



Enhancement of Principal Component Analysis using Gaussian Blur Filter

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ABSTRACT

Characteristic evolving is most serious move that deal with image discrimination. It makes the content of images as ideal as possible. Gaussian blur filter used to eliminate noise and add purity to images. Principal component analysis algorithm is a straightforward and active method to evolve feature vector and to minimize the dimensionality of data set, this paper proposed using the Gaussian blur filter to eliminate noise of images and improve the PCA for feature extraction. The traditional PCA result as total average of recall and precision are (93% ,97%) and for the improved PCA average recall and precision are (98% ,100%), this show that the improved PCA is more effective in recall and precision.

Keywords: Gaussian Fuss, Noise Removal, Gaussian Blur Filter, Principle Component Analysis.

تحسين تحليل المكون الرئيسي باستخدام منقي التمويه للشئي الضبابي

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الخلاصة

استخلاص الخصائص هي اهم خطوه التي تتعامل مع تمييز الصور. تجعل محتويات الصورة مثاليه بقدر المستطاع. منقي التمويه للشئي الضبابي يستخدم لحذف الضوضاء واضافه النقاوه الى الصور. خوارزميه تحليل المكون الرئيسي طريقه سهله وفعاله لاستخلاص خصائص القوه المتجهه وتقليل ابعاد مجموعه البيانات. هذا البحث اقترح استخدام منقي التمويه للشئي الضبابي لحذف الضوضاء من الصور وتحسين تحليل المكون الرئيسي لاستخلاص الخصائص . لتحليل مكون الرئيسي التقليديه مجموع نتائج كمعدل من الاستدعاء و الدقه (93%،97%) ولنظام المحسن من تحليل المكون الرئيسي كمعدل من الاستدعاء والدقه (98%،100%) هذا يبين انه النظام المحسن من تحليل المكون الرئيسي فعال اكثر في الاستدعاء والدقه.

1. Introduction

Feature extraction is a way of getting visual details of images for indexing and retrieval, it applied to denote a part of information which is pertinent for solving the computation task concerned to a certain application [1]. Image filtering makes potentially several useful tasks in image processing, a filter can be applied to minimize the amount of unwanted noise in a particular image, Gaussian blur is counted an ideal blur for many applications [2]. Principle Component Analysis PCA is a vintage feature extraction and data representation technique openly used in pattern recognition [3].

2. Related Work

In 2014, Tara prasad Singh [4] show erect an entire face discrimination framework employing master component analysis holistic path describe linear dropping to the ethnic image space to

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complete dimensionality shorthand. In 2015, Murali M [5] show principal component Analysis is applied for face discrimination mechanism for feature consistency in big data group and to light their likeness and variation is further main move in face discrimination. In 2017, Harshada Ashok Kardile [6] they mainly present face discrimination framework based on principal component analysis and build system which is able to distinguish single face from larger database.

3. Gaussian Fuss

Gaussian fuss widely divided on indicative. That denote each pixel in the fuss image is total of the right pixel rate and a random Gaussian divided fuss rate. private matter is white Gaussian fuss. White fuss lay its denotation from white light. master source of Gaussian fuss in digital image appear pending conquest, like sensor fuss [7]. Fuss is the outcome of fault in the image, and yonder is three main origin of fuss, If the image is exact from a photograph made on film, film cereals is origin of fuss. Fuss can also be the outcome of loss to the film, or by the exact itself. If the image is gain over straight in a digital shape, the mechanism for gathering the data can produce fuss. Electronic transfer of image data can produce fuss [8].

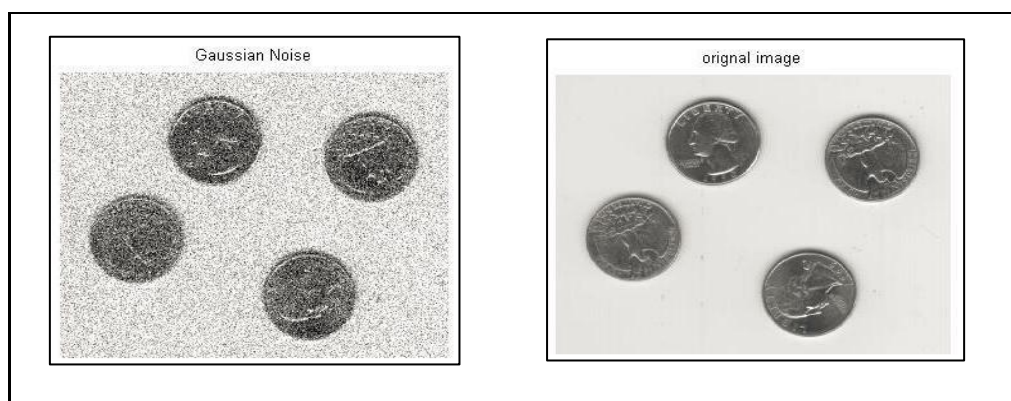


Figure (A)-Describe image with Gaussian noise [7]

4. Noise Removal

Noise elimination algorithm is operation of eliminating or minimizes the fuss from the image. The noise elimination algorithms reduce or clear the visibility of fuss by sleeking whole image leaving areas close dissimilarity limit [9]. Image reducing noise is pivotal image operation task as operation itself as well as a component in other operation. more ways to reduce fuss in an image or a set of data and ways occur. There are two kinds of models linear model and non-liner model [10].

5. Gaussian Blur Filter

Smoothing method has a setting parameter which is used to control the range of smoothing. The aim of smoothing is leaving out noise or other rapid phenomena. The Gaussian smoothing operator is applied to blur images and remove unwanted detail and noise. In image processing, a Gaussian sleeking is the outcome of haziness an image by a Gaussian function. that is openly applied impact in pictorial software, principally to minimize image fuss and minimize detail [11].



Figure (B)-show image with Gaussian blur filter [12]

6. Principle Component Analysis

Principle component analysis is a dimensionality lessening mechanism that is applied to pressure and discrimination issues, also known as Eigen space projection or karhunen – loeve transformation, the major aim is the dimensionality lessening, there for the eigenvector of the difference matrix must be found to distinguish the images [13]. Master component is away which apply developed underlying arithmetic masters to convert a figure that potential associated mutable till less figure from mutable named master component consider as serious outcome of used longitudinal algebraic. benefit that it can find types of datum while pressure datum via minimize figure from sizes minus damage the acquaintance. it may be known as specific object. Way for compute it [14].

move 1: get datum.

Suppose at the side of A_i , have T direction from volume P, perform group for images and D perform a pixel rates.

$$A_i = (D_i \dots DP), 1 \tag{1}$$

move 2: get the average.

Compute average for object direction and for group objects that average position quadrate posits average object of each object direction.

move 3: average is posited from the ethnic image.

$$X = Vp-A \tag{2}$$

X is the modern array found by posited average from object to ethnic datum.

move four: Compute difference array.

Suppose r with w is specific direction with specific rate to difference array H, difference array found via pound array X to the transfer array X. the difference is that X represent the new array resulted by subtract average of image obtained by $(VP=1/P (\sigma_{k=1} \text{ To } P, A_i))$ from original data, and transfer array X_t represent the switching the row and Colum of X array and producing another array known as X_t .

$$H = X * X_t \tag{3}$$

move five: specific direction with specific rate for difference array found while master countenance chosen.

eigenvectors are isolated in down ward with their conforming eigenvalues. eigenvector related with highest eigenvalue that is the one be inverted the highest difference in the image. Highest figure rate eigenvectors then chosen to produce an image space from the consequent difference matrix H.

7. Proposed Work

In proposed system we have implemented feature extraction based on enhancement Principal component analysis algorithm using Gaussian blur filter

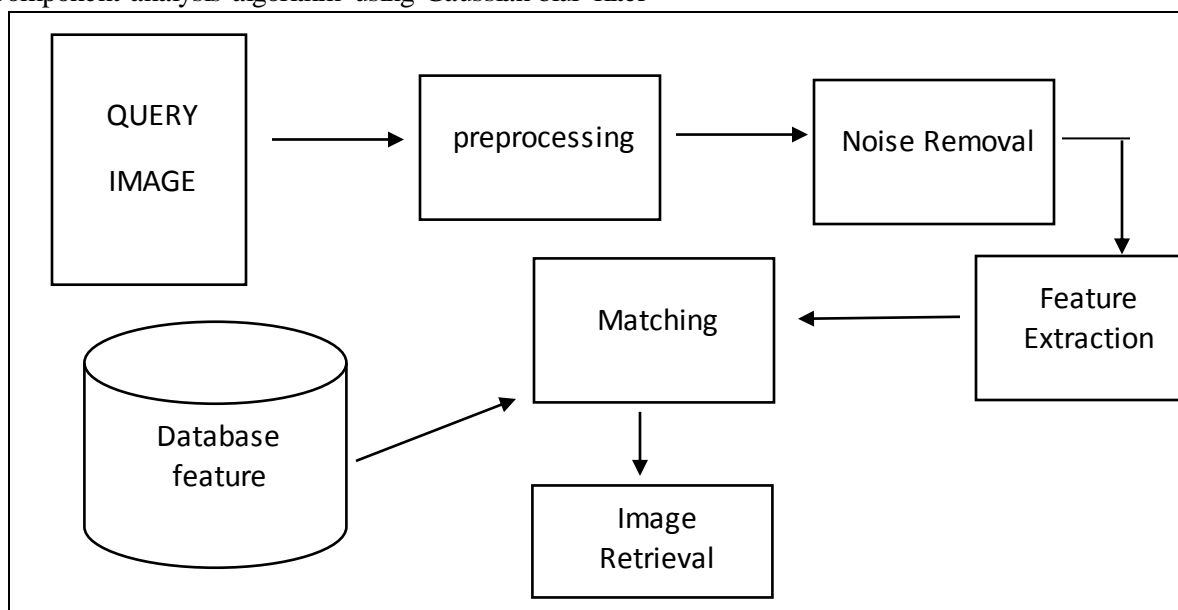


Figure 1- describe the improved PCA

The image database is used to test the improved PCA and the traditional PCA so we used a database of different type of queries and with different numbers in each one.

1. Query image

User can input any image with any size to the system, the input image is known as (Query image).

2. preprocessing operation

After inputting image now applying the preprocessing on image to find proper information that is used for further analysis. change the size of image window to uniform windows size that will help in image analysis and overcome the randomness of result this operation called size normalization

3. Remove Noise

Noise clarify un wanted information which damage image quality It known as the operation that effect the achieved image that is not piece of sense. Noise removal is Process of eliminating un wanted details and noise out of image, and help to add purity to image and get best result of system, image filters is applied to enhance the image goodness and reduction flexibility and adaptability for un wanted noise types and for that reason we apply Gaussian smoothing also known as Gaussian blur filter that blur image as result of Gaussian function that is typically applied to eliminate Gaussian noise from image if it exists and pure image.

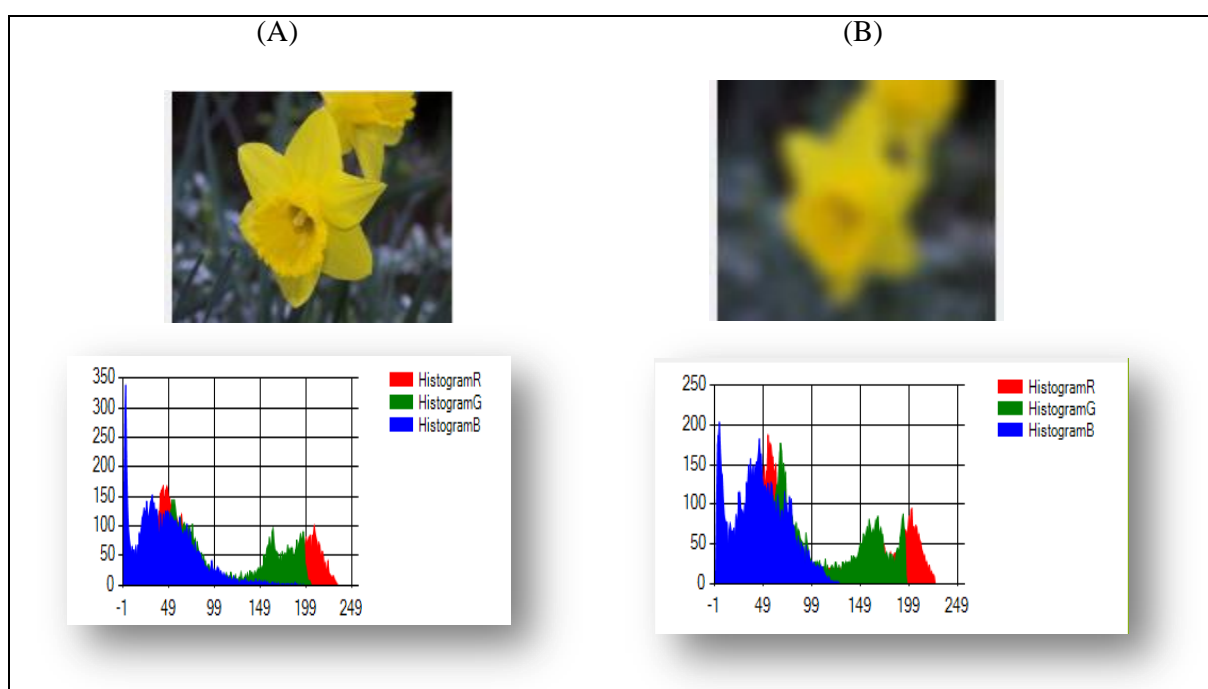


Figure 2-describe using Gaussian blur filter to improve PCA with histogram

In this Figure-2, (A) represent the image before filter and the illustration of histogram for it, and (B) represent the image after applying the Gaussian blur filter to remove noise and pure image with histogram illustration. The histogram of an image is graphical representation of color distribution in digital image consist of x-axis and y-axis. X-axis perform figure of colors that is in an image. The Y-axis perform the figure of pixel which show how many number of pixel in an image. To offer the best result we used the histogram because information derived from it is helpful in application like image compression and the manipulation is effective in image enhancement. And supply useful image statistics. The histogram corresponds to the estimated probability thickness function of the noisy data. The main idea here is to estimate a noiseless histogram from the image containing Gaussian noise. And by using histogram as illustration we notice the Gaussian clear image from the noise as seen in histogram.

4. Feature extraction

The most important step in image retrieval is evolve feature vector of images, feature extraction is the process of evolving feature images vector and for this purpose we used the principal component analysis (PCA) algorithm which is effective technique to evolve feature vector and decrease the dimension of dataset.

5. Matching

After feature extraction of image now perform matching using (Euclidian distance) between image features in database and input image in order to retrieve the similar images to the input image.

Algorithm: improved PCA
Input : M // Image
Output : Image retrieval
Process { Step1: chose M from database Step2: M set as size normalization Step3: Apply Gaussian blur filter on M to remove noise 3.1: G set as Gaussian mask 3.2: convolve M with G to obtain M1 3.3: produce (M1) as filtered image Step4: compute PCA Feature Vector for (M1) Step5: Match Feature vector by Euclidean distance Step6: end}

8. Experimental Results

In the system images are read as matrix by applying the preprocessing on the images and then apply Gaussian blur filter to remove noise and then passed these filtered images to the PCA premier move is to find the difference matrix then find eigenvalue and eigenvector, the algorithm is developed in c sharp. To obtain the evaluation metrics for the proposed system we used different queries of image (Cats with 30 image, Airplanes with 50 image, Flowers with 60 image) we used the recall and precision. the result for comparison is shown in Table-1.

Table 1-represents comparison of recall and precision for PCA system with the improved PCA.

Query image	Traditional PCA		The improved PCA	
	recall	precision	recall	precision
cats	96%	100%	100%	100%
airplane	92%	96%	98%	100%
Flowers	93%	96%	96%	100%
Total	93%	97%	98%	100%

From this Table-1 the improved PCA produced better result for recall and precision than the traditional PCA. In these next Figures-(3,4,5) show the difference between the traditional PCA and improved PCA for image retrieval (recall and precision), in which X-Axis represent the number of (features), Y-axis represent the average of recall and precision.

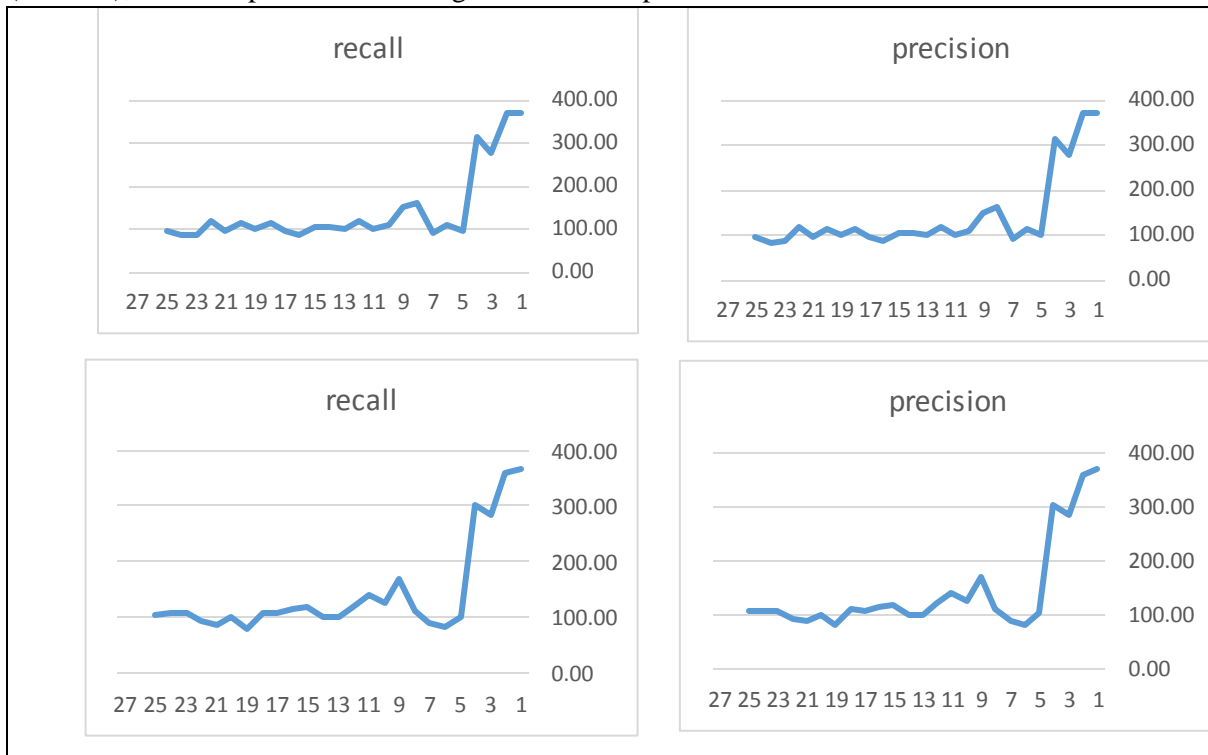


Figure 3-the recall and precision of cat images for traditional and improved PCA

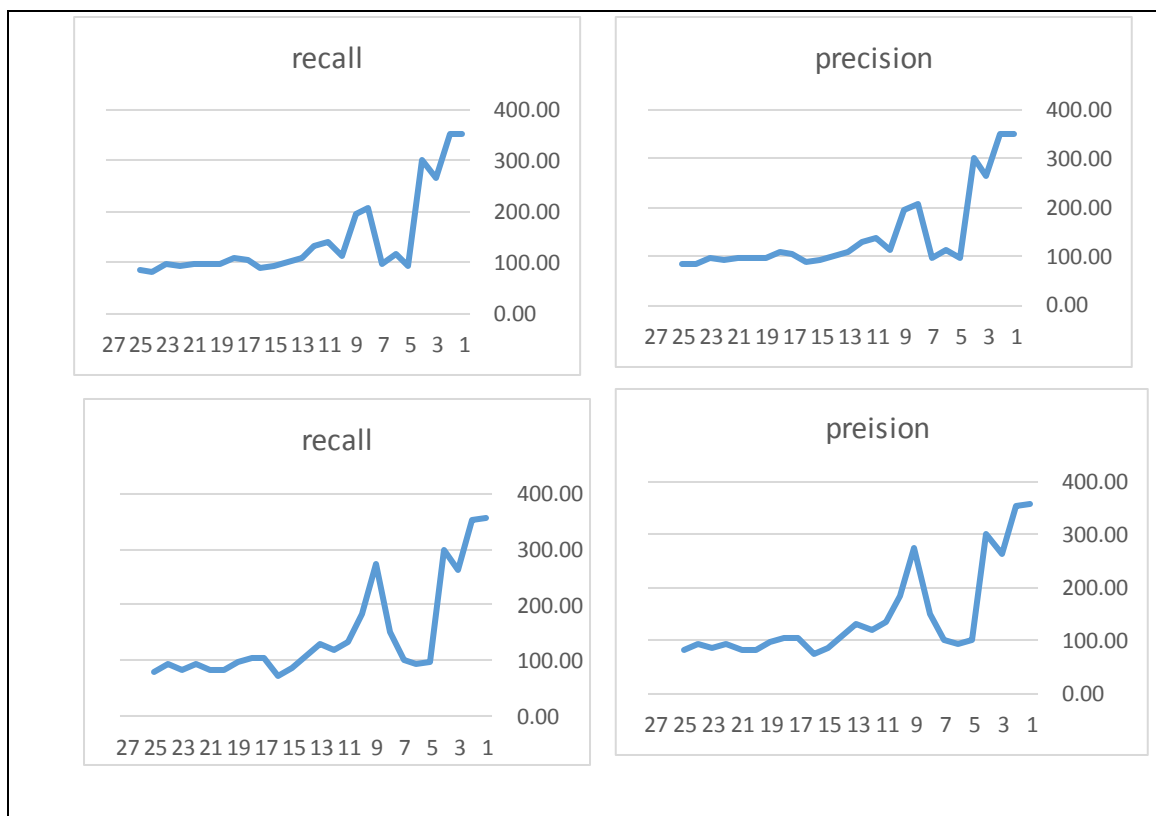


Figure 4-show the recall and precision of airplane images for traditional and improved PCA

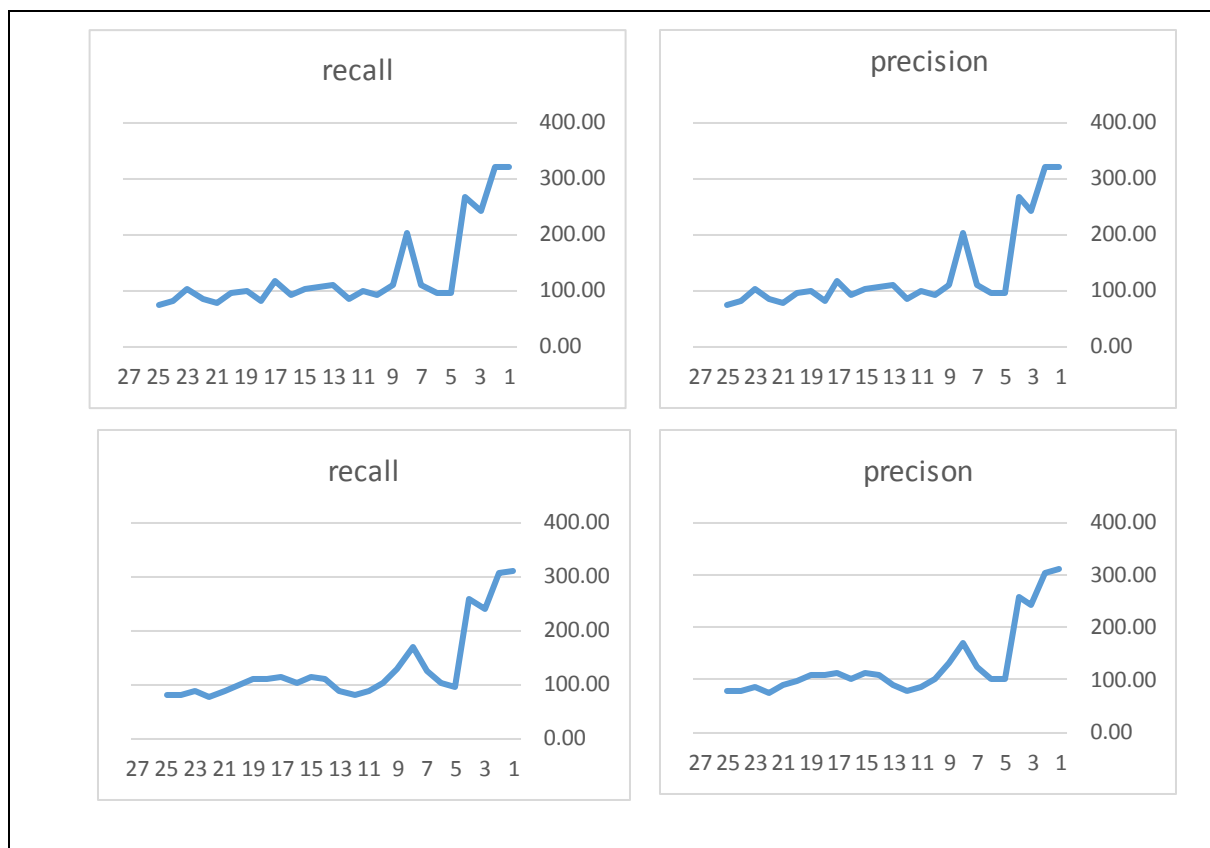


Figure 5-show the recall and precision of flower images for traditional and improved PCA These are some retrieval examples for improved PCA retrieval for query image:

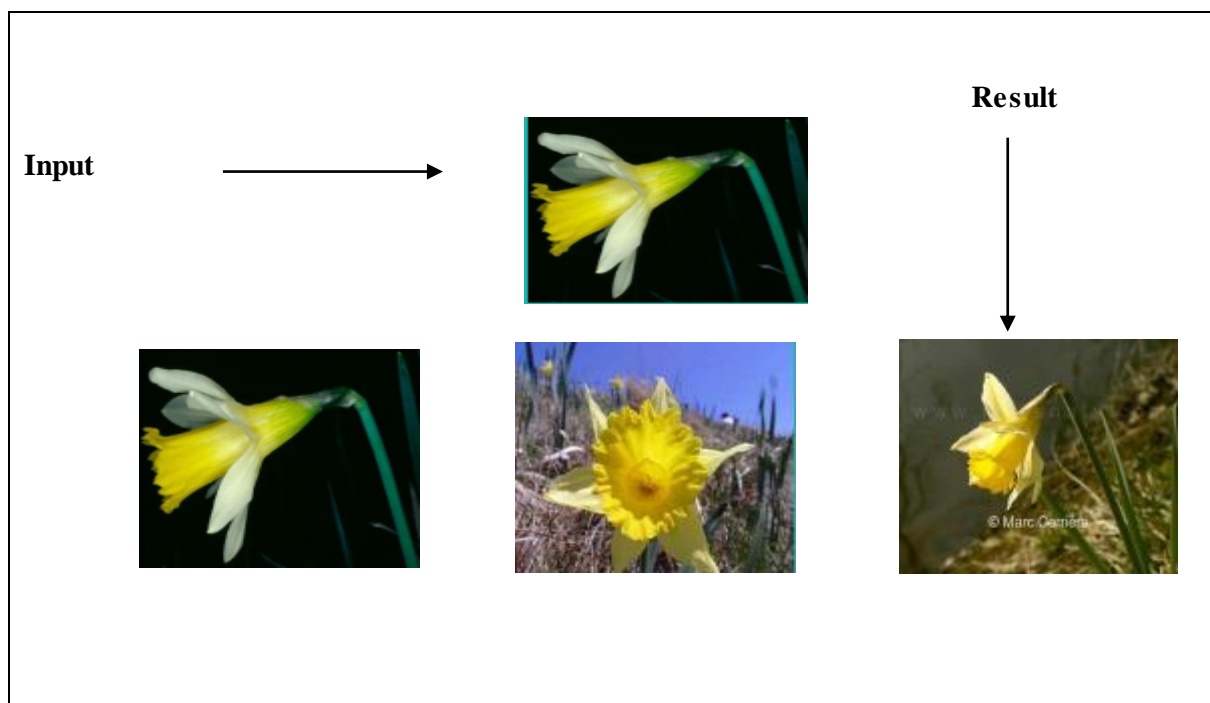


Figure 6-Image retrieval for the Flower query from database

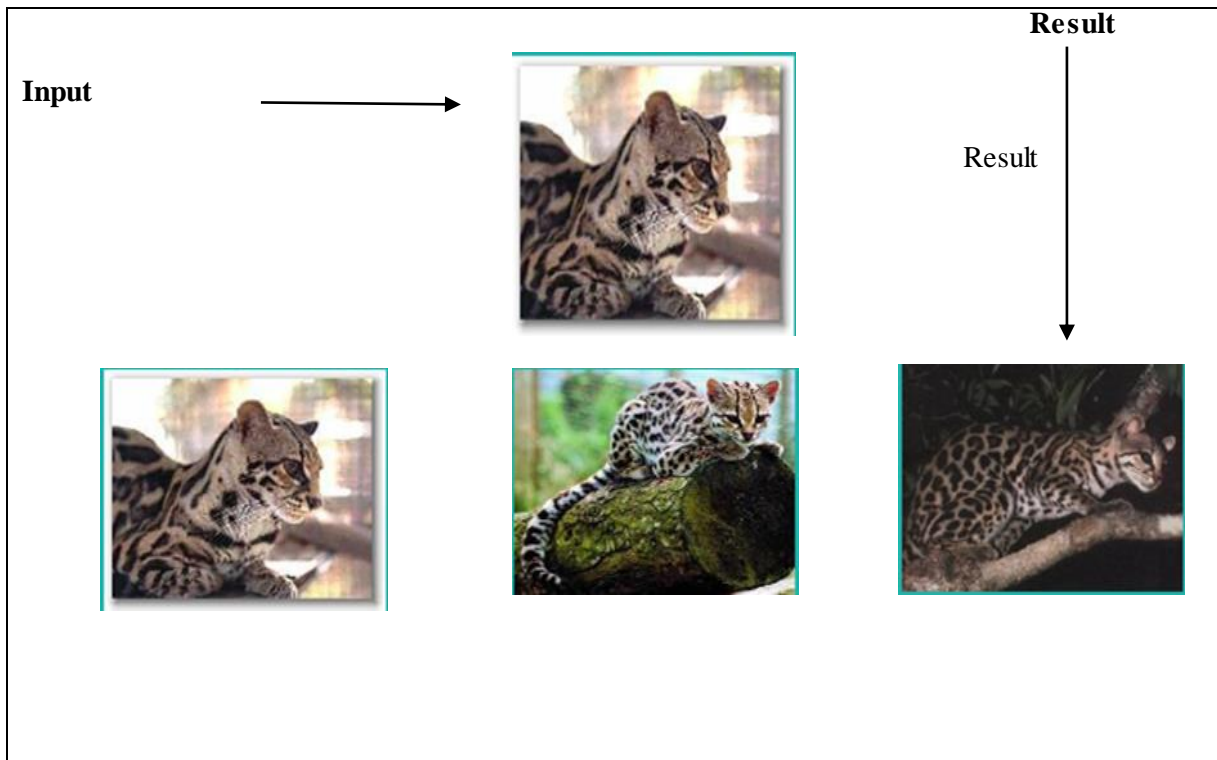


Figure 7-Image retrieval for the cat query from database

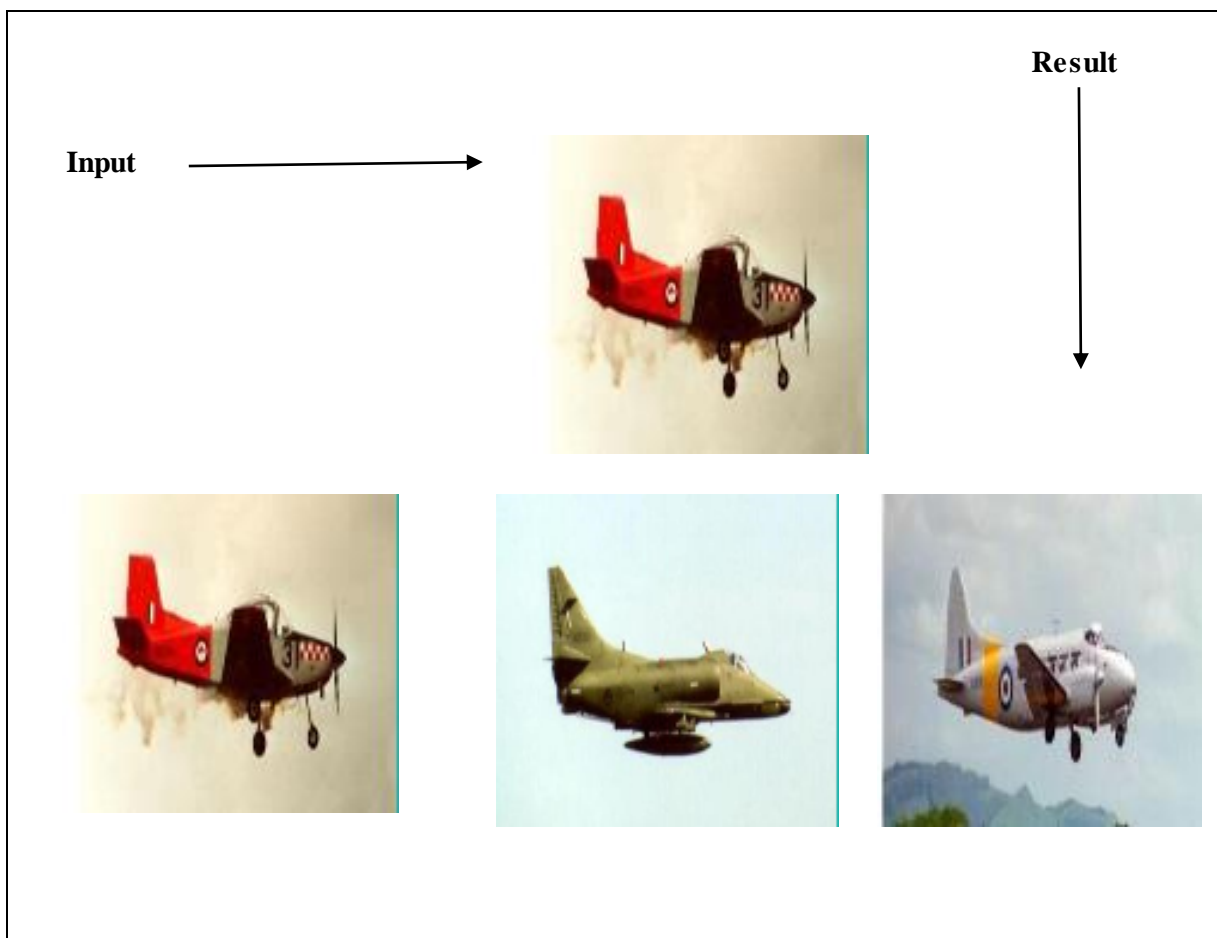


Figure 8-Image retrieval for the airplane query from database

These Figures-(6, 7, 8) represent the image retrieval examples for each query image and it matches image and relevant from database.

9. Conclusion

In this paper we have successfully presents the enhancement of Principal component analysis algorithm for feature extraction by eliminating the noise using Gaussian blur filter. The proposed work provides best recall and precision for images than the traditional PCA system. As shown in experimental results. PCA used for evolve feature vector and reduce the dimensionality of data. Gaussian blur filter used to remove (eliminate) noise from images as shown in Figure-2 for the proposed system.

10. Reference

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