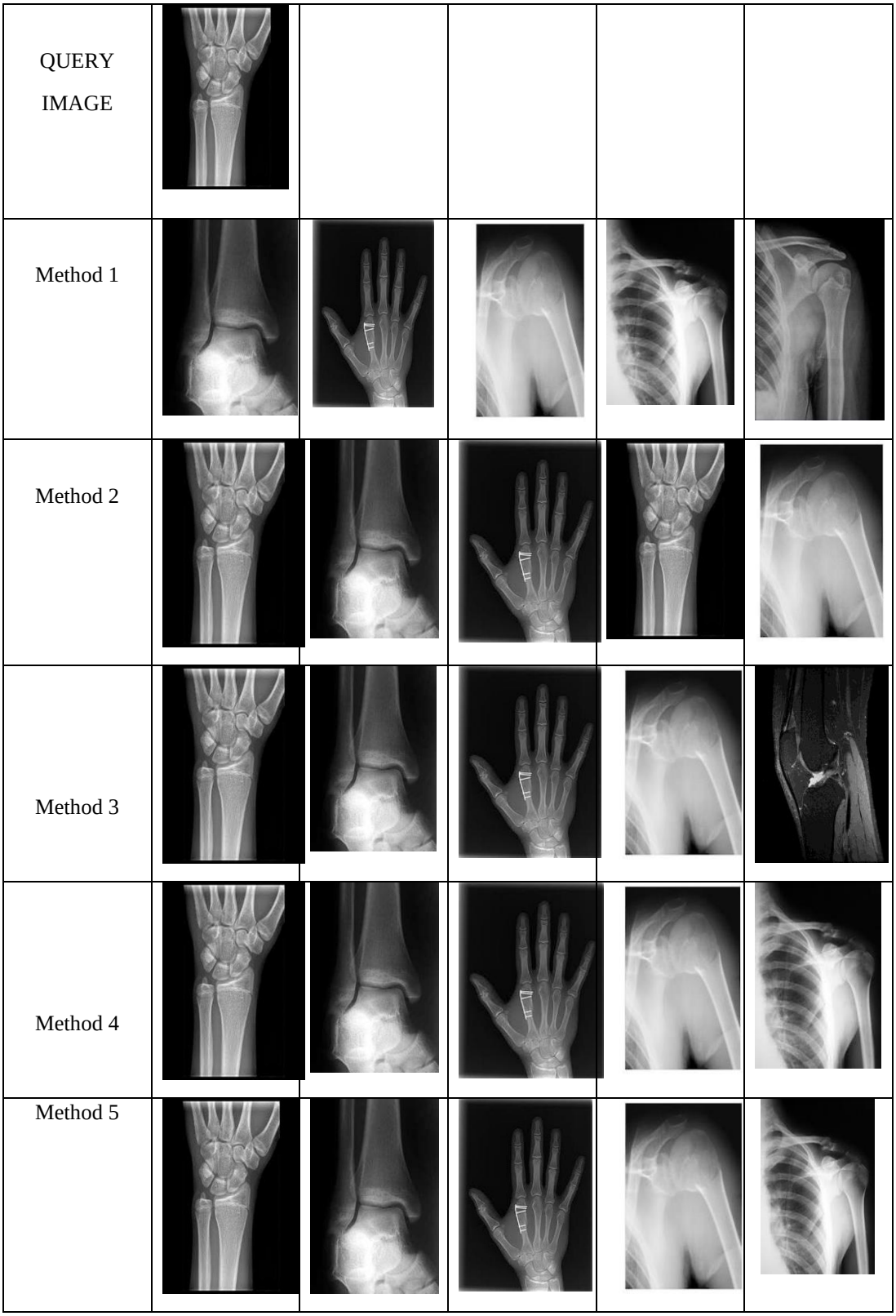

Figure 1: Input image and best five medical image retrievals with different techniques

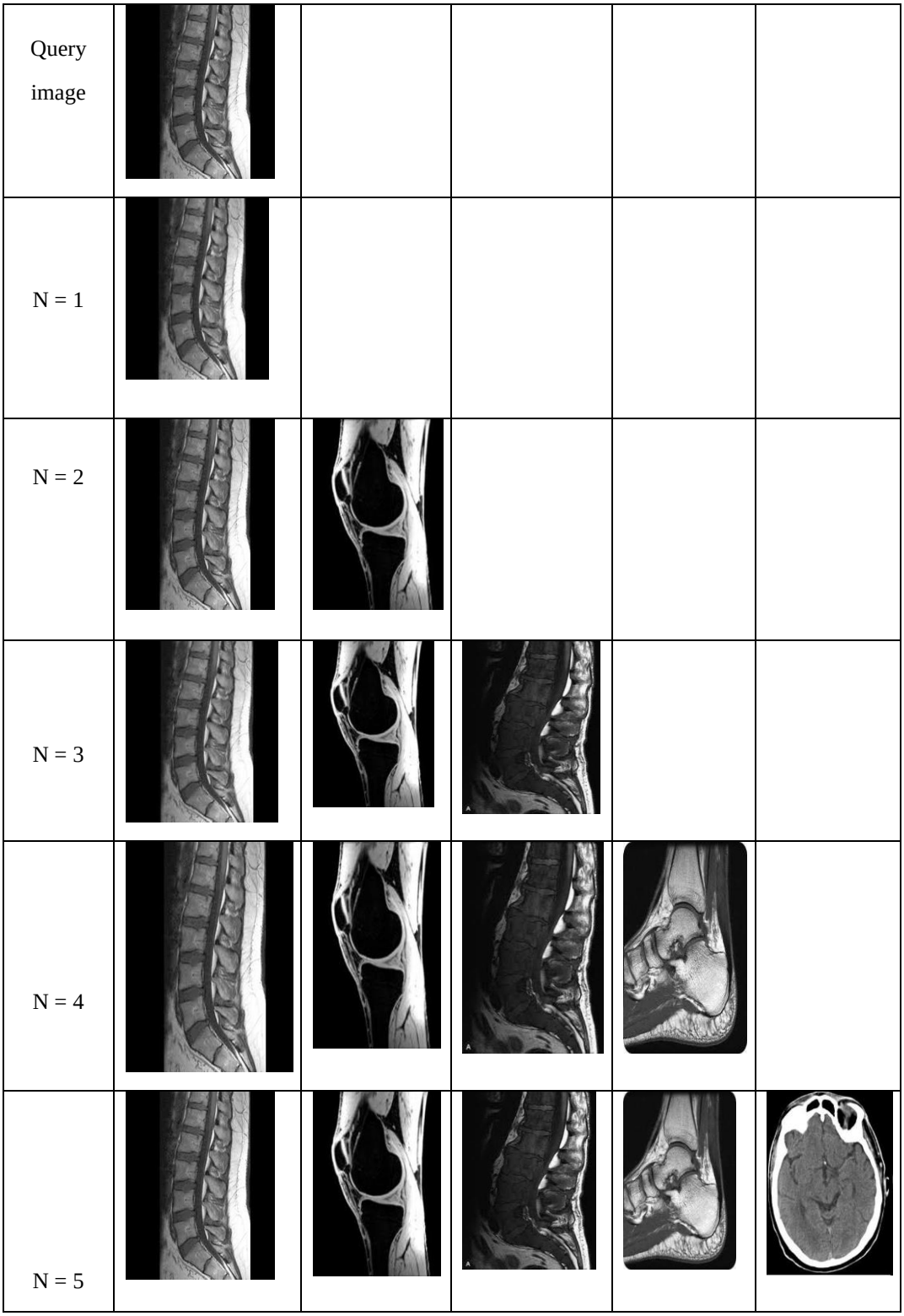

Figure 2 Medical image and its retrieved images (N= required number of retrieved outputs) (Top-1 to Top-5 image retrieval results)

Figure 3 Input image and Top-10 image retrieval results

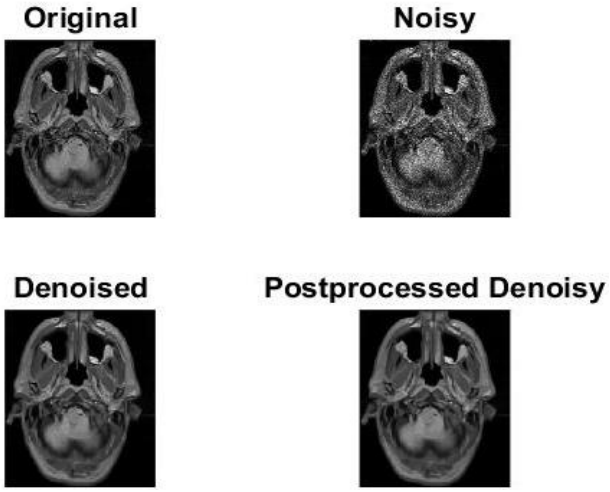

Figure 4 Medical, noisy image, denoised image and processed image

Figure 5 A medical image database

Similarity Measurement techniques: The retrieving process is being done with the comparison of input query image and database images. The method identifies the nearest or best sited image for the given input query. The famous similarity identify functions are

a) Euclidean Distance
b) Cosine Similarity
c) Chebyshev Distance

d) Manhattan Distance
e) Squared Euclidian Distance
f) Latent Semantic Indexing
g) Hybrid graph
h) Minkowski distance
i) Earth Mover's Distance

Retrieval Measures: The retrieved output gives a lot of information which is useful in evaluating the performance of the system. The images are to be categorized as relevant and irrelevant images of which relevant images includes the images which meet the user needs, whereas irrelevant images include the images which do not meet the user information.

a) Confusion matrix
b) Recall
c) Precision
d) Accuracy
e) Feature extraction time
f) Total processing time
g) Mean Average Precision
h) Error Rate
i) F1-score
j) Average Precision
k) Precision-Recall Curve
l) averaged normalized modified retrieval rank

4. Conclusion

In the current situation image retrieval plays a fundamental role. The image search and recovery from vast picture database is troublesome assignment. In recent years CBIR is increasing more consideration for investigator to tackle this issue. In this paper, it is analyzed the image retrieval process, ranking of image retrieval process, features of medical images, de-noising process, a small data of medical images, etc. The paper covers different distance measures to retrieve the image from a huge database. It also covered different quality parameters to explain the efficiency of medical image retrieval process. The CBIR is famous methodology for recover an assortment of pictures from a lot of image database. The CBIR utilizes the image visual substance for instance colour, shape and texture to file and denote the images. The features color, shape and texture are the general features to identify any image like medical or colour image. Depends on the feature section, the retrieval process will be continued.

5.References

1. Arunkarthikeyan, K. and Balamurugan, K., 2021. Experimental Studies on Deep Cryo Treated Plus Tempered Tungsten Carbide Inserts in Turning Operation. In Advances in Industrial Automation and Smart Manufacturing (pp. 313-323). Springer, Singapore.
2. Balamurugan, K., Uthayakumar, M., Sankar, S., Hareesh, U.S. and Warrier, K.G.K., 2018. Effect of abrasive waterjet machining on LaPO 4/Y 2 O 3 ceramic matrix composite. Journal of the Australian Ceramic Society, 54(2), pp.205-214.
3. Balamurugan, K., Uthayakumar, M., Sankar, S., Hareesh, U.S. and Warrier, K.G.K., 2017. Mathematical modelling on multiple variables in machining LaPO4/Y2O3 composite by abrasive waterjet. International Journal of Machining and Machinability of Materials, 19(5), pp.426-439.
4. Balamurugan, K., Uthayakumar, M., Sankar, S., Hareesh, U.S. and Warrier, K.G.K., 2018. Preparation, characterisation and machining of LaPO4-Y2O3 composite by abrasive water jet machine. International Journal of Computer Aided Engineering and Technology, 10(6), pp.684-697.
5. B A Ahmad Hassanat and S Ahmad Tarawneh, "Fusion of Color And Statistic Features for Enhancing Content-Based Image Retrieval Systems", Journal of Theoretical and Applied Information Technology, 88, 3, (2016), 644-655.
6. Bindu Tushara, D., & Harsha Vardhini, P. A, " FPGA implementation of image transformation techniques with Zigbee transmission to PC", International Journal of Applied Engineering Research, 10(55), pp.420–425, 2015.
7. D. Chandraprakash and M. Narayana, "Content Based Satellite Cloud Image Retrieval and Rainfall Estimation Using Shape Features", International Journal of Electronics and Communication Engineering, 5, 4, (2017), 229-235.

8. Fu-ping Yang and Meili Hao, "Effective Image Retrieval Using Texture Elements and Color Fuzzy Correlogram", Information (MDPI), 8, 27, (2017), 1-11.
9. G.ChinnaNarasimhulu, P.A.Harsha Vardhini, "A new medical image retrieval process and its parameters evaluation", International Journal of Developments in Technology and Science, pp. 10-14, Volume 1, issue1, 2019.
10. G.ChinnaNarasimhulu, Y.MuraliMohanbabu, G.Penchalaiah, "A New Approach for Effective Image Retrieval of Different Medical Images", IJSART, 4, 4 (2018), 217-220.
11. K.Radhika and S. Varadarajan "Ensemble Subspace Discriminant Classification of Satellite Images" Journal of Scientific & Industrial Research (JSIR), volume 77, Issue 1, November, 2018, 633-638.
12. K.Radhika and S. Varadarajan, "Multi spectral classification using cluster ensemble technique", International Journal of Intelligent Systems Technologies and Applications, Volume 17, Issue 1/2, 55-69, April 2018.
13. Khawaja Tehseen Ahmed, Shahida Ummesafia, Amjad Iqbal "Content based image retrieval using image features information fusion", Information Fusion 51, (2019), 76–99.
14. Latchoumi, T.P., Loganathan, J., Parthiban, L. and Janakiraman, S., 2016, August. OFS method for selecting active features using clustering techniques. In *Proceedings of the International Conference on Informatics and Analytics* (pp. 1-4). https://doi.org/10.1145/2980258.2982108
15. Latchoumi, T.P., Reddy, M.S. and Balamurugan, K., 2020. Applied Machine Learning Predictive Analytics to SQL Injection Attack Detection and Prevention. European Journal of Molecular & Clinical Medicine, 7(02), p.2020.
16. M B Suresh and B Mohankumar Naik, "Content Based Image Retrieval Using Texture Structure Histogram and Texture Features", International Journal of Computational Intelligence Research, 13, 9, (2017), 2237-2245.
17. P.A.Harsha Vardhini, Y.Murali Mohan Babu, "FPGA Based Energy-Aware Image Compression and Transmission with Single Board Computers", Journal of Green Engineering, Vol.10, issue.5, pp. 2483-2497, May 2020.
18. Ranjeeth, S., Latchoumi, T.P. and Paul, P.V., 2020. Role of gender on academic performance based on different parameters: Data from secondary school education. Data in brief, 29, p.105257.
19. R. Usha and K. Perumal, "Content Based Image Retrieval using Combined Features of Color and Texture Features with SVM Classification", International Journal of Computer Science & Communication Networks, 4, 5, (2015), 169-174.
20. Salahuddin Unar, Xingyuan Wang, Chunpeng Wang, Yu Wang "A decisive content based image retrieval approach for feature fusion in visual and textual images", Knowledge-Based Systems, 179, (2019), 8–20.
21. Somnath Mukhopadhyay, J. K. Mandal, "Wavelet based Denoising of Medical Images using Sub-band Adaptive Thresholding through Genetic Algorithm", Procedia Technology, 10, 680 – 689, 2013.
22. Suman Mishra 'Multi-Layer Architecture for Breast Cancer Diagnosis' in Indian Journal of Computer Science and Engineering, Vol. 5 No.1 Feb-Mar 2014, pp. 18-25.
23. Tushara, D.B., & Vardhini, P.A. (2016). Effective implementation of edge detection algorithm on FPGA and beagle board. 2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT), 2807-2811.
24. Y.Muralimohanbabu, K.Radhika and D.NagaJyothi, "Evolutionary Algorithm Based Extreme Learning Machine for Retrieval of Images", International Journal of Engineering & Technology, 7, 3.24, (2018), 472-475.