E-ISSN 2581 – 7957
P-ISSN 2277 – 3916
CVR Journal of Science and Technology, Volume 23, December 2022
DOI: 10.32377/cvrjst2315

Augmented Corvus Search Optimization for Image Retrieval in Content Based Images

A. Srinivasa Reddy
Assoc. Professor, CVR College of Engineering/CSIT Department, Hyderabad, India
Email: srinivas.asr@gmail.com

Abstract: **One of the most distinctive study areas in the field of Computer applications has been Content-Based Image Retrieval (CBIR). The goal of this research is to increase the recovery presentation of the CBIR framework by combining advanced approaches to predict appropriate centroid in Fuzzy C-Means (FCM). The use of a consolidated approach to predict FCM centroid should reduce complexity and computing time. When compared to existing procedures such as PWO, SSO, and CSO, the results show that combining ACSO with FCM yields better results when compared to challenge procedures.**

Index Terms: **Corvus Search Optimization, FCM, CSO, SSO, Augmentation.**

I. Introduction

Content-Based Image Retrieval (CBIR) frameworks focus on features from raw images and calculate a secondary measure (comparability or disparity) between an inquiry image and database images using these features [1]. CBIR is a system in which a structure organizes a customer's desire by selecting several images from a potentially huge collection and communicating it either verbally or graphically [2]. There are two types of image recovery processes: those that rely on global highlights (global features) and those that rely on nearby highlights (nearby highlights) (local features). One of the most difficult aspects of picture recovery, regardless of whether global or local highlights are recovered, is the extraction of the fundamental visual highlights [3]. Component extraction is a crucial operation in CBIR, and the method for isolating highlights from given images determines its effectiveness [4]. Picture properties like as coloring, surface, and shape are represented by element vectors. The similarity of two photographs is determined as a percentage of their element vector differences [5]. CBIR [6] was designed to recover photographs with similar visual components from a query image, which has proven to be a difficult challenge in the field of computer vision and artificial intelligence. In a similar way that the content-based recovery is enlarged, the standard CBIR can be extended by the inventive method. There is no access to content information here, and just visual highlights are used. As content-based recovery performs in multimodal ways, the CBIR finds the important articles. The comment recognizer may arrange explanations and ROIs in the recovered images and using them re-audits the results [1,3]. The recovery of annotated images is dependent on the image metadata or watchwords that link to the visual content or attributes of the image document. Fuzzy C-Means (FCM) is a well-known clustering algorithm that is a standalone learning system that is simple to use and may retain more data from a dataset than other techniques [4,6]. The enhancement of the centroid in FCM is performed utilizing specific improvement computations and centroid esteems. To overcome the problems caused by employing a single element and improve recovery precision, an image recovery technique is proposed that connects shading, surface, and shape, these three key features.

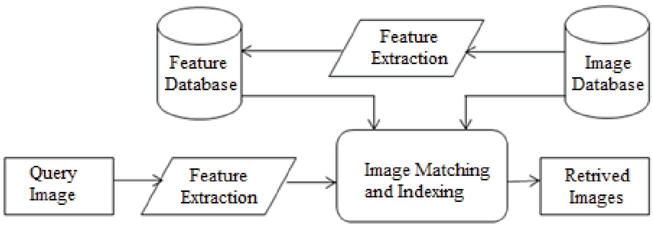


Figure 1. Model of CBIR

II. Content Based Image Retrieval

The use of computer vision algorithms to the picture recovery problem, i.e., the difficulty of searching enormous databases for digital photographs is known as content-based image recovery (CBIR) [2,3] or query by image content (QBIC). Traditional idea-based methodologies are incompatible with content-based image recovery. The term "content-based" denotes that the investigation focuses on the picture's content rather than its metadata, such as watchwords, labels, or portrayals. Traditional concept-based approaches are in opposition to content-based image retrieval. The problem of searching for digital photographs in huge databases is known as CBIR. Colors, forms, surfaces, and any other information that may be derived from the image are all examples of "content" in this context. Because searches based only on metadata are reliant on the quality and completeness of the explanation, CBIR is intriguing. The term "content-based" refers to a search that looks at a picture's content rather than metadata like keywords, tags, or descriptions. Because searches based entirely on metadata rely on the quality and completeness of annotations, CBIR is excellent.

T. Kato used the term "content-based picture recovery" in 1992 to characterize his experiments with automatic image retrieval from a database. Images are retrieved based on color and shape in the CBIR [2]. Since then, the term CBIR has been used to characterize the technique of leveraging linguistic image attributes to retrieve desired photos from a vast collection. Insights, design recognition, signal preparation, and computer vision are some of the disciplines where techniques, gadgets, and calculations are used.

Received on 24-02-2022, Revised on 22-04-2022, Accepted on 29-04-2022.

Because of the limitations of metadata-based systems and the large range of potential applications for effective picture retrieval, interest in CBIR has developed. Existing technology can quickly search textual information about photos; however, this necessitates people manually describing each image in the database. For exceptionally large databases or automatically generated photos, such as those from surveillance cameras, this may be impracticable. It's also possible that photographs with various synonyms in their descriptions will go unnoticed.

Particle swarm optimization (PSO) is one of the bio-inspired algorithms and it is a simple one to search for an optimal solution in the solution space. It is different from other optimization algorithms in such a way that only the objective function is needed and it is not dependent on the gradient or any differential form of the objective. It also has very few hyperparameters.

The Social Spider Optimization (SSO) is a novel swarm algorithm that is based on the cooperative characteristics of the social spider. In SSO, search agents represent a set of spiders which collectively move according to the biological behavior of the colony. In most of SI algorithms, all individuals are modeled considering the same properties and behavior. In contrast, SSO defines two different search agents: male and female. Therefore, according to the gender, everyone is conducted by using a different evolutionary operation which emulates its biological role in the colony. This individual categorization allows reducing critical flaws present in several SI approaches such as incorrect exploration-exploitation balance and premature convergence.

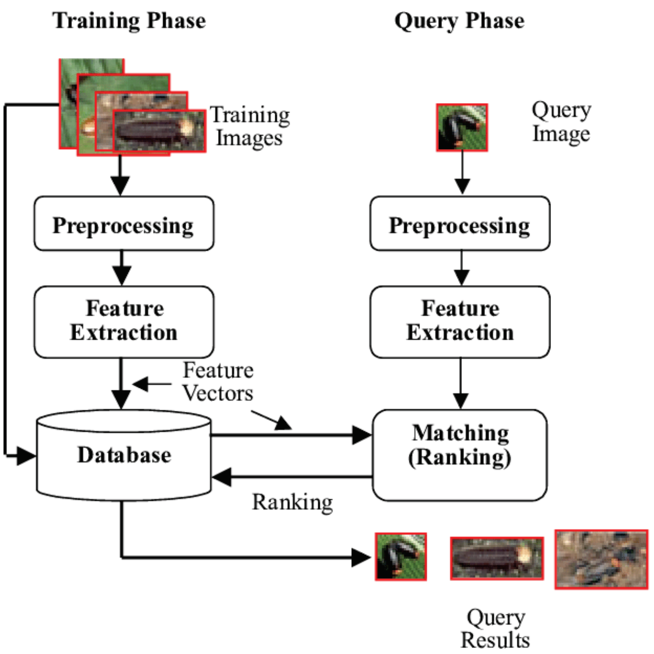


Figure 2. CBIR architecture

A. Texture

Surface estimations look for visual examples in photos and how they are classified geographically. Texel's speak to surfaces, based on how many surfaces are visible in the image, which are then separated into different sets. These are the sets describe the surface as well as the location of the surface in the image.

B. Color

Creating a shading histogram for each image that recognizes the number of pixels within the image containing specific values is the first step in registering separation estimates based on shading similitude. One of the most common approaches is to examine images based on the colours they contain, as this can be done independent of the size or orientation of the image. In contrast, Search has sought to split shading extent by area and by the spatial link between a few shade zones.

C. Shape

The term "shape" does not refer to the state of a painting, but rather to the state of a sought-after location. Shapes are usually resolved by first dividing or identifying edges in a picture. Shape channels are used by several ways to recognise different states of a picture. Shape descriptors could also be invariant to interpretation, turn, and scale.

D. Image Retrieval

The terms recall and precision are discussed in image retrieval contexts in terms of a set of retrieved images, a collection of relevant images, which is a list of all photographs on the internet that are relevant for a specific image, and a set of photos gathered by a web search engine for a query.

Recall

Recall is the percentage of relevant photographs that are successfully recovered.

$$Recall = \frac{|\{relevant\ images\} \cap \{retrieved\ images\}|}{|\{relevant\ images\}|} \quad (1)$$

$$Recall = \frac{TP}{TP + FN} \quad (2)$$

Precision

Precision is the percentage of retrieved photographs that are related to the query.

$$Precision = \frac{|\{relevant\ images\} \cap \{retrieved\ images\}|}{|\{retrieved\ images\}|} \quad (3)$$

$$Precision = \frac{TP}{TP + FP} \quad (4)$$

III. Proposed Methodology

For image recovery, this evaluation includes both text and image attributes (shape, shading, and surface). To achieve the best centroid esteem, the isolated highlights group used Fuzzy C-Means (FCM) in conjunction with advancement techniques. The CSO, SSO, and PSO streamlining systems are used to predict fitting centroid values. Predicting optimum centroid values for each group using Computation time and complexity are greatly reduced when FCM is used in conjunction with improvement strategies. The highlights of a specific query image contrast with the centroid esteems in testing with the smallest separating groups. For picture recovery, this evaluation includes both text and image attributes (shape, shading, and surface). To achieve the best centroid esteem, the isolated highlights group used Fuzzy C-Means (FCM) in conjunction with advancement techniques. CSO, SSO, and PSO are three streamlining systems that aim to predict appropriate centroid values.

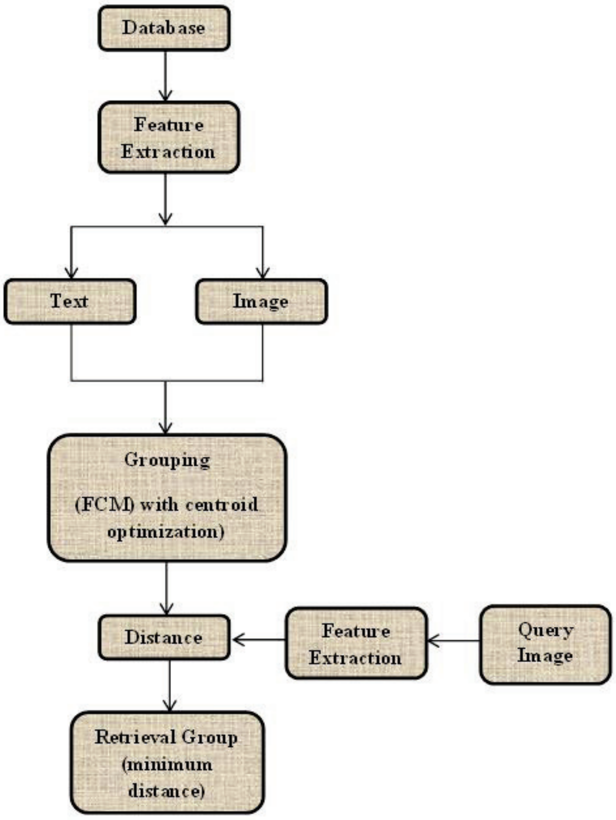


Figure 3. Proposed Methodology

A. Feature Extraction

To recover photographs for a specific database, this function combines text elements such as filename and catchphrases with picture highlights like as surface, shading, and shape if the filename contains a string or other strange characters, it is converted to ASCII code in text highlights and the numbering is preserved. Watchword, on the other hand, denotes the envelope name of related photographs. If a shape is used as a highlight in a photograph, it's possible that identifying the edge is the first step in removing that element. The watchful edge indicator is used to determine the edge of an item in the scene.

After the scene, follow the bunch of the piece edge that has been recognized is a huge advance. The shading histogram can be applied to any shading space, while it is most associated with three-dimensional spaces such as RGB or HSV. The phrase power histogram can be used to describe monochrome images. The shading histogram is N-dimensional for multi-ghostly images, where each pixel is spoken to by a discretionary number of assessments. Every estimate has its own wavelength range of light, some of which may be visible and others of which may be invisible. GLCM is the best method for extracting the required features from photographs.

B. GLCM

GLCM (Gray Level Co-occurrence Matrix) is a factual surface exploration approach that considers the spatial relationship between pixels in images. GLCM is mostly used in example recognition and determines the power variation at the pixel of interest. The GLCM surface considers the relationship between two pixels at some random minute, referred to as the pixels that serve as a reference and those that are close by The GLCM set of characteristics can be used to express a general average for the degree of linkage between pixels in distinct edges. such as homogeneity, consistency, and so on.

The partition evacuate between pixels is one of the guiding parameters that influences the isolation capacities of GLCM. When you select detachment 1, you'll be asked to think about the degree of connection between consecutive pixels. In this case, increasing the division causes the level of connection between removed pixels to be reflected. Contrast, correlation, and energy are all terms that can be used to describe something. Homogeneity and entropy are among the GLCM's features.

$$Contrast = \sum_{v}\sum_{u}(u-v)^2 * p(u,v) \tag{5}$$

$$Correlation = \sum_{v}\sum_{u}\frac{(u-m_u)(v-m_v) * p(u,v)}{\delta_u \delta_v} \tag{6}$$

$$Energy = \sum_{v}\sum_{u}(u-v)^2 \tag{7}$$

$$Entropy = -\sum_{u,v} p(u,v) * \log(p(u,v)) \tag{8}$$

$$Homogeneity = \sum_{v}\sum_{u}\frac{p(u,v)}{1+|u-v|} \tag{9}$$

C. Fuzzy C-Means Clustering (FCM)

FCM is an unsupervised clustering-based information bunching process that collects the informative index into n groups, with those untruths near a group's focal point having an abnormal state of having a place and vice versa. It is based on minimizing the desired work.

$$FCM = \sum_{i=1}^{n}\sum_{j=1}^{c}(\mu_{ij})^{m}\left\|x_i - v_j\right\|^2 \quad (10)$$

Here $1 \leq m \leq \infty$ and μ_{ij} is the relationship of x_i in the cluster j and $\|x_i - v_j\|$ is Euclidean distance.

D. Corvus Search Optimization

Particle Swarm Optimization, Social Spider Optimization, Harmony Search, Bat Algorithm, and Genetic Algorithms other nature-inspired approaches are among the most recent optimizations. We employ the Corvus or Crow Search Algorithm for optimization when retrieving photos based on content in our proposed methodology.

Crows are a widely distributed class of winged birds that are now considered to be among the most intelligent creatures on the planet. Crows, as a group, display incredible understanding and consistently pass knowledge tests with flying colours They can keep their faces, use instruments, communicate in complex ways, and hide and retrieve food at all times of the year.

In a crow mob, there will be a behavior that has many similarities to a streamlining operation. According to this behaviour, crows hide their excess food in specified natural locations (hiding sites) and retrieve it when it is needed. Crows are ruthless winged creatures who pursue each other in search of better food supplies. Finding a food supply hidden by a crow isn't easy because if a crow notices another crow following it, the crow will try to fool the other crow by fleeing to a different part of the earth. The nature of sustenance source is objective (health) labour, and the best nutrition wellspring of the earth is the global solution to the issue.

CSO tries to emulate the crows' sophisticated behavior by considering these resemblances to find solutions to challenges.

The CSO Principles are:

i. Crows live in groups.
ii. Crows maintain the location of their hiding places.
iii. A gang of crows is pursuing each other for a break-in.
iv. By default, crows protect their supplies from theft.

Assume that crow A wants to get to its hiding spot for food, and that crow B wants to follow crow A to find that hiding place at some point in the future. In this scenario, there could be two possibilities.

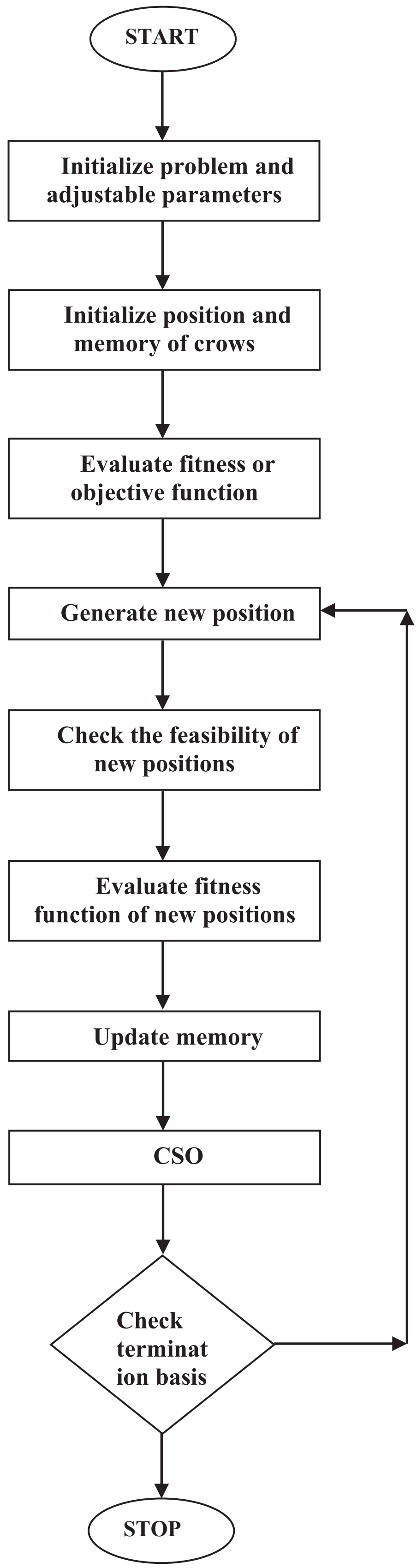


Figure 4: CSO flow chart

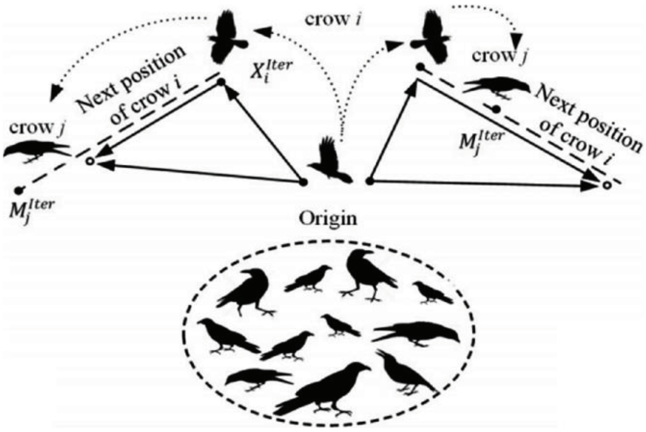


Figure 5. Corvus Optimization Overview

Case-1: Crow A is unaware that crow B is following him. As a result, crow B will approach crow A's hiding spot.

Case-2: Crow A is aware that crow B is pursuing it. As a result, to prevent its cache from being stolen, crow A will deceive crow B by moving to a different part of the search arena.

IV. Results and Discussion

The purpose of retrieving images for a given question is to compare the results of subsequent tests. The test includes many inquiry images, each with five different photos for approval (table-1), and the display of each question picture is evaluated using three standard estimates **A**ccuracy, **R**ecall, and **F**-measures for PSO, SSO, and CSO (table-2). The examinations contain the usual execution results of each inquiry picture in the set for various streamlining strategies that function with FCM in predicting ideal centroid. Finally, the below table clearly shows the performance of existing and proposed methods.

TABLE I.
Query Images

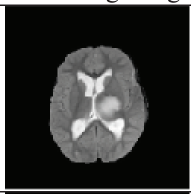
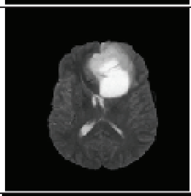
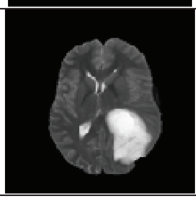
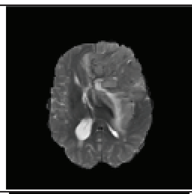
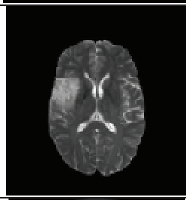
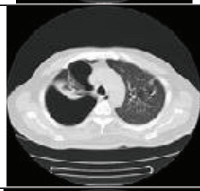
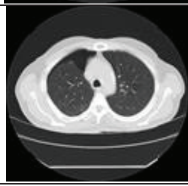
S. No	Brain & Lung Images
Br1	
Br2	
Br3	
Br4	
Br5	
Ln1	
Ln2	
Ln3	
Ln4	
Ln5	

TABLE II.
PERFORMANCE EVALUATION

Output	Corvus Search Optimization			Social Spider Optimization			Particle Swarm Optimization		
	A	R	F	A	R	F	A	R	F
Ln1	92	88	90	89	90	87	87	87	87
Ln2	90	89	89	88	83	85	85	85	85
Ln3	92	91	91	90	85	87	87	87	87
Ln4	90	89	90	88	83	85	85	85	85
Ln5	92	91	91	89	85	87	87	87	87
Br1	94	93	93	88	86	87	89	87	88
Br2	96	95	94	90	88	87	91	89	90
Br3	94	93	93	88	86	87	89	87	88
Br4	96	95	95	90	88	89	91	89	90
Br5	94	93	93	88	86	87	89	87	88

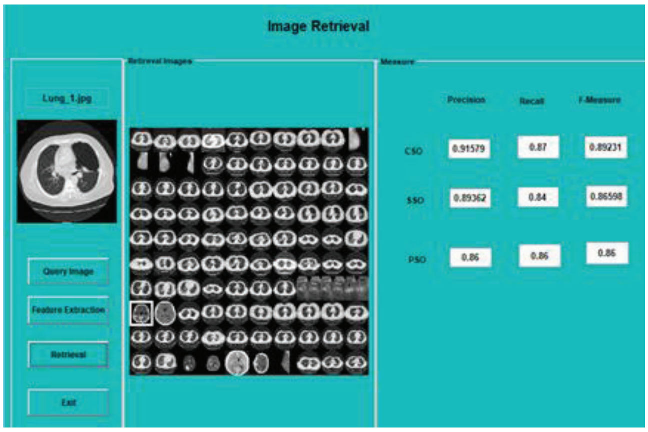


Figure 6: Sample Output

V. CONCLUSIONS

The preceding data demonstrate that Augmented Corvus Search Optimization outperforms traditional SSO and PSO approaches. We used Brain and Lung photos as input Query images and ran our suggested algorithm on them, comparing Precision, Recall, and F-measures with current mythologies, and then presenting the findings. We can easily see from the results that our recommended method produces superior results. Color photos can be used to test the same procedures.

REFERENCES

[1] A. Srinivasa Reddy, "Prediction of Brain Tumor Image Segmentation using MRG and GLCM Algorithms", International Journal of Engineering and Advanced Technology, Volume-8 Issue-4, pages:1159-1165, April 2019.
[2] Guang-Hai Liu, Jing-Yu Yang and ZuoYong Li," Content-based image retrieval using computational visual attention model", Pattern Recognition, pp.1-42, 2013.
[3] Ferreira, Santos, Torres, Goncalves, Rezende and Weiguo Fan, "Relevance feedback based on genetic programming for image retrieval", Pattern Recognition Letters, Vol.32, No.1, pp.27–37, 2011.
[4] Srinivasa Reddy A, Chenna Reddy P (2019) A hybrid K-means algorithm improving low-density map based medical image segmentation with density modification. Int J Biomed Eng Technol 31(2):176–192.
[5] Alireza Askarzadeh, "A novel metaheuristic method for solving constrained engineering optimization problems: Crow search algorithm", Computers and Structures - Elsevier, 169 (2016) 1–12.
[6] A. S. Reddy and P. C. Reddy, "Novel Algorithm based on Region Growing Method for Better Image Segmentation," IEEE. 2018 3rd International Conference on Communication and Electronics Systems (ICCES), *2018*.