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Locust Based Optimized Mining for Skull Images.

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ABSTRACT

This paper presents a reliable and robust mining approach using the texture pattern retrieved from the animal skull image. A surface pattern of the skull images are considered as the texture and the features are extracted at different orientations using a Gabor filter. A novel locust based optimization technique is proposed, which obtains the optimal surface feature. Most of the secret sharing techniques use pixel based mining. In this paper an effective texture based authentication is proposed which shows high efficiency. Performance of the system provides high accuracy and speedy verification. Experimental results prove that the proposed method is effective and feasible in surface pattern recognition.
Keywords: Content Based Image Retrieval, Semantic Gap, Feature Extraction, Image Processing.

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INTRODUCTION

Visual Image Retrieval (VIS) works with the visual properties of an image which are compared for its matching. Imagery database maintenance and indexing is in significant egress, when images and their pertinent information are retrieved over demand. Human-machine interaction in image understanding and problem defining in any field has become the emerging issue in real world applications. Tracking over the semantic similarities has become an inseparable issue in the field of computer vision. The speed of technological advances stands in contrast to the requirement for a reliable computer vision and machine learning in relevancy retrieval and analysis. The vision of human perception embedded along with expert system helps to bring out efficient and accurate results by working with the exact contents of the image which are close to the man mind thoughts, rather than depending on metadata of image repositories. Traditional expert systems are not sufficient to guarantee the metrics such as Quality (resolution and color depth), Nature (dimensionality), Throughput (rate of retrieval), and accuracy (matching of human and machine perceptions). Evaluation on the results with respect to the user semantics had not been compromised during indexing and sustainment.

The research focuses in two levels. First level is the construction of feature vector for the given query image. The same process has to be carried out for image database in prior. Second, fuzzy labels generation based on fuzzy-rules and conversion into semantic labels with the help of in-built semantic label library respectively. The proposed scheme handles two techniques such as vector construction and semantic tagging for hidden properties of an image. First, vector construction used to transform the visual low level features of the image into numerical measurements. After extracting the low level features, conversion of class labels into semantic labels helps to generate semantic classes which act as an additional feature along with extracted geometric local features.

Section 2 reviews some conventional CBIR (Content Based Image Retrieval) techniques in image retrieval. Section 3, includes complete information of the proposed optimal extraction through locust based feature retrieval. Section 4 shows the experimental results of the proposed method. And, section 5 concludes the paper.

RELATED WORK

Background of CBIR

CBVIR (Content Based Visual Image Retrieval) is an effective Image retrieval technique for automated retrieval of images from databases (local or remote), initially used by Kato [1] in 1992. The work in visual interception for trade mark and art museum database shows a way for automatic image retrieval close to human view. The gap between the richness of the user semantics and visual features provide maximum support in bridging using CBIR techniques. Generally a feature frequent in an image describes this image well.

CBVIR technique uses the image features instead of image itself. Kato[1] used CBIR techniques to develop a reliable tool to retrieve the images using color and shape features from large database. Chuen and Rong [2], works to reduce the number of features to be extracted by constructing common color palette. The idea behind their work is computation of occurrence of same pixel color between each pixel and adjacent, gives the probability of attribute of the image and thus it supports to quickly classify pixels of an image into clusters. This optimal less feature extraction model reduces the computation complexity to some range. Hossein Pourghassem [3] combines relevance feedback with PSO. He worked with X-ray with clinical view on shape edge and texture. Similarity measurement is found to be improved with PSO, where each particle (individual swarm) remembers best solution by itself. Kashif and Odetayo [4] developed CBIR for biometric security, where feature extraction done as color histogram for color, Gabor filter for texture, moment invariant for shape followed by wavelet transformation to give multi resolution of images for image classification. Finally Euclidean distance for similarity measure and fuzzy rules to control the result based on fuzzy heuristics.

Feature Analysis in Image Processing

Related works [5,6] are carried out towards image knowledge mining and are successfully implemented in various applications like biomedicine, biometric, authentication, industrial automation, social security etc. Various features are obtained from the image and decisions are made based on the relevancy. Shape features, Morphology features, histogram features, Correlogram features are the various information that can be retrieved. Shape features deal with length of x, y coordinate, area, perimeter etc., where morphological features identify the specific patterns available in the image. The statistical analysis detailed by Histogram distribution where as correlogram measures the spatial distribution along with that of statistical features.

Features can be extracted in spatial domain as well as transform domain. Most of the image transformation techniques do not efficiently identify the edge information of image. The challenge in Content Based Information Retrieval is identifying the edge information from the image.

The contour information specifies the shape, includes edge and correlogram information. Wavelet is used to extract the texture feature using its mean and variance of the wavelet sub band. Wavelet suffers to identify edge discontinuities in image[7]. Curvet transform provides better edge information and it is computationally inefficient [8]. Though many efficient techniques are proposed they still lack to identify the efficient texture of the skull images.

PROPOSED WORK

An autonomous intelligent machine should be capable of performing three fundamental functions such as Prediction, Cohesive and Optimization. This paper deals with secure sharing of a secret image among n participants using [9] .The secret image is analyzed to extract the surface texture using Gabor filter at different orientations. The optimal extraction of the surface pattern is performed using a Locust optimization technique. The retrieved optimal surface pattern along with the geometrical features is used as an authentication measure. Instead of hiding the visual information in this proposed system, the thorough study over the image pixel values make the machine understand the given image, so that it can accurately recognize for any activities with its pixel values. The overview of the analysis of image process is shown in figure 1.

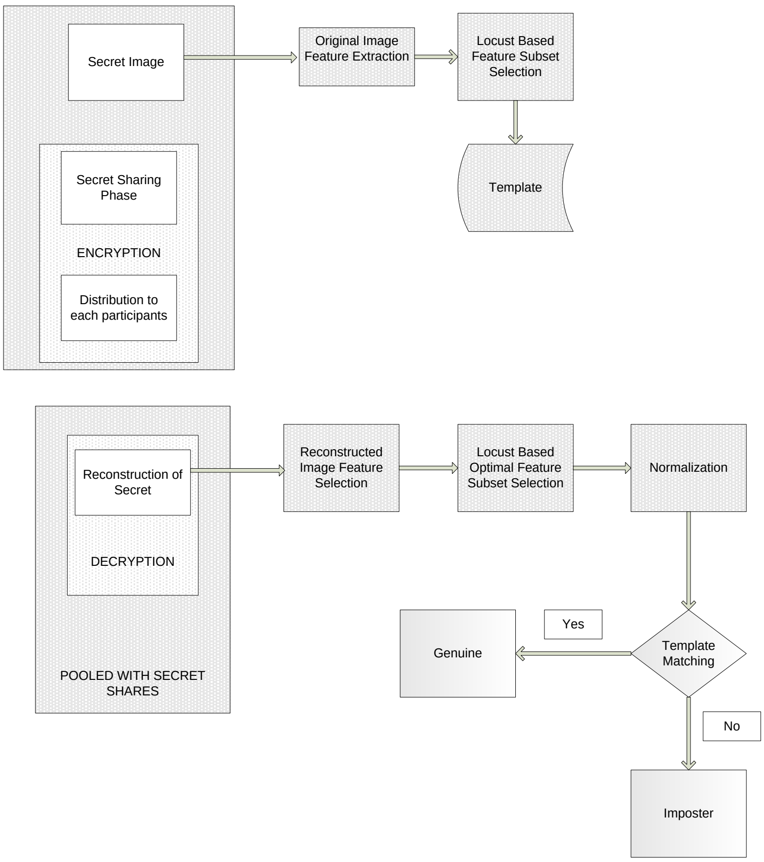

Fig 1: Analysis of Image processing

Overview of GABOR Filter

The surface features are extracted from the skull image using Gabor Filter is explained as follows. The responses of the Gabor functions which are similar to the human perception is modelled by Marcelja (1980) and Daughman (1980,1985). The texture analysis done by Gabor filters efficiently, for both frequency and spatial domains.

Generally 2D Gabor functions will hold good spatial localization and accurate selection over orientation frequency. The 2D Gaussian function for Gabor filter is given by

$$G_{\sigma,u,\theta}(x,y) = g_\sigma(x,y).\exp([2\pi ju(x\cos\theta + y\sin\theta)])$$

Where

$$g_{\sigma}(x,y) = \frac{1}{2\pi\sigma^2}\exp[-(x^2+y^2)/2\sigma^2 \qquad (1)$$

where $j=\sqrt{-1},$ frequency of span limited sinusoidal grading is represented as u, orientation is specified using θ, Gaussian function is specified as $g_\sigma(x,y),$ standard deviation of the Gaussian envelope is σ .The complex form representation of equation(1) is given as follows

$$G_{\sigma,u,\theta}(x,y) = R_{\sigma,u,\theta}(x,y) + jI_{\sigma,u,\theta}(x,y) \qquad \text{where}$$

$$R_{\sigma,u,\theta}(x,y) = g_\sigma(x,y).\cos[2\pi u(x\cos\theta + y\sin\theta)])$$

$$I_{\sigma,u,\theta}(x,y) = g_\sigma(x,y).\sin[2\pi u(x\cos\theta + y\sin\theta)])$$

Gabor filter is a tunable filter which extracts visual recognizable textures like image. Accurate identification using Gabor filter is possible only by choosing the parameter suitably. Texture pattern extraction is ensured, by the proposed method which divides the image into $M \times M$ non overlapped blocks. Selection of block size should be done carefully since too small or big sized block will not result in good patterns. The blocks are tuned at different orientations to identify the concavity pattern of the image. The real part of the Gabor is tuned in order to obtain a clear texture of the skull image. The skull image cannot be categorized with any specific pattern but resembles the concavity characteristics, which are stable and its density makes it suitable to view as a texture. Skull Images consist of concave angular structures retrieved as surface pattern using 2D Gabor filter. The process of choosing the orientation values for tuning each block is described in the following section

Estimation of Orientations

Skull images are not predictable to any defined patterns. 2D Gabor filters are used mostly with eight different orientations $\theta \in \{0, \pi/8, 2\pi/8 \ldots.. 7\pi/8\}$ .The optimal direction at each block is determined by six local direction masks given in Fig 2.The local orientation is determined using a $3X3$ window within which most of the displacements are identified. Each block is processed using the six local masks individually, resulting in six local features. Every pixel f(x, y) in the image is considered as the centre of the mask and the direction intensity is referred as D_l where $l = 1 \cdots 6$. The direction features are obtained as

$$D_l(x,y) = \sum_{m=-1}^{1}\sum_{n=-1}^{1} | f(x+m, y+n) * D_l(m,n) | \qquad D_l = \sum_{y=1}^{i}\sum_{x=1}^{j} D_l(x,y)$$

Where i, j are the width and height of the image block , f(x,y) is the image pixel value , D_l is the local density pattern. Each block is using the chosen mask patterns that modify the original pixel values to the intensity value which posses the relationship of neighboring pixel. The intensity pixel values are added up and are chosen as the orientation values thus resulting in six orientations for each block. Each block is processed using the 2D Gabor at six different orientations which results in analyzing and retrieving the best feature available in each block.

0	-1	0
0	0	0
0	1	0

0	0	-1
0	0	0
0	0	1

-1	0	0
0	0	0
1	0	0

-1	0	0
0	0	0
0	0	1

0	-1	0
0	0	0
1	0	0

0	0	-1
0	0	0
1	0	0

Fig 2: Mask patterns (3X3 pixels)

Local Region Pattern Extraction Phase

Instead of tuning the cryptographic techniques simple authentication also gives better results through perfect visual analysis. Accurate analysis over the visual features and the resulting analyzed reports act as better input to existing simple cryptographic algorithms and bring out optimal authentication by protecting both the sides from intruders. Feature grasping plays a vital role in image analysis, since the visual properties of the image speaks more about the perspective cases. Apart from extracting possible features and then reducing the feature vector means to minimize the search space (i.e optimizing the feature set after extraction), it is better to extract optimized features with keen analysis over the image properties. The group of flies with cohesive feeding behaviour are launched over the grid stripped image under analysis. The pixels satisfying the threshold levels get attracted towards the sensing nature of the flies. The selected pixels are grouped through connectivity lines and thus the best patterns (best piece of food) which show the significant texture on the surface of the image, provide more information about the visualization and internal local features of the image.

Each block will generate six patterns where each is best (longest & largest) from its image view. The locust based optimization algorithm is called recursively on each block for all its six views and finally the best among six patterns is chosen effectively. The feature extraction phase is combined with filtering to bring optimized and minimized set of features that provides more information about the image. This technique results in reduction of vagueness and uncertainity in the extracted feature set. Semantic gap has been tried to get reduced by collecting features and comparing with dataset, to retrieve similar images coinciding with the extracted features. Speaking about large dataset, number of matches towards extracted feature set may be above reality and thus those matches are extracted irrelevant to human sense. Generally there is a thought that the semantic interpretation of an image has very little to do with statistics of the values of the pixels. But, an idea of utilizing pixel values is proposed in this article. Individual pixel value could not bring any big sound to new innovations ,but working with the comparisons of pixel values collectively helps to retrieve effective surface texture pattern for skull image . Thus the relative brightness of pairs of pixels is computed such that regularity, coarseness and direction of the texture are estimated.

Optimal Extraction of Pattern Using Locust

Locust is swarm of flies which is illustrated for their devasting behaviour over the food grains. Their way of feeding is in group on the part of a farm which most probably fulfills its requirements. This technique has been imposed to retrieve the texture feature from the given visual images. The proposed algorithm helps to extract the local surface pattern of each block which represents the accurate pattern visible in the image. Extraction of pattern performs a Greedy technique which attracts towards the region with likely improvement. This algorithm possesses the characteristics such as

- Perform a random walk over the given search space.
- Blind to perform effective search.
- Work with incomplete information.
- Reduce burdens in decision making and classification.
- Number of possible solutions are available (ie food surely awaits)
- Fitness values are robust to dynamic environmental changes
- Parallelism can be obtained
- Stalling Over region where no improvements seem to be possible are avoided by jumping

Step 1: Initial Population of $B_{iV_j}, \cdots B_{iV_n}$ where i = 1 to z (Total number of blocks)
j = 1 to n (Orientation) is pooled for further activities.
Step 2: Repeat the following steps for defined blocks and its all orientation.
Step 3: Let threshold for $B = M \times M$ block matrix is $250 \le PIXELVALUE \le 255$
For ¥ij [B] where Calculate

$$\begin{bmatrix} POS\{B[i][j] \ge TH\})thenB[i][j] = 1 \\ POS\{B[i][j] < TH\})thenB[i][j] = 0 \end{bmatrix}$$

Step 4: Check that ¥i,j $B[i][j] \le m$ whether $B[i][j] == 0$ then Increment j until m-1 and i. Repeat step 4 until all rows in B are analyzed.
Step 5: If $(i, j) > m$, algorithm stops and return as the results of feature extracted otherwise go to step 6.
Step 6: The adjacent pixels with true values are connected to visualize the line patterns in skull surface.
Step 7: If in the first iteration
For i = 0 to m-1
For j = 0 to m-1
Check (B[i][j]==1 and B[i][j+1]==0)

Let $x[i] = x[i] \cup \{i\}$

$y[j] = y[j] \cup \{j\}$

Assign initial value =j
Line draw $initialposition((i, j), (i+1, j-1))$ //
Find the sibling pixels with true values.
Step 8: if $(LC[i][j] == 0 \ \&\&B[i][j+1] == 0 \ \&\&B[i][j+2] == 0)$ then

The mechanism defined to find the best solution in a fixed amount of time (intention is to find the crop which fully satisfies its hunger) Thus, these evolutionary behaviour is translated into computational algorithm which brings successful search results of optimal solution.. This algorithm holds the capability of responding to environment stimuli and developing operations for effective behavioral change over time. This proposed evolutionary algorithm explained in Figure 3 is suitable for prediction, optimization and machine learning (No exchanges only mutation)

Geometrical Feature Measures

The statistical and geometrical analyze are performed over the entire image which help to identify the shape parameters. This method is followed to identify the edges of the skull image. The area and perimeter of the animal skull is calculated. Feature vectors are calculated using these features along with the optimized feature set.

Step 1: The image I is converted into binary image BI

Step 2: Every Image pixel is processed to identify the location where the pixel values changes from 1 to 0 and 0 to 1 is identified

then Store TRow = i and TCol = j of values

then Store PRow = i and PCol = j of values where i, j =1 to M

Step 3: Retrieve the following measures as

i) Initial (TRow) shows the top edge and join the top horizontal line is drawn using
Drawline ([1,M],[TRow, TRow])

ii) Identify left position and draw Left vertical line

Fig 3: Algorithm to identify the Geometrical Size and Shape of Skull Image

Similarity Measure

To perform the matching process, the original and the reconstructed feature vector is compared to identify the similarity distance metric. To determine the similarity matching of surface pattern Canberra distance measure is used. This distance measure normalizes the difference in the denominator and the numerator generally signifies the value of the difference. This is a good measure to use, because the difference value never exceeds one and avoids scaling effect.

$$D(O,R)=\sum_{i=1}^{LV}\frac{|f_{R,i}-f_{o,i}|}{|f_{R,i}+f_{o,i}|}$$

where O is the original Image
R is the Reconstructed Image
L_V is the length of the feature vector
$f_{R,i}$ is the i^{th} feature of the reconstructed image

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$f_{O,i}$ is the i^{th} feature of the original image

EXPERIMENTAL RESULTS

The experimental study is performed in the Matlab platform. The performance of the proposed algorithm is checked over a database having about 100 animal skull images. The sample skull images are given in Figure 4.

Fig 4: Sample Skull images

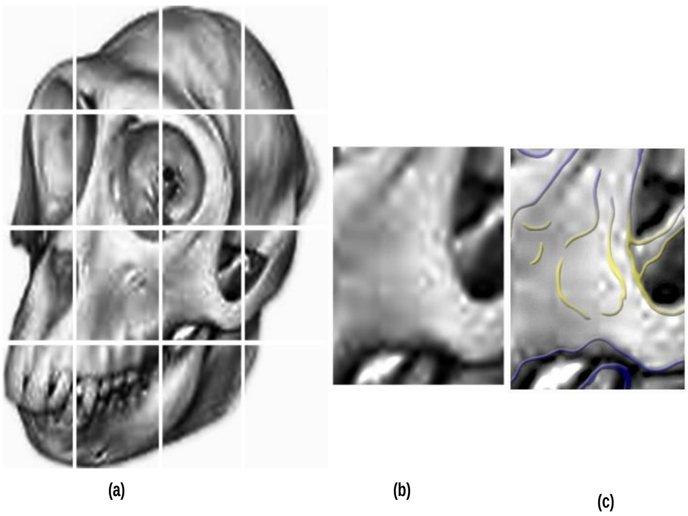

Fig 5: (a) Splitting the image into 16 regions (b) and (c) shows a single block with identified pattern.

Figure 2 shows the splitting of the image into $M \times M$ non overlapping blocks and the results obtained in each block after applying Gabor filter. The optimal extracted feature from each block is shown in Figure 3.

Comparison And Performance Evaluation

The effectiveness of the proposed method is verified and compared with traditional Gabor Filter and multiple Gabor Filter. Figure 7 (a, b) shows that FAR and FFR distribution using various Gabor Filter. One of the curves corresponds to imposter matching. The total error attains the minimum when the decision threshold is assigned to the intersection of genuine and imposter distribution curves. To prove the effectiveness, the proposed method is compared with multiple resolution filter [10] , Wangs laplacian palm [11] and W.H.Han [6] method and are shown in Figure 8. The proposed method fulfills high accuracy of authentication.

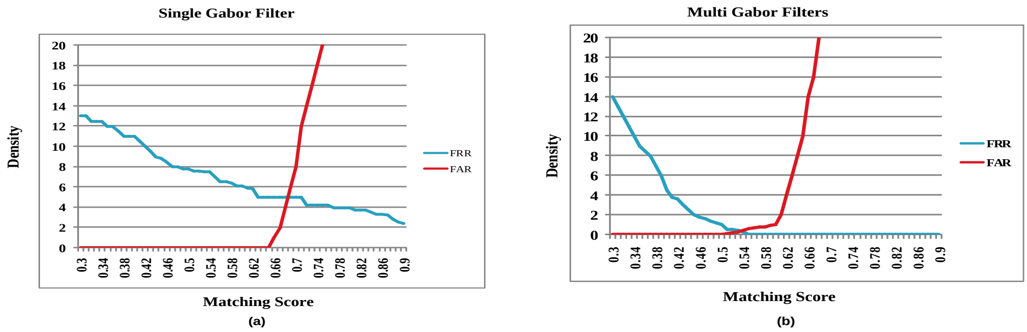

Fig 6: FAR and FRR distributions of (a) single Gabor filter; (b) multi Gabor filter

CONCLUSION

We have proposed a robust and a reliable mining scheme using the surface pattern of the animal skull image. The surface pattern is retrieved using Gabor filter at various orientations. The locust based optimization techniques is applied to retrieve the best pattern on each non overlapping block of the image. The Canberra distance measure performs the similarity match measurement. Compared with single and multiple traditional Gabor filter our proposed approach shows better retrieval results.

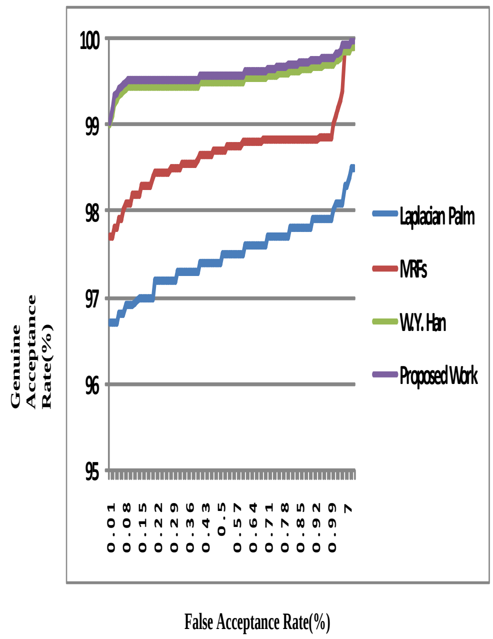

Fig 7: Comparative Analysis

REFERENCES

[1] Kato and Toshikayo, "Database architecture for large image gallery management – An Introduction to Content based image retrieval", IEEE Transactions on multimedia, (1992).

[2] Chuen-Horng Lin, Rong-Tai Chen, Yung-Kuan Chan, "Smart content-based image retrieval system based on color and texture feature", Image and Vision Computing, Volume. 27, pp. 658–665, (2009).

[3] Suhasini, Sri Rama Krishna and Murali Krishna, "CBIR using color histogram processing", Journal of Theoretical and Applied Information Technology, Vol.6, No.1, pp.116-122, (2009).

[4] Hossein Pourghassem, "A Relevance Feedback Approach Based on Modification of Similarity Measure Using Particle Swarm Optimization in a Medical X-ray Image Retrieval System", Majlesi Journal of Electrical Engineering Vol. 4, No. 2, (2010).

[5] Ganasekar P, Nagappan A, Sharavanan S, Saravanan O, Vinothkumar D, Elayabharathi T, and Karthik G, 'Investigation on Feature Extraction and Classification of Medical Images', World Academy of Sciences,60,2011.

[6] Wei-Yu Han , Jen-Chun Lee,' Palm vein recognition using adaptive Gabor filter', Expert Systems with Applications, 39 ,3225–13234,2012.

[7] Asad Ali, Saeed Murtaza , Aamir Saeed Malik," Content Based Image Retrieval Using Daubechies Wavelet Transform", Proceedings of the 2nd national Workshop on trends in Information Technology, 110-115,2003.

[8] L J Anbarasi, MJ Vincent, GSA Mala," A novel visual secret sharing scheme for multiple secrets via error diffusion in halftone visual cryptography", 2011 International Recent Trends in Information Technology (ICRTIT) 129-133

[9] LJ Anbarasi, GSA Mala, M Narendra, "DNA Based Multi-secret Image Sharing", Procedia Computer Science 46, 1794-1801, 2015

[10] Lin, C.-L., & Fan, K.-C. (2004). "Biometric verification using thermal images of palmdorsa vein patterns". IEEE Transactions on Circuits and Systems for Video Technology, 14(2), 199–213

[11] Wang, J. G., Yau, W. Y., & Suwandy, A. (2008). "Fusion of palm print and palm vein images for person recognition based on Laplacian palm feature". Pattern Recognition, 41(5), 1514–1527.

[12] Dr.JaniAnbarasi L, Ms.Jetlin C.P and Mrs.Jayalakshmi ,Modigari Narendra, "Locust Based Optimization Mining Approach for Animal Skull Images" in the International Conference on Knowledge Based Computing Technologies (ICKCT 2016) t KCG College of Technology on 4th February 2017.