A Review on Quality of Image during CBIR Operations and Compression

Diwanshi, Dharminder Kumar, Sakshi Dhingra

Department of Computer Science and Engineering, Guru Jambheshwar University of Science and Technology, Hisar, Haryana, India

Corresponding author: Diwanshi, Email: singla.diwanshi2@gmail.com

The research paper is review the quality of image at the time of CBIR operation. Research is opting to maintain the quality of image even after performing compression. Research work has highlighted the impact of CBIR operation and compression operation over quality of image. The major issue in image processing research is impact of image processing over image quality. Moreover there is need to discuss loss less compression mechanism to retain quality of image. Research paper is considering different methodologies used by existing research paper along with their working mechanism, advantages and disadvantage. Research is considering image processing as process of extracting information from pictures and combining it for use in a variety of applications. Image processing programmes are useful in a variety of situations. A few examples include medical imaging, industrial applications. The remote sensing, spaces as well as military applications are also considered. The application of computer vision mechanism to the graphic content retrieval problem has been considered a challenge in finding digital pictures in huge databases. Existing researches have worked to improve the overall performance during image processing by retaining quality of the image. Moreover, there is increase in accurate decisions making. Research is opting to retain the quality of image during CBIR operations.

Keywords: CBIR, Edge detection, Image processing, Quality of image.

2021. In Raju Pal & Praveen K. Shukla (eds.), *SCRS Conference Proceedings on Intelligent Systems*, 201–211. Computing & Intelligent Systems, SCRS, India. https://doi.org/10.52458/978-93-91842-08-6-19

1 Introduction

Image processing is a way of doing a few activities in an image with a view to recovering an improved image or separating a few essential features. It is a methodology in which feedback is provided, and results are either illustrated or highlighted. It is a technology that is increasingly developing in different aspects of industry. CBIR [1] is getting popularity day by day and used with different deep learning mechanisms [2]. Some of the research has focused on semantic characterization [3].

2 Need of CBIR

Finding an image within a large number of photographs is a difficult challenge. The problem can be solved by manually labeling files. However, it is too costly, time-consuming, and impractical for a variety of applications. The semantic consistency with which the image is described determines the labeling procedure. As a result, a large number of content-based image retrieval mechanisms have been created to retrieve low-level functions for representing images.

Off-line function extraction and on-line image retrieval are the two steps of a traditional content-based retrieval system. During the off-line level, the device collects visual attributes from each image in the database depending on their pixel values and saves them in a separate database within the system called a function database. In some cases K-NN and BayesNet [4] has been used with CBIR for more efficiency. Image data is ambiguous by default, and this property causes problems in content-based retrieval, such as:

(i) Image content descriptions are often based on inexact and arbitrary definitions.
(ii) The explanations of the photographs, as well as some of the visual elements, are typically imprecise and ambiguous.
(iii) The user's requirements for image retrieval can be naturally ambiguous.
(iv) Making use of fuzzy logic [8] and soft computing [5,9] in case of different image processing for image classification[10] by Remote sensing image retrieval in CBIR [11] for image ranking mechanism[12] is complex task.

3 Image Processing Mechanism

Research is revolving around processing mechanisms. Research is considering image compression along with edge detection before applying CNN during CBIR operations [13, 14, 15, 18, 21].

a) **Image compression [24, 25]:** It is required to reduce the size of image. Image compression has been considered as process of reducing size of image. The objective of image compression is to reduce storage consumption. The reduced size of image makes the further processing fast. The lossless compression mechanism could be used. Image compression techniques may be lossy or loss less.

   1. **Lossless compression**has been considered to archive purposes. It is used for medical imaging as well as technical drawings. Some time it is used for clip art, or comics.
   2. **Lossy compression mechanism**may introduce compression artifacts when these are utilized at low bit rates. Lossy mechanismshave been found suitable in case of natural images such as photographs in applications where small loss of fidelity is acceptable. This loss is acceptable in order to fulfill substantial reduction in bit rate. Lossy compressions which are producing negligible differences might be known as visually lossless.

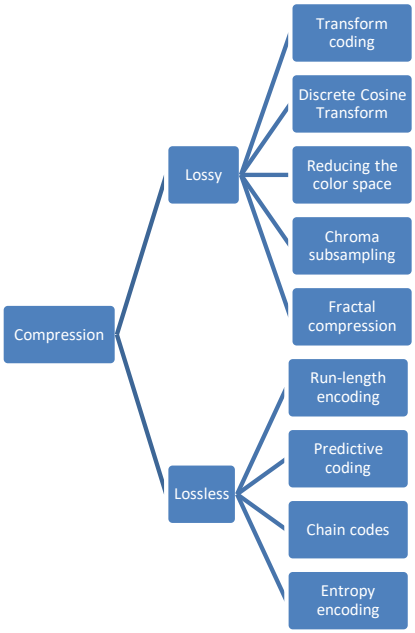

Fig. 1. Types of image compression [26]

b) Edge detection [28,29,30,31,32]: The process of extracting the outlines or border from image is termed as edge detection. To reduce image content during of feature selection there would be need of edge detection. Edge detection eliminates the useless content of image to allow rapid feature selection. The edge detection mechanism has been applied before feature selection in order to reduce the time consumption. Moreover the used of compression mechanism would reduce the size of image. There have been four type of edge detection:

1. **Prewitt:** The Prewitt operator has been utilised in image processing. It is one of the edge detection algorithms. This has been considered as discrete differentiation operator. It calculates an approximation of gradient of image intensity function. On every point in the image, output of Prewitt operator might be corresponding gradient vector. Result might be norm of vector sometime.
2. **Robert:** Roberts Cross operator implements simple, quick to calculate, 2-D spatial gradient measurement over graphical contents. It highlights the regions of high spatial frequency that are corresponding to the edges. Input to operator is a grayscale in its most common usage.
3. **Sobel:** The Sobel operator is termed as Sobel–Feldman operator. It is also known as Sobel filter that has been utilized in graphical processing as well as computer vision. It is well known edge detection algorithms. It develops graphical content that are emphasizing the edges.
4. **Canny:** Canny edge detection is a method for extracting valuable structural information from various objects of vision and for significantly reducing the quantity of data to be processed. It has been used extensively in many computer vision systems. Canny has found that the edge detection requirements are relatively similar for various vision systems. In a variety of situations, an edge detection solution can therefore be used to address these requirements. The basic edge detection criteria include:

- Detect the edge at a low error rate, which means that as many edges as possible in the image are accurately detected.
- The edge point the operator detected should be located on the edge centre accurately.
- Only once should a given edge in the picture be marked, and noise need not make false edges, where possible.

c) Feature selection: Features are selected in order to detect the pattern. It is a mechanism in which relevant features are selected from all the available features. Feature selection is important in these days because it plays a major role in accuracy.

4 Literature Review

There have been several researches in field of CBIR that has made using of fuzzy based feature selection approach. Moreover the researches that are made in field of image compression and edge detection are presented in this section.

Nabi et al [1] presented that an environment where optimal answers for any search question are sought after, an information retrieval framework that delivers reliable and valid results is needed. However, due to the well-known semantic gab issue of image representation, a CBIR scheme faces some challenges, as it heavily relied on derived image characteristic as the basis for a similarity search among query graphics and database graphics.

Saritha et al [2] introduced CBIR searches and retrieves digital photographs from a massive archive using image content features. To accomplish the quest goal, a number of visual feature extraction techniques were used. Any strong algorithms were not used due to the computing time constraint. A content-based image retrieval system's retrieval efficiency was critically dependent on feature representation and similarity measurements.

Yan et al [3] did research for semantic characterization. Since humans search for media information based on its underlying semantics, semantic characterization is needed for creating intelligent multimedia databases. The aim of research was to show how layered intelligent search mechanisms can be created using architectures and "digital keywords."

Kumar et al [4] did research for processing of multimedia images. Through the advancement of online and multi-media, a large amount of images were generated and appropriated; nevertheless, effectively storing and offering such a large amount of bulky database is a major concern.

Konstantinidis et al [5] did research on CBIR. The term "content-related image retrieval" (CBIR) has considered group of techniques for retrieving images based on features such as colour, texture, and form. Color picture histograms are an effective method that is commonly utilised in CBIR. The experimental findings showed that the approach was less susceptible to picture adjustments (such as lighting differences, occlusions, and noise) than other histogram development approaches.

Kucuktunc et al [6] suggested a method for creating fuzzy colour histograms for content-based image retrieval. Using a Mamdani-style fuzzy inference method, algorithm connected colours from the L*a*b* colour space to fuzzy colour histogram bins. First, the L*a*b* colour space was investigated in order to identify important colours that would lead to blurry colour histogram bins. As a result, membership functions and fuzzy rules were described.

Timón et al [7] proposed research where clustering attempted to categorise various patterns into classes known as clusters. Research considered that computing resources have become primary constraint for dealing with massive datasets.

Yadaiah et al [8] presented CBIR as a set of techniques to get semantically-relevant graphics from an image collection with support of automatically-derived image choices. In general, visual characteristics in CBIR systems were represented at a low level. They were purely rigid statistical indica-

tors that have little effect over the underlying subjectivity and fogginess of people's understandings and experiences. As a consequence, a gap did exist among low-level functionality and high-level semantics.

Kher et al [9] proposed research where soft computing methods included a wide range of uses in image recognition and machine vision. This paper was a study of numerous soft computing methods' applications in various image processing fields, such as fuzzy logic, neural networks, neuro-fuzzy structures, genetic algorithms, evolutionary computing, help vector machines, and so on.

Sindu et al [10] considered popularity of smart phones and computing devices. They found that a vast number of visual images are produced in daily life. These photos were created and saved in databases for later usage. Since a large number of digital photographs were kept in databases, it is necessary to retrieve the appropriate picture. One of the computer vision software was CBIR, which performed image recovery from vast databases.

Rudrawaret et al [11] concentrated on image retrieval and played a significant role in a variety of fields, including therapeutic determination, biometrics. It also considered geological data satellite frameworks, online searching, and genuine research, among others. When the database's size grew exponentially, applications that included pictures faced additional challenges and major problems in indexing, learning, and retrieval.

The collection of various digital picture databases has grown, according to Ahmed et al [12]. Many users discovered that searching for and retrieving needed pictures from huge collections was a tough job, therefore successful and effective retrieval techniques were created to make the search and retrieval process more effective and efficient. Different visual characteristics have been considered indirect to obtain pictures from databases in most CBIR techniques.

A new term frequency-inverse document frequency (tf-idf) based Content Based Image Retrieval (CBIR) technique based on deep Convolutional Neural Networks (CNN) was presented by Kondylidis et al [13]. That is, the learnt filters of the convolutional layers of a CNN model were used as visual word detectors by the author.

Remote Sensing Image Retrieval was deemed a difficult subject by Imbriaco et al [14] owing to the unique character of Remote Sensing images. The retrieval problem is obviously complicated by the presence of numerous semantic items in such pictures. The author of this article proposed an image retrieval pipeline that utilizes attentive, convolutional characteristics and combines them to create a global descriptor with support of vector of aggregated descriptors.

Erkutet et al [15] developed a novel CBIR technique based on HSV histogram data. By evaluating peaks in histogram content and using a sliding window technique to determine the area inside histogram that corresponded to background colours, model was able to extract the background from the picture.

Endoscopy has shown remarkable effectiveness in identifying stomach lesions, according to Hu et al [16], with large quantities of endoscopic pictures generated worldwide each day. The CBGIR (content-based gastric image retrieval) technology has shown significant promise in gastric image analysis. In individuals with gastric cancer, the prevalence of gastric precancerous diseases (GPD) is greater. As a result, during the GPD stage, appropriate intervention is critical. A CBGIR technique was presented in this article, which uses a modified ResNet-18 to produce binary hash codes in case of rapid and accurate image extraction.

A traditional colour histogram (CCH) didn't take into account colour similarity across bins or colour dissimilarity within the same bin [17]. As a result, it was vulnerable to noise interference such lighting fluctuations and quantization mistakes. Furthermore, CCH's high size of histogram bins necessitated a lot of processing when comparing histograms. To solve these issues, this article proposed a new colour histogram format known as the fuzzy colour histogram (FCH), which takes into account the colour similarity of each pixel's colour linked with all histogram bins using a fuzzy-set membership function. The fuzzy c-means algorithm was used to provide a new and quick method

for calculating membership values. The suggested FCH was also put to use in the indexing and retrieval of images. The results of the experiments clearly indicated that FCH outperforms CCH in terms of retrieval. For picture retrieval from huge image datasets, such computing approach proved very appealing.

Some basic ideas for content-based picture retrieval were presented by Long et al [18]. They concentrated on improving content-based picture retrieval methods. The author then went into depth on several commonly used techniques for visual content descriptions, which was the focus of the study.

The rapid development of multimedia data transmission made requirement for efficient, picture databases with high capacity along with strong search engines to extract graphical content from them, according to Castelli et al [19]. A worldwide all-star team of field pioneers contributed to this book, sharing their insights into all essential areas of image database and search engine development. The book covered everything from picture database design to indexing and retrieval to transmission, display, and user interface. The authors also highlighted cutting-edge applications in medical imaging, multimedia communications, earth science, remote sensing, and other key application areas, utilising examples from a variety of disciplines. Several studies utilised fuzzy attribute reduction [20], while others in the CBIR field used soft computing methods with machine learning assistance [21]. CBIR has been utilised in several studies for mobile devices that use multi-stage Autoencoders [22].

There have been a number of studies in the area of picture compression. Huffman based coded product quantization in case ofgraphical hash extraction by Tingting Luan [23]. Lossless Compression depending on single frame interferogram was studied by Minzhu Yang [24]. Songgang Zhang [25] studied the compression method for UAV video compression. Aidong Liu [26] developed an integrated calibration system data compression method. Leihong Zhang [27] investigated the picture transmission mechanism of a Huffman coding-based correlation imaging method.

Xiafeng Li [28] presented a deep learning-based cancer picture edge identification method. For a noisy picture, Akbari Sekehravani [29] developed a canny edge detection method. S. A. M. H. K. Vignesh[30] suggested utilising fractional derivatives and information sets to identify edges. Image edge detection with support of fractional calculus was developed by E. A. A. Nandal [31]. Ghosh [32] examined various EDGE Detection Techniques.

Table 1. Literature Survey

S.No.	Author/ Year	Methodology used	Sort comings	Data set used
1.	H. Abdel-Nabi / 2019 [1]	To perform image fetching with support of deep learning.	Need to improve the accuracy	It consists of the collection of 600 images with 20 different categories From ImageNet 2012 dataset
2.	R.R. Saritha/ 2018 [2]	Considering image processing with deep learning	Need to do more work on performance	Data set of data deep belief networks
3.	M. Kumar/ 2018 [4]	Making using of KNN for CBIR	The quality of image need to be retained.	Wang dataset
4.	V. Yadaiah/ 2018 [8]	Making use of fuzzy logic based computing approach for CBIR	There is lack of technical feasibility.	Dataset of 2-D Fuzzy Colored Image (FCI)
5.	Rahul Kher/ 2020 [9]	Making use of soft computing in case of different image processing.	Scope of research is limited due to lack of technical work.	Original Lena and images obtained using FBPNN
6.	S.Sindu / 2019	Processing of classi-	There is need to	Visual Object Classes

	[10]	fied images for CBIR.	reduce image size during processing to save space.	(VOCs) comprising 9963 images along with 20 object classes
7.	Amruta Rudrawar / 2018 [11]	Performing Remote sensing image retrieval in CBIR	Research has not provided any solution to retain quality of image.	UC-Merced Landuse Remote Sensing Image dataset
8.	ALI AHMED/ 2020[12]	Using image ranking mechanism for CBIR	The approach need to be upgraded by making use of edge detection and compression mechanism.	Kvasir dataset
9.	Kondylidis /2018 [13]	Using deep CNN for image processing	CNN training and testing process is time consuming	Inria holiday, Oxford 5k, Paris 6k, UKBench
10.	R. Imbriaco /2019 [14]	Performing image retrieval using remote sensor	The remote sensor needs to compress image to make it portable.	RSIR datasets
11.	U. Erkut /2019 [15]	Using background elimination during image processing.	The use of edge detection could improve the performance of system.	1000 images from 10 different groups from coral database
12.	H. Hu/ 2020 [16]	To make use of assist CNN for decision making.	Need to do more work on performance and accuracy.	GPD data set

5 Problem Statement

There have been several researches that are making use of CBIR in field of engineering and medical science. But these researches are suffering due to space and time consumption because of large sized images. There is a need of image compression and edge detection during decision making. It is found that if the size of image is large then the decision making takes huge time. Thus there is a need of image processing to eliminate the useless part of image using compression, cropping, edge detection etc. But sometimes wrong decisions are taken by the system due to damaged and degraded graphical contents. Thus there is a need to work on quality of image during CBIR operations.

6 Integration of Image Compression and Edge Detection In CBIR

The goal of the study is to examine existing content-based image retrieval, edge recognition, and image compression algorithms. Furthermore, that component would have an impact on image quality during image processing. In CBIR, the research would next develop and implement a hybrid soft computing technique for edge recognition and picture compression.

6.1 Image Compression

The technique of encoding or transforming an image file so that it takes up less space than the original file is known as image compression. It is a form of image compression technology that minimizes the size of an image file while maintaining or improving its quality.

Lossy compression methods include:
a. Transform coding:

This is the technique that is most frequently utilised. The Discrete Cosine Transform is the most often used lossy compression method. JPEG, the most common lossy format, and the more modern HEIF both utilise DCT. Quantization and entropy coding are also widely employed, as is the more recently created wavelet transform.

b. Reducing the colour space to the image's most frequent colours:

The chosen colours are given in the compressed image's colour palette in the header. To prevent posterization, each pixel simply refers to the index of a colour in the colour palette; this technique may be coupled with dithering.

c. Subsampling of chroma:

By averaging or deleting part of the chrominance information in the picture, this takes use of the fact that the human eye detects spatial changes in brightness more strongly than those in colour.

d. Fractal compression is a term used to describe the compression of fractals:

Lossless compression methods include:
a. Run-length encoding that is the default technique in PCX and one of many options in BMP, TGA, and TIFF;

b. Area image compression; and

c. Predictive coding, which is used in DPCM.

d. Entropy encoding - arithmetic coding and Huffman coding are the two most popular entropy encoding methods.

e. Adaptive dictionary algorithms like LZW, which are utilized in GIF and TIFF.

6.2 Edge Detection

Edge detection is an image processing method that identifies spots in a digital picture that have discontinuities, or abrupt changes in image brightness. The borders (or boundaries) of a picture are the places where the image brightness changes significantly. We identify the borders or edges of objects in a picture using edge detection, which involves detecting where the brightness of the image changes significantly. The structure of objects in a picture may be extracted via edge detection. Canny edge detection has been considered as mechanism to get valuable information in case of different visual objects while minimizing quantity of content to be executed significantly. It's been used in a variety of computer vision systems.

There are five stages in the Canny edge detection algorithm:
1. Noise abatement
2. Calculation of the gradient
3. Suppression that isn't maximal
4. There is a double threshold.
5. Hysteresis-based edge tracking.

In comparison to the canny technique, other edge detection methods such as Sobel are unable to create smooth and thin edges. However, Sobel and Canny techniques, like other approaches, are very susceptible to noise pixels. It is not always possible to filter all of the noisy images properly. Edge detection will be influenced by unremoved noisy pixels.

6.3 Process Flow

Research is supposed to analyze the existing Content based image retrieval - edge detection and image compression algorithms. Moreover that factor would influence the quality of image during image processing would be focused. Then research would propose and apply hybrid soft computing algorithm for edge detection and image compression in CBIR. Finally evaluation of performance metrics of proposed soft computing algorithm with the existing algorithms would be performed. Future work research work would considering the existing researches related to image processing and CBIR and considering the technical challenges and issues in these researches. Moreover the research will focus on the factors that would influence the quality of image during image processing. Research is based on experimental research methodology. The image considered for processing would be compressed after fetching. Then the edge detection mechanism would be applied on compressed image. The feature extraction module is implemented afterward. The accuracy of prediction would be evaluated in final stage.

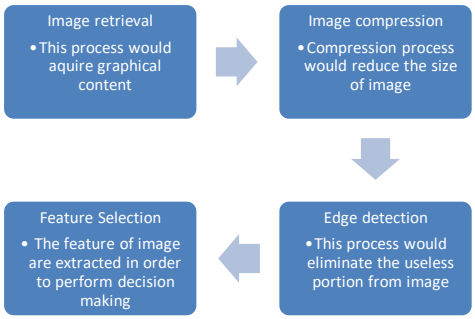

Fig. 2. Process flow for CBIR with image compression and edge detection

7 Conclusion

Research concludes that the edge detection and image compression could be used to minimize the time consumption and improve the performance during feature selection. Moreover edge detection and image compression also reduces the storage requirement. In this way research becomes capable to provide cost effective and efficient solution to extract the features from images in order to perform decision.

8 Scope and Relevance

New mechanism is supposed to improve the overall performance during image processing by retaining quality of the image. Moreover, there is increase in accurate decisions making. Research is opting to retain the quality of image during CBIR operations even after compression and edge detection. The scope and relevance of research varies in case of researcher, professional and society. Researcher could use such research for further enhancement and could make further research to improve performance during image processing in CBIR operation. On other hand professionals might use the mechanism in biometric application and other security systems. Society could make use of CBIR approach in their regular activities.

9 Scope of Work

Upcoming researches could make use of proposed work mechanism and might use further hybrid approach to increase the accuracy. In further research different edge detection mechanism or dif-

ferent compression mechanism could be used. Those compression mechanisms could provide more compressed image. In future research work more efficient image compression and edge detection mechanism could be used.

Up-coming research could make use of loss less data compression mechanism and may provide better PSNR as compare to present work.

References

[1] Nabi, H. A., Naymat, G. A. and Awajan, A. (2019). Content Based Image Retrieval Approach using Deep Learning. In *2nd International Conference on new Trends in Computing Sciences,* 1-8

[2] Saritha, R. R., Paul, V. and Kumar, P. G. (2018). Content based image retrieval using deep learning process. *Cluster Computing*, 22(1):1-14.

[3] Yan, L. and Ma, Z. (2011). Intelligent Multimedia Databases and Information Retrieval: Advancing Applications and Technologies, DOI: 10.4018/978-1-61350-126-9.

[4] Kumar, M., Chhabra, P. and Garg, N. K. (2018). An efficient content based image retrieval system using BayesNet and K-NN. *Multimedia Tools and Applications*, 77(16):21557-21570.

[5] Konstantinidis, K., Gasteratos, A. and Andreadis, I. (2005). Image Retrieval Based on Fuzzy Color Histogram Processing. *Optics Communications*, 248(4-6):375-386.

[6] Kucuktunc, O. and Zamalieva, D. (2009). Fuzzy Color Histogram-based CBIR System. Available at: *http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.721.9298&rep=rep1&type=pdf*.

[7] Timón et al. (2005). Implementing fuzzy minimals clustering mechanism in parallel. *Expert Systems with Applications*, 48(15):35–41.

[8] Yadaiah, V., Vivekanandam, R. and Jatothu, R. (2018). Fuzzy Logic dependent Soft Computing mechanism for CBIR with help of Incremental Filtering Feature Selection to Identify Patterns. *International Journal of Applied Engineering Research*, 13(5):2432-2442.

[9] Kher, R. and Kher, H. (2020). Soft Computing Techniques for Various Image Processing Applications: A Survey. *Journal of Electrical and Electronic Engineering*, 8(3):71-80.

[10] Sindu, S. and Kousalya, R. (2019). Two Phase Content Based Image Retrieval with relevance ranking on classified images. In *International Conference on Computer Communication and Informatics*, 1-6.

[11] Rudrawar, A. (2018). CBIRusing Bag of Visual Words Representation. *Proceedings of the Second International conference on I-SMAC*, ISBN: 978-1-5386-1442-6.

[12] AHMED, A. and Malebary, S. J. (2020). Query Expansion Based on Top-Ranked Images for Content-Based Medical Image Retrieval. *IEEE Access*, 8: 194541-194550.

[13]Kondylidis, Tzelepi, M. and Tefas, A. (2018). Exploiting tf-idf in deep convolutional neural networks for content based image retrieval. *Multimedia Tools and Applications*, 77(23):30729–30748.

[14] Imbriaco, R. et al. (2019). Aggregated deep local features for remote sensing image retrieval. *Remote Sensing*, 11(5):493.

[15] Erkut, U. et al. (2019). HSV color histogram based image retrieval with background elimination. In *Proceeding of the 1st International Information Software Engineering Conference,* 1–5.

[16] Hu, H. et al. (2020). Content-based gastric image retrieval using convolutional neural networks. *International Journal of Imaging Systems and Technology*, 31(1):439-449.

[17] Han, J. and Ma, K. K. (2002). Fuzzy color histogram and its use in color image retrieval. *IEEE Transactions on Image Processing*, 11(8):944–952.

[18] Long, F. et al. (2003). Fundamentals of Content Based Image Retrieval. *Springer-Verlag, Berlin Heidelberg New York*.

[19] Castelli, V. and Bergman, L. (2002). Image Databases: Search and Retrieval of Digital Imagery. *Wiley-Interscience, USA*.

[20] Jensen, R. and Shen, Q. (2004). Fuzzy-rough attributes reduction with application to web categorization. *Fuzzy Sets and Systems*, 14:469-485.

[21]Kaur, P. and Singh, R. K. (2020). Content-Based Image Retrieval Using Machine Learning and Soft Computing Techniques. *International Journal of Scientific & Technology Research*, 9(01):1327-1332.

[22] Aiswarya, K. S., Santhi, N. and Ramar, K. (2020). Content-based image retrieval for mobile devices using multi-stage Autoencoders. *Journal of Critical Reviews*, 7(6).

[23] Luan, T. et al. (2019). Huffman Coded Product Quantization for Image Hash Retrieval. *Chinese Journal of Image Graphics,* 24:389-399.

[24] Yang, M., Zou, Z. and Han, C. (2019). Lossless Compression depending on single-frame interferogram. *Modern electronic technology,* 42:57-60.
[25] Zhang, S. et al. (2019). Research on UAV compression of videodepending on compression mechanism. *Integrated circuit applications,* 36:39-40.
[26] Liu, A. et al. (2018). A data compression technique to support embedded calibration system. *Computer and Digital Engineering,* 46:2607-2610.
[27] Zhang, L. and Ye, H. (2019). Study on image transmission method of correlation imaging mechanism depending on Huffman technique. *Packaging Engineering,* 40:244-249.
[28] Li, X. (2020). Edge detection algorithm of cancer image based on deep learning. *Bioengineered*, 693-707.
[29] Sekehravani, A. et al. (2020). Implementing canny edge detection algorithm for noisy image. *Bulletin of Electrical Engineering and Informatics*, *https://beei.org/index.php/EEI/article/view/1837*.
[30] Kothapalli, V., Arora, S. and Hanmandlu, M. (2018). Edge detection using Fractional derivatives and Information sets. *Journal of Electronic Imaging*, 27(5): 051226.
[31]Nandal, A. et al. (2018). Image edge detection using fractional calculus with feature and contrast enhancemen. *Circuits, Systems, and Signal Processing*, 37:3946–3972.
[32] Ghosh, C. et al. (2020). Different EDGE Detection Techniques: A Review. *Electronic Systems and Intelligent Computing*, 686:885-898.