



Analysis of CBIR on the basis of Accuracy, BER and Entropy

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Abstract: In this paper, we present associate economical algorithmic rule primarily based on SURF (Speeded up sturdy Features), SVM and NN. The method applies the SURF formula within the detection and outline for image features; first it applies the SURF feature detector in extracting reference pictures and matching feature points within the image, respectively. In the process of feature points matching; the false matching points area unit eliminated through this formula. Finally, according to the remainder of point which may estimate the space geometric transformation parameters between two pictures and so matching method is completed. In this thesis, SURF algorithm is used to notice and descript the interest points; and match the interest points by using Surf [1, 3]. In this paper, the same is tried to retrieve with the employment of SURF and fed into Support Vector Machine (SVM) and NN (Neural Network) for further classification. The SURF technique is fast and sturdy interest points detector that is used in several laptop vision applications. For the implementation of this proposed work we have a tendency to use the Image Processing Toolbox under MATLAB Software.

Keywords: Image processing, Matching, Surf, Neural Network and SVM.

I. INTRODUCTION

CBIR or **Content Based Image Retrieval** is the retrieval of pictures supported on visual options like texture, colour and form. Logic for its advancement is that in various massive pictures databases and conventional procedures of image categorization have verified to be deficient, laborious and intensely time exhausted. These traditional techniques of image indexing and move from saving a picture within the info and correlating it with a keyword or variety to combining it with a categorized description. In CBIR, every image that is saved within the info has its options extracted and related to the options of the question image. At present, the image matching schemes can be approximately classified into two categories; one is that the image matching supported on image matching and have matching. Matching technique is precisely use the image grey worth to regulate the area pure mathematics remodel between the images; this method will change use of the information of the image, so it is conjointly renowned because the matching technique that's supported integral image. It has no element detection steps within the feature matching stage. The size of window is steady and even whole image matching is approved in estimation. So the estimating quantity is intelligible and conjointly straightforward to be

ascertained. In recent years, very large collections of pictures and videos have developed swiftly. In parallel with this development, con-tent based retrieval and querying the indexed choices are mandatory to access the directions that area unit visual. Two of the vital elements of the visual instruction are texture and color. The history of the content-based image retrieval can be classified into three phases:

- The retrieval based on artificial notes.
- The retrieval based on vision character of image contents.
- The retrieval image is based on image linguistic options.

The image retrieval that is supported artificial notes labels images by utilising text foremost, in fact it has antecedent modified image retrieval into conventional keywords retrieval. Difficulty with the approach is that, it carries excessive workload and it still remains subjectiveness and uncertainty. Because the image retrieval is primarily based on artificial notes still remains deficiency that modify vision image options has been return up and evolve into the first study. The character of this approach is image option extraction impersonally whether the retrieval is fine or not depends on the features extraction accuracy. So the analysis supported on vision options is enhancing the target in

the academic association. The option of vision can be classified by semantic hierarchy into middle level feature and low-level feature. Low-level feature involves texture, color and inflexion. Middle level involves shape description and object feature. Content based Image Retrieval systems strive to retrieve pictures similar to a user-defined specification or arrangement. Their aim is to support image retrieval based on content properties. One of the major benefits of the CBIR technique is that the probability of associate automatic retrieval mechanism rather than the standard keyword-based technique that usually needs terribly arduous and long last annotation of info picture.

CBIR process involves two steps:

- The **Feature Extractions** the first step within the method is extracting image options to a distinguishable extent.
- The **Matching** is the second step involves matching these features to yield a result that's visually similar.

There are various CBIR systems that are presently exist and are being matured steadily:

- **QBIC or Query by Image Content** was matured by IBM and Alma den Analysis Centre to permit purchasers to diagrammatically create and clarify objections supported numerous visual properties like colour, texture and shape. It supports objections based on input pictures, user-constructed sketches, selected colour and texture patterns.
- **VIR Image Engine** by Virage like QBIC empowers image retrieval based on primitive facet such as texture, colour and structure. It analyses the pixels in the image and execute an analysis process for deriving image characterization features.
- **VisualSEEK and WebSEEK** were matured by the Department of Electrical Engineering of Columbia University where both these schemes support colour and abstraction scenario matching likewise texture matching.
- **NeTra** was matured by the Department of Electrical and Computer Engineering, University of California. It supports spatial layout, colour, shape and texture matching as well as image segmentation.
- **MARS or Multimedia Analysis and Retrieval System** was matured by the Beckman Institute for Advanced Science and Technology of Illinois University. It supports texture, colour, spatial layout and form matching.
- **Viper or Visual Information Processing for Enhanced Retrieval** was matured at the Computer Vision Group of Geneva University. It supports colour and texture matching.

1.1. SPEEDEDUP ROBUST FEATURE

SURF (Speeded up Robust Features) is a robust local option indicator; first presented by Herbert Bay et al in 2006; that may be used in computer vision operations like object recognition or 3D reconstruction. This is slightly accelerated by the SIFT descriptor. That's why recognized version of SURF is several times fast than SIFT and demanded by its authors to be more robust against not alike image transformations than SIFT. And SURF is supported on sums of 2D Haar wavelet responses and organize an efficient use of integral images. This uses an integer approximation to the determinant of Hessian blob detector; which can be computed intensely smoothly with an integral image. Therefore For options; it uses the sum of the Haar wavelet response around the point of interest. These can be computed with the aid of the integral image. SURF used in this method to extract relevant options and descriptors from images. This method is favored over its predecessor due to its succinct descriptor length for instance 64 floating point values.

In SURF, scriptor vector of length 64 is developed by victimisation a bar graph of gradient orientations within the native neighborhood around each key purpose. Altered SURF (Speeded up Robust Features) is one of the well-known feature-detection algorithms [11, 17]. The panorama image stitching theme that integrate a picture matching algorithm; modified SURF associated an image mixing algorithm; multi-band mixing. This procedure is classified within the succeeding steps: first; get feature descriptor of the image victimisation modified SURF; secondly; notice matching pairs; using correlation matrix; and eliminate the match couples by RANSAC (Random Sample Consensus); then; adapt pictures the pictures the photographs} by bundle adaption and judge the definite homographic matrix; finally; mix images by Alpha mixing. And contrasting of SIFT (Scale Invariant Feature Transform) and Harris detector area unit conjointly shown as a base of choice of image matching algorithmic rule. And according to the operations; this system an build the sewing seam undetectable and reach an ideal panorama for large image information and it's fast than last approach. SURF approximates or even outperforms earlier suggested schemes with reference to repeatability; distinctiveness; and robustness; yet may be calculated and correlated rapidly. Integral images for image convolutions; by building on the stability of the leading current detector sand descriptors specially employing a Wellington boot matrix-based live for the detector; and a distribution-based descriptor and by facilitate these ways to the essential [18,20]. This leads to a mixture of novel detection; explanation; and matching steps. It approximates or

even outperforms earlier suggested techniques with relevancy repeatability; distinctiveness; and robustness; yet may be calculated and related to quickly and this can be managed by;

- Relying on integral images for image convolutions
- Building on the strengths of the leading existing detectors and descriptors (using a Hessian matrix-based live for the detector; and a distribution primarily based descriptor).
- Simplifying these methods to the essential.

1.2. NEURAL NETWORKS

Neural network is set of interconnected neurons. This method is used for universal approximation. Artificial neural networks are composed of interconnecting artificial neurons (programming creates that mimic the properties of biological neurons). And artificial neural networks may either be used to reach associate understanding of biological neural networks; or for explaining computing complications while not naturally designing a model of a true biological system that is extremely complicated. An Artificial neural network algorithms plan to abstract this complication associated target on what component most from an instruction process purpose of read could hypothetically. Fine achievement (e.g. as measured by good prognostic capability; low generalization error); or performance mimicking animal or human error patterns; will then be used as one supply of confirmation towards supporting the hypothesis that the abstraction fully captured one thing valuable from the purpose of read of information process within the brain of human. And another incentive for these abstractions is to lessen the quantity of calculation needed to simulate artificial neural networks.

1.2.1. Architecture of artificial neural network

The basic architecture contains of 3 forms of nerve cell layers: input; hidden; and output. And feed-forward networks; the signal flow is from input to output units; closely in a feed-forward direction. Accordingly information process will enlarge over varied layers of units; however no feedback connections exist. The periodic networks include feedback connections. The contrary to feed-forward networks; the dynamical properties of the network are relevant. In many cases; the activation values of the units endure a recreation method such that the network can emerge to a continuing stage during which these activations don't vary any longer [12].

1.2.2. Artificial Neural Networks

Artificial neural networks are composed of interconnecting artificial neurons (programming constructs that mimic the properties of biological

neurons). Therefore Artificial neural networks could either be used to reach associate acceptance of biological neural networks; or for illuminating computing complications while not essentially generating a model of a real biological system that's excessively complicated: artificial neural network algorithms decide to abstract this complication associated target on what could hypothetically part most from an instruction process purpose of read. Fine achievement (e.g. as measured by good prognosticative capability and low generalization error), or accomplishment of mimicking associate animal or the human error patterns and will then be used as an supply of data towards supporting the hypothesis that the abstraction very catch one thing that's valuable from the purpose of read of data process within the brain [20]. Another inducement for these abstractions is to lessen the number of calculation required to imitate artificial neural networks; therefore on confess one to operations with nice networks and train them on immense knowledge sets. And application areas of ANNs involve system identification and control (vehicle control; method control); game-playing and call creating (backgammon, chess, racing), pattern recognition (radar systems; face identification; object recognition); sequence recognition (gesture, speech, handwritten text recognition); medical diagnosis; money applications; knowledge mining, visualization and e-mail spam filtering.

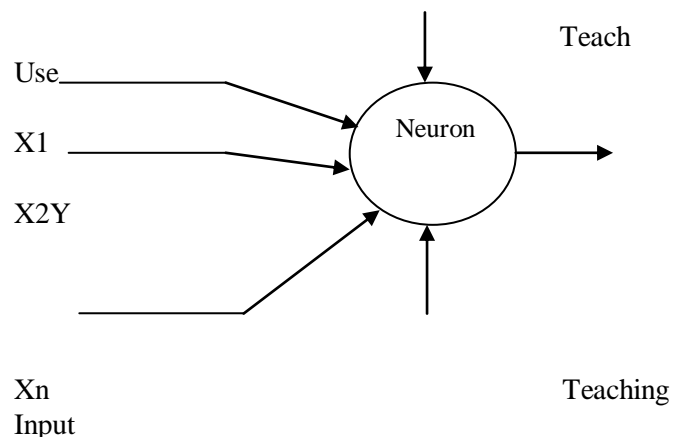


Figure 1: Neural Network

1.2.3. Delta Rule

The delta rule is a gradient descent learning law for modernize the weights of the artificial neurons in a single-layer perceptron. This is a exclusive case of the more general back propagation algorithm. For a neuron j with activation function $g(x)$; the delta rule for j , i th weight is given by

$$\Delta W_{ij} = (t_j - y_j) g'(h_j) x_i \quad (1)$$

Therefore delta law is generally defined in simplified form for a perceptron with a linear activation function as $\Delta W_{ij} = \alpha (t_j - y_j) x_i$; where α is known as the learning rate parameter.

1.3. SUPPORT VECTOR MACHINE

The Support Vector Machine (SVM) is a state-of-the-art analysis methodology popularised in 1992 by Boser, Guyon, and Vapnik. The SVM classifier is broadly used in bioinformatics (and alternative disciplines) attributable to its extraordinarily accurate; adept to estimate and method the high-dimensional knowledge like organic phenomenon and exhibility in modelling numerous origin of knowledge. SVMs belong to the general classification of kernel methods. And a kernel method is associated degree algorithmic rule that depends on the knowledge solely through dot-products. This is the case; the real number may be recovered by a kernel function that estimates a real number in few in all probability high dimensional feature areas. It has two benefits: First; the aptitude to develop non-linear call boundaries exploitation strategies planned for linear classifiers. And second; the use of kernel functions grants the user to use a classifier to data that haven't any accessible fixed-dimensional vector area illustration. Thus higher example of such knowledge in bioinformatics are sequence; either deoxy ribonucleic acid or super molecule; and protein structure. Using SVMs with efficiency desires associated degree understanding of however they work. When coaching associated degree SVM the professional requires making a variety of conclusions: a way to pre-process the info, how to the kernel to use or work; and finally; setting the parameters of the SVM and also the kernel [1]. Uninformed choices could result in extremely shortened performance. Therefore our goal to support the user with associated degree intuitive understanding of these choices and support general usage indications [7, 13]. All the examples shown were developed using the PyML machine learning surroundings, which focuses on kernel strategies and SVMs.

1.3.1. Preliminaries: Linear Classifiers

Support vector machines are examples of a linear two-class classifier. This section describes what that means. The data for a 2 category learning complication contains of objects labelled with one amongst 2 labels akin to the 2 classes; for accessibility we have a tendency to suppose the labels are +1 or -1. In what follows boldface x stands for a vector with components x_i . Thus notation x_i can stand for the i th vector in a dataset, $f(x_i; y_i)$ gni =1, where Y_i is the label related to x_i . The boundary between regions divided as positive and negative is called the choice boundary of the classifier.

The decision boundary expressed by a hyper plane is claimed to be linear as a result of it's linear within the input examples. A classifier with a linear decision boundary is known as a linear classifier. Conversely, when call of the boundary is a classifier depends upon the info in non-linear the classifier is claimed to non-linear.

1.3.2. Kernels: From Linear To Non-Linear Classifiers

In various applications a non-linear classifier supports improved efficiency. Yet; linear classifiers have benefits; one of them being that they often have simple training algorithms that scale well with so many examples [9, 10]. This begs the question: Can the machinery of linear classifiers be broadening to develop non-linear decision boundaries? Therefore furthermore; can we handle domains such as protein sequences or structures where a representation in a steady dimensional vector space is not convenient? The naive method of making a non-linear classifier out of a linear classifier is to map our data from the input space X to a feature space F using a non-linear function.

The method of explicitly calculating non-linear features does not scale well with the so many input features: when implementing the mapping from the above example the dimensionality of the feature space F is quadratic in the dimensionality of the original space. The result in a quadratic raise in memory usage for saving the features and a quadratic raise in the time needed to calculate the discriminant function of the classifier. The complication of quadratic is profitable for low dimensional data; but when handling gene explanation data that can have thousands of dimensions; quadratic complication in the number of dimensions is not satisfactory. And Kernel methods resolve this argument by neglecting the step of explicitly mapping the data to a high dimensional feature-space.

Gaussian kernel is defined by:

$$K(x_i, x_j) = \exp\left(-\frac{\|x_i - x_j\|^2}{2\sigma^2}\right) \quad (2)$$

Where $k > 0$ is a parameter that command the width of Gaussian. It plays an identical role as the degree of the polynomial kernel in commanding the exhibility of the arising classifier. We saw that a linear decision boundary can be kernelized i.e. its dependence on the data is only through dot products. In order for this to be profitable, the training algorithms need to be kernelizable as well [6]. It turns out that an extreme number of machine learning algorithms can be expressed using kernels | including ridge regression, the perceptron algorithm, and SVMs [16].

II. PREVIOUS WORK

In the previous work, there were various techniques that were used to restore the images. So that input image will highly precise for understand and improved results. eg – one class, two-class, and multiclass SVMs to annotate images for supporting keyword retrieval of image, multiresolution-based signature subspace classifier (MSSC). The MSSC was generated to extremely save the computational time. With application to psoriasis images. The essential techniques consist or involved of feature extraction and image segmentation (classification) methods. Other method, confidence-based dynamic ensemble (CDE), which employs a three-level classification scheme At the base-level, the CDE uses one-class Support Vector Machines (SVMs) to characterize a confidence factor for ascertaining the correctness of an annotation (or a class prediction) made by a binary SVM classifier.

III. PROPOSED APPROACH

The block diagram of the proposed system is shown in the following Figure.

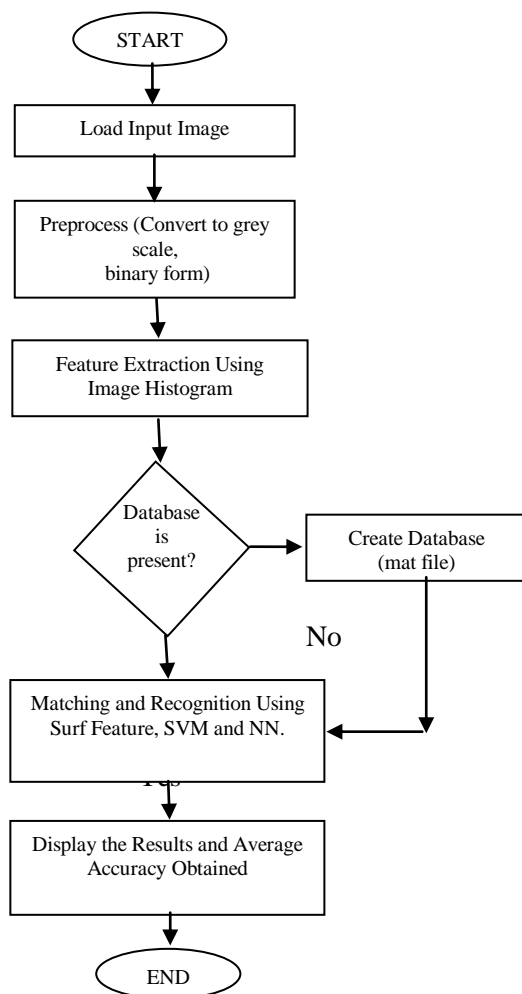


Figure 3.1: Flow Chart of Proposed Work

IV. RESULTS AND DISCUSSION

A starting GUI was created to perform all the five operations that is browse input image, process input image, create database, process database and match.



Figure 3.2: Matched Image

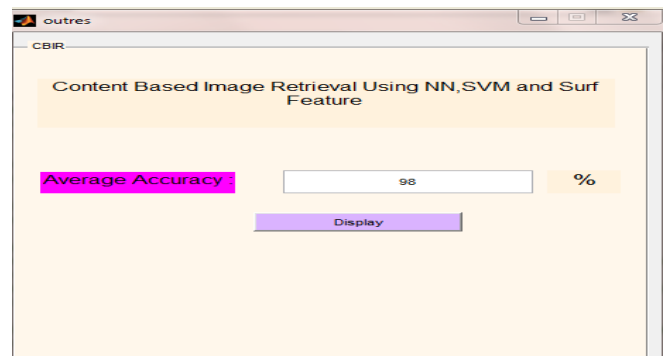


Figure 3.3: Average Accuracy of CBIR

This figure shows the result of given input image and represents the accuracy of retrieval image.

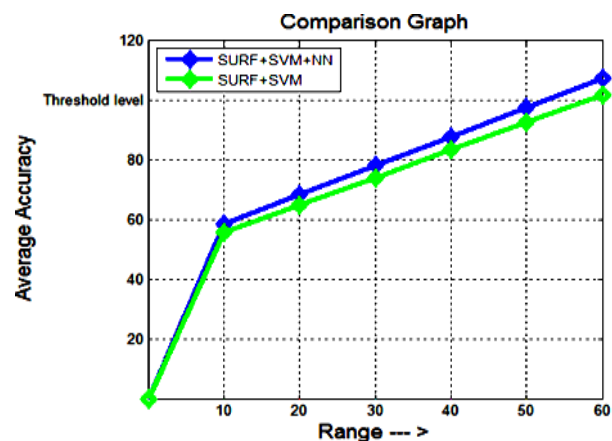
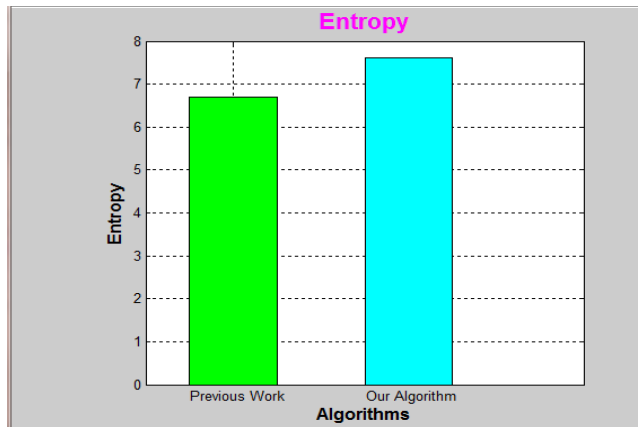


Figure 3.4: Accuracy between Previous and Proposed work

In this work we are using SURF, SVM and NN for better results. But in previous methods the results are not good. So, in this figure we show that our work is better as compare to previous work.

BER: It is a performance measure defined as the no. of bit errors per unit time and it is unit less, generally expressed in percent age. The ratio of bit error can be described as an estimate of the bit error probability approximately. For a long time interval and with high no. of bit errors, this estimate is accurate.

$$BER = 1/PSNR$$



	Previous Work	Proposed Work
BER	2.3020	1.3382

ENTROPY

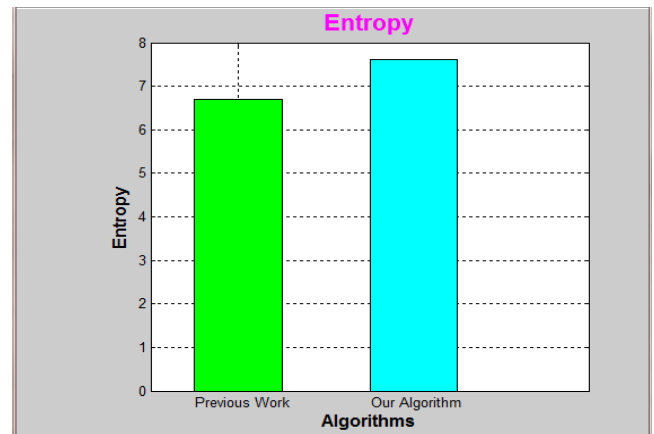
Image entropy as used in my compression tests is calculated with the same formula used by the Galileo Imaging Team:

$$\text{Entropy} = - \sum_i P_i \log_2 P_i$$

Image entropy is a quantity which is used to describe the 'business' of an image, i.e. the amount of information which must be coded for by a compression algorithm. Low entropy images, such as those containing a lot of black sky, have very little contrast and large runs of pixels with the same or similar DN values. An image that is perfectly flat will have entropy of zero. Consequently, they can be compressed to a relatively small size. On the other hand, high entropy images such as an image of heavily cratered areas on the moon have a great deal of contrast from one pixel to the next and consequently cannot be compressed as much as low entropy images.

In the above expression, P_i is the probability that the difference between 2 adjacent pixels is equal to i , and \log_2 is the base 2 logarithm. Here is an IDL program I

wrote to calculate the entropy of an image using this expression.



	Previous Work	Proposed Work
Entropy	6.6975	7.6026

Mean square error (MSE) in the previous work was very high and those were reducing the working of accuracy and increase the working of time etc. This figure represents result of our proposed methods.

This table show the result of proposed and previous method. In the previous work MSE was very high but in our work MSE result is low as compare to previous method.

PSNR(Peak signal to noise ratio) increase the working. In the previous work PSNR is low but in proposed method It will increase (shows in table).

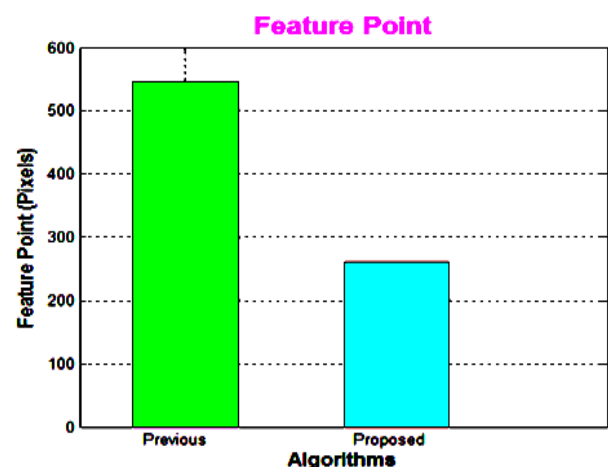


Figure 3.5: Feature Point

Table: Comparison of Feature Point between Previous and Proposed work

	Previous Work	Proposed Work
Feature Point	547	261

Table : Matching between Previous and Proposed work

Comparison of Matching time between Previous Work and Proposed Work		
	Previous Work	Proposed Work
Time (sec-->)	2.0300	1.8504

This table show the result of proposed and previous method. In the previous work matching time was high but in our work matching time result is low as compare to previous method

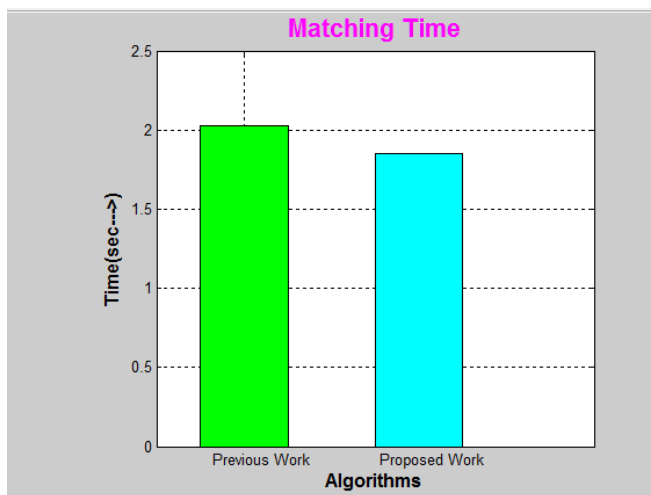


Figure: Matching Time

Matching Time in the previous work was very high. This figure represents result of our proposed methods which is better.

V. CONCLUSION

We proposed 'Image Matching Based on Improved SURF Algorithm using SVM Classifier and Neural Network'. Content-Based Image Retrieval (CBIR) is a challenging task which retrieves the similar images from the large database. Therefore most of the CBIR system uses the low-level features such as color; texture and shape to extract the features from the images. Finally it estimates the space geometric transformation parameters between two images and completes the matching according to the rest of the matching point [3, 6]. Many CBIR techniques have been proposed earlier but they were not good enough and can be temporarily tampered with so the task was not fulfilled. CBIR alone with Surf

and SVM Method could not provide better results. Therefore we use Content Based Image Retrieval with Surf, SVM and Neural Network providing three level improved results. Even if image is tampered with our Accuracy is not affected and thus our purpose is fulfilled. Better BER and CCR results of Content Based Image Retrieval with Surf, SVM and Neural Network.

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