COMPARISON OF CBIR TECHNIQUES: SVM, NEURAL NETWORK AND FUZZY LOGIC.

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Abstract : Content Based Image Retrieval[CBIR] is also known as Query based image retrieval . CBIR is the use to recovering the image for finding a particular image from database of image. The paper discusses about the different technique's working of CBIR SVM, neural networks and fuzzy logic. These techniques are extensively used for retrieval of images which have similar texture, shape and color features to the input image. The paper also discuss on comparing these techniques.

***IndexTerms* – CBIR, SVM [Support Vector Machine], Fuzzy Logic, Neural Network.**

I. INTRODUCTION

1.1 Introduction of CBIR

The Text Based Image Retrieval (TBIR) is the strategy from which we can discover a image from content. Content based image Retrieval [CBIR] is the usage of PC vision used to recouping the picture for looking through a particular picture from considerable database of images. CBIR is any development's standard masterminds propelled picture archives by their visual substance. From the importance of CBIR, anything running from a picture similarity ability to an effective picture clarification engine falls under the space of CBIR The most generally perceived kind of CBIR is a image look for in perspective of visual. The extending measure of deliberately conveyed image requires new systems to narrative and access this data. Consistent databases consider printed looks on Meta data figuratively speaking.[7] CBIR is a framework which uses visual substance, consistently called as features, to look for image from significant scale picture databases as showed by customers' requesting as a request picture. Adjacent to the normal highlights like shading and surface, another section extraction tally called edge histogram is introduced. Edges pass on central information to a photograph and therefore can be associated with picture recuperation.[1]

Present day innovation has prompt a quickened development of advanced media accumulations, frequently containing both still image and recordings. Capacity gadgets are loaded with terabytes of computerized images, making it progressively harder to recover image of enthusiasm from such accumulations. Plainly scan capacities are required for finding what we are searching for in such huge accumulations, however how might we make such hunts valuable? Manual explanation of images with catchphrases depicting the picture substance can make it simpler to discover images of intrigue, however this takes a ton of time, making this approach exorbitant. It is additionally as it were supportive to a specific degree, since we don't generally know ahead of time what sort of pursuits that will be made later on.[9] Moreover, extraordinary people are probably going to comment on the same picture utilizing distinctive catchphrases, making it hard to make an appropriate scientific classification and explain image with the "right" watchwords. For the majority of the above reasons, the utilization of content-based image retrieval (CBIR) has been proposed. CBIR is as per Datta el al. (2008) any innovation that on a fundamental level arranges advanced image files by their visual substance.[6]

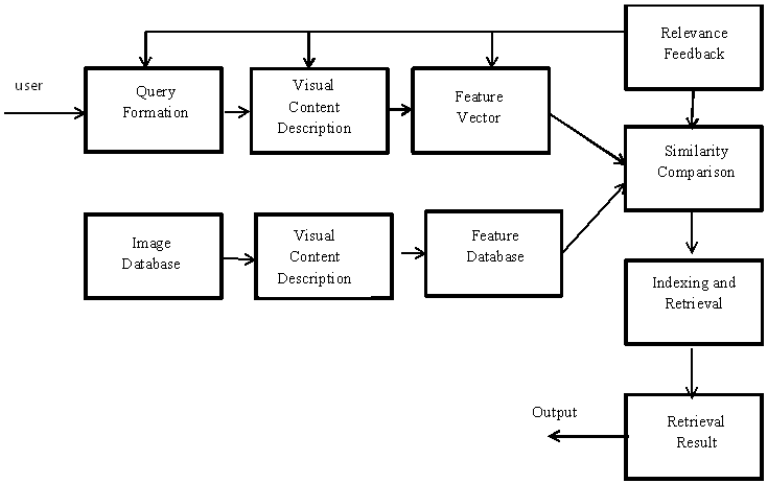
To look in picture accumulations in light of visual substance is possibly a capable procedure. Envision a framework in which the client can inquiry the framework to recover all still images and video outlines containing some kind of IED, whereupon the framework reacts by showing precisely those images.[9] In like manner, envision a similar framework, yet where the client rather inquiry the framework by giving an example picture of a vessel taken by a high-determination camera, whereupon the framework gives all images in the database in which the vessel is available, together with data in regards to its already reported areas. It is our conviction that these sorts of methods can be of awesome enthusiasm to the Swedish Armed Forces.[7] A portion of the points of this undertaking are accordingly to get a diagram of what the best in class of CBIR is, the thing that sort of frameworks are accessible on the business showcase or as open source devices as of now today, what the fundamental current restrictions of CBIR are, and what sort of usefulness that can be normal in the close future (characterized as several years from the present).[9]

Working of CBIR.

- Select an image for input.
- Extract Visual features from the query image.
- Apply Similarity matching method to find the similar images
- Retrieve the images based on distances formulas.

1.2 Block Diagram of CBIR.

First we have to select one data for input of the system. Then the features are extracted from the query image. Similarity index will be matching by different techniques. And at the end based on indexing scheme will get the more similar images from database. There are features like texture, color, shape etc.



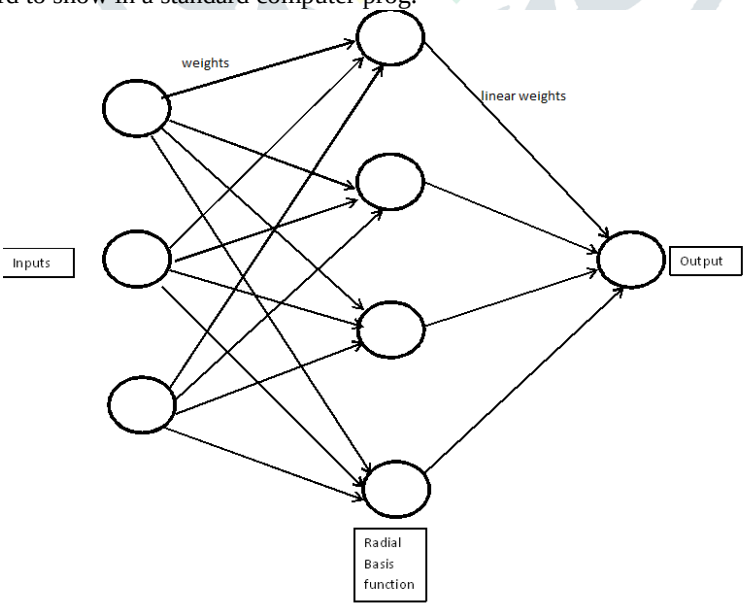
[Figure 1 block diagram of CBIR][1]

II. CBIR TECHNIQUES

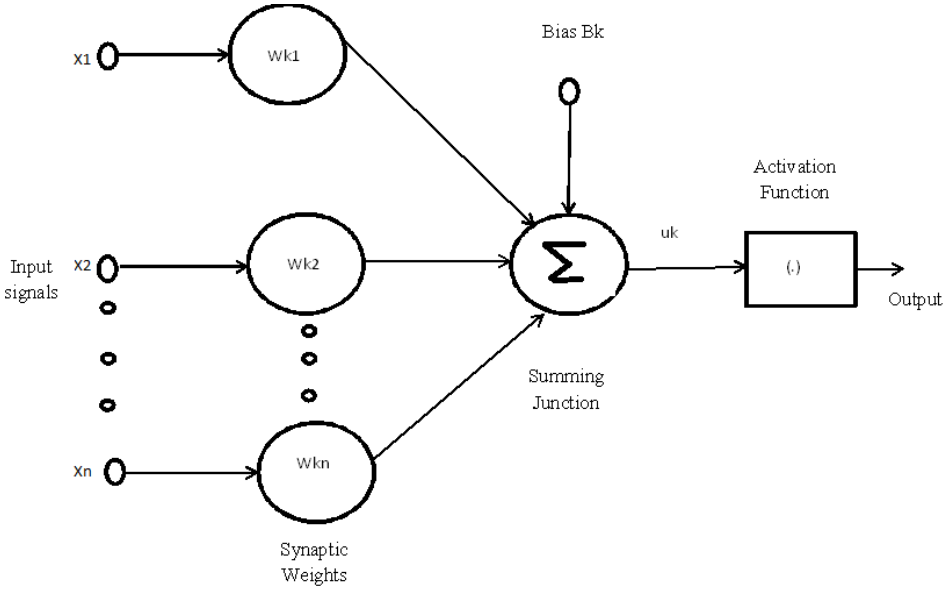
There are some techniques are existing in CBIR. Genetic algorithm, Support Vector Machine [SVM],Neural Network ,Fuzzy Logic, Neuro Fuzzy technique.

2.1 Neural Network

Neural networks are a computational approach which relies on a colossal amassing of neural units wholeheartedly showing the way a trademark cerebrum oversees issues with enormous get-togethers of predictable neurons related by axons. Neural Networks are self-learned and coordinated instead of unequivocally adjusted and beat needs in ranges where the course of action or feature prominent affirmation is hard to show in a standard computer prog. [5]



[Figure 2 Neural network]



[Figure 3 Neural Network][1]

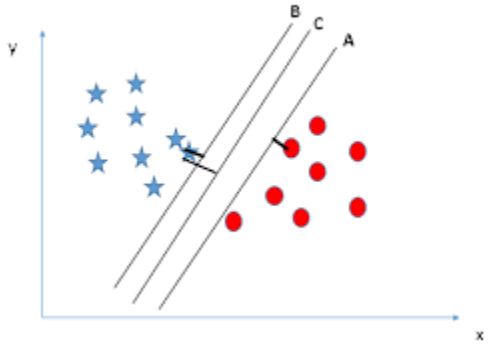
Neural network generally incorporate distinctive layers or a 3D square graph, and the flag path explores from front to back. Back spread is the place the forward inciting is used to reset weights on the "front" neural units and this is every now and then done in blend with organizing where the correct result is known . More present frameworks are sans besides gushing the degree that acknowledgment and hindrance with affiliations giving in a generously more turbulent and complex arrangement. Dynamic neural networks are the most interesting in that they enough can, in light of models, plot new affiliations and even new neural units while incapacitating others. [5]

Present day neural network grows reliably work with a couple of thousand to a couple of million neural units and an impressive number of affiliations, which is so far two or three requesting of size less unusual than the human cerebrum and nearer to the planning essentialness of a worm. New cerebrum get some information about consistently vivifies late cases in neural systems.

An enchanting piece of these structures is that they are odd in their thriving with self learning. In the wake of setting up some breeze up clearly astounding issue solvers and others don't execute as well. With a specific genuine goal to set them up two or three thousand cycles of connection regularly happen. [1]

Generally, the utilization of neural framework models implied a directional move in the late eighties from sporadic state (critical) simulated scholarly fitness, delineated by expert structures with information typified in if-then measures, to low-level machine learning, depicted by learning exemplified in the parameters of a dynamical system.[5]

2.2 SVM



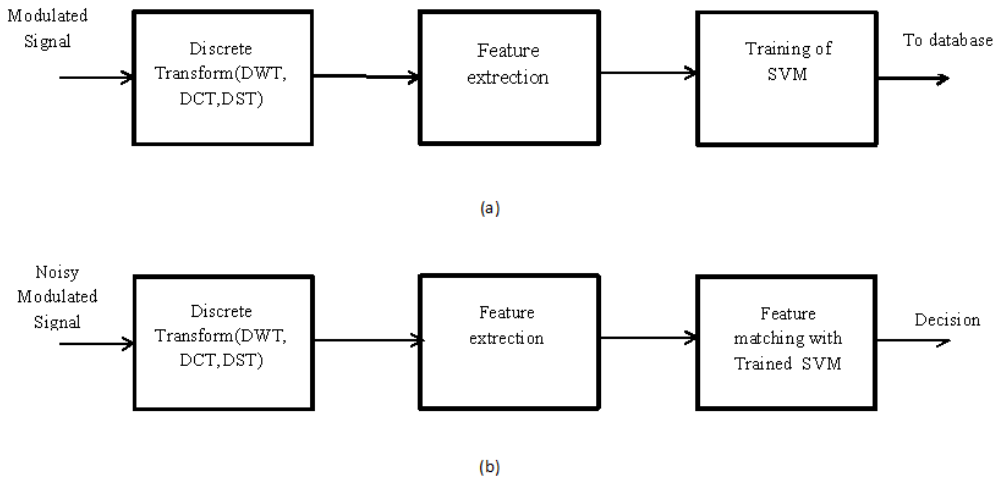
[Figure 4 SVM] [4]

Support Vector Machine(SVM) is a machine learning. For it's calculation, we plot in n-dimensional space everything as a point with the estimation of each element being the estimation of a specific facilitate. So, we perform to find the hyper-plane which

separate the two classes exceptionally well .Bolster Vectors are basically the co-ordinates of individual perception. SVM is an outskirts which best isolates the two classes.[2]

Distinguish the privilege hyper-plane: we have three hyper-planes. So, recognize the privilege hyper-plane to characterize star and circle. You have to recollect a thumb run to distinguish the privilege hyper-plane: "Select the hyper-plane which isolates the two classes better". For this situation, hyper-plane "B" has amazingly played out this activity. [3]

Recognize the privilege hyper-plane: we have three hyper-planes and all are isolating the classes well. How would we be able to recognize the privilege hyper-plane? augmenting the separations between closest information point and hyper-plane will help us to choose the privilege hyper-plane. This separation is called Margin. you can see that the edge for hyper-plane C is high when contrasted with both An and B. Henceforth, we name the privilege hyper-plane as C. Another lightning purpose behind



[Figure 5 block diagram of SVM]

choosing the hyper-plane with higher edge is heartiness. In the event that we select a hyper-plane having low edge at that point there is high possibility of miss-grouping.[4]

Recognize the privilege hyper-plane: Use the tenets as talked about in past area to distinguish the privilege hyper-plane Some of you may have chosen the hyper-plane B as it has higher edge contrasted with A. However, SVM chooses the hyper-plane which orders the classes precisely before boosting edge. Here, hyper-plane B has an order mistake and A has arranged all accurately. Consequently, the privilege hyper-plane is A. [3]

Would we be able to group two classes: I cannot isolate the two classes utilizing a straight line, as one of star lies in the domain of other class as an anomaly. As I have just specified, one star at opposite end resembles an exception for star class. SVM has an element to disregard anomalies and discover the hyper-plane that has most extreme edge. so we can say, SVM is vigorous to exceptions. [3]

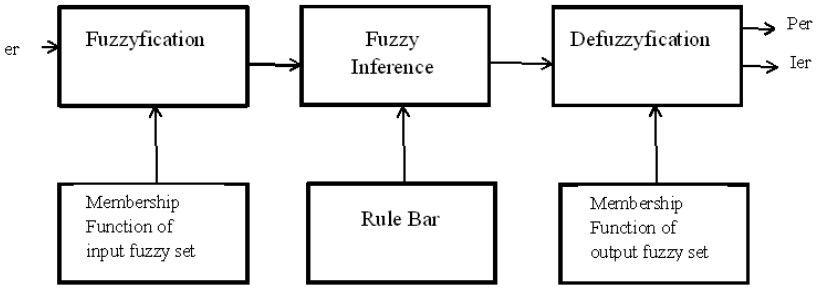
Discover the hyper-plane to isolate to classes: In the situation beneath, we don't have direct hyper-plane between the two classes, then how does SVM arrange this?

SVM take care of this issue. It takes care of this issue by presenting extra element. Here, we will include another component z=x^2+y^2. how about we plot the information focuses on hub x and z:

In SVM Difficult to have a direct hyper-plane which is between these two classes. Be that as it may, another consuming inquiry which emerges is, should we have to add this component physically to have a hyper-plane. No, SVM has a procedure called the portion trap. These are capacities which takes low dimensional information space and change it to a higher dimensional space i.e. it changes over not detachable issue to divisible issue, these capacities called portions. It's for the most part valuable in non-direct partition issue. Basically, it does some to a great degree complex information changes, at that point discover the procedure to isolate the information in light of the names or provide you've characterized.[4]

2.3 Fuzzy Logic

Feathery method of reasoning is a kind of different respected basis in which reality estimations of factors might be any real number in the locale of 0 and 1, thought to be "fleecy". By discrete, in Boolean method of reasoning, reality estimations of segments may essentially be the "fresh" characteristics 0 or 1. Cushioned reason has been utilized to deal with the likelihood of halfway truth, where reality respect may continue running between completely clear and totally false.. Additionally, whenassist constantly when etymological factors are utilized, these degrees might be overseen by particular limits. [8]



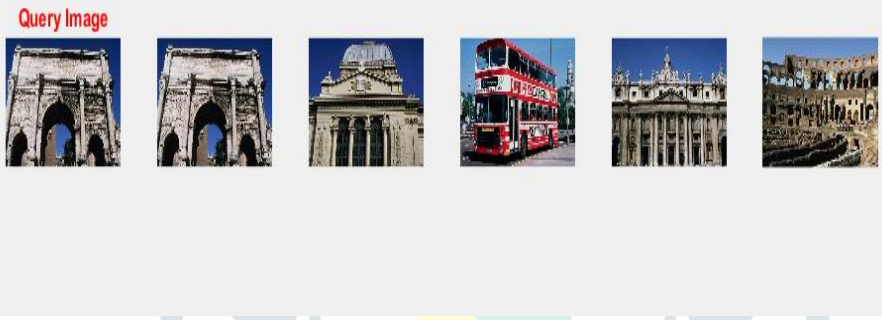
[Figure 6 Fuzzy Logic][8]

The word fluffy rationale was present in 1965 suggestion of fluffy set theory by Lotfi Zadeh.Fuzzy rationale had however been considered since the 1920s, as unbounded regarded rationale—conspicuously by Łukasiewicz and Tarski.[8]

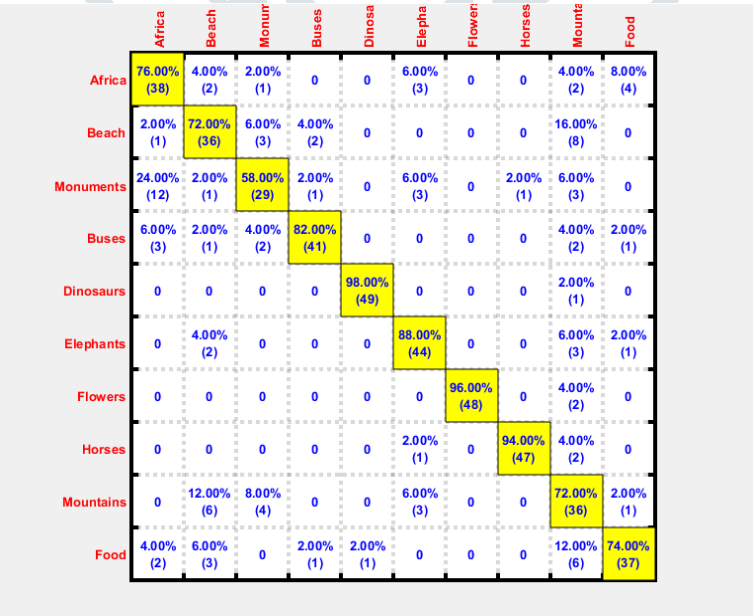
Fluffy rationale has been associated with numerous fields, from control theory to synthetic intellectual competence.[8]

III. RESULTS AND DISCUSSION

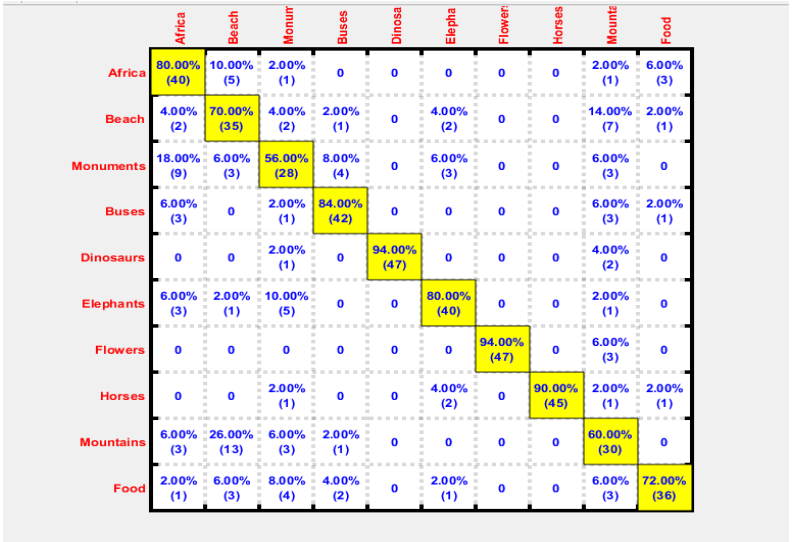
3.1 Results of Performance Parameters.



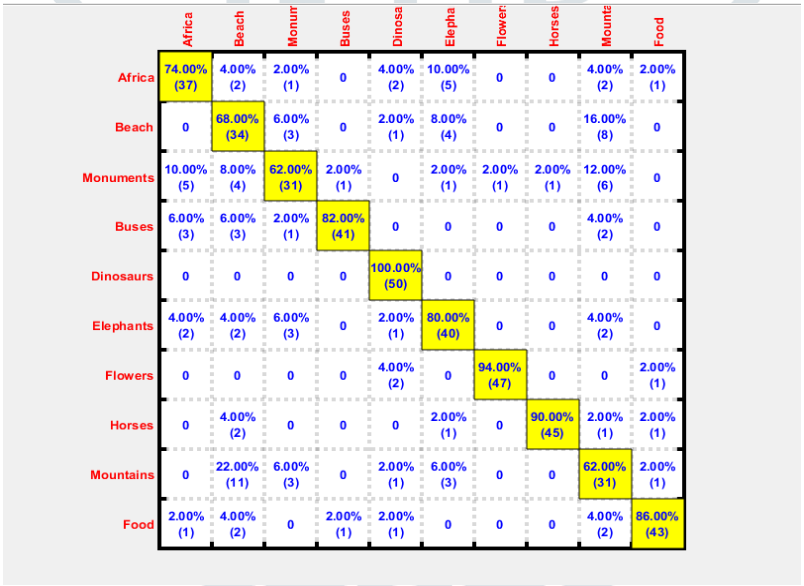
[Figure 7 result]



[Figure 8 confusion matrix of SVM]



[Figure 9 confusion matrix of Neural Network]



[Figure 10 confusion matrix of Fuzzy Logic]

3.2 Performance Parameters

There are following Performance Parameters

1) Precision – It measures the ability of the systems to retrieve that models which are relevant.[1]

Precision = TP/(TP+FP)

2) Recall – Recall means the ability of the system to retrieve all those models which are relevant.[1]

Recall = TP/(TP+TN)

3) Accuracy - retrieved image is only perfect image.[1]

Accuracy = TP+TN/(TP+TN+FP+FN)

TP=True positive [relevant i/p relevant o/p]

FP=False positive [not relevant i/p but retrieved in o/p]

TN=True negative [[not relevant i/p but retrieved in o/p]

FN=False negative [relevant image and not retrieved in o/p]

Table 3.1: Performance Parameters.

Performance Parameter	SVM	Neural Network	Fuzzy Logic
Learning Mechanism	Induction	Adjusting Weight	Induction
Learning Speed	High	Low	High
Fault Tolerance	High	Very High	Low
Flexibility	High	High	Low
Accuracy	0.922	0.920	0.911
Recall	0.06	0.06	0.07
Precision	0.61	0.60	0.73

Here
Learning Mechanism of SVM is induction, Neural Network is Adjusting Weight, Fuzzy Logic is Induction. Learning Speed is high for SVM and Fuzzy Logic and low for Neural Network. Fault tolerance is high for SVM, very high for neural network and low for fuzzy logic. Flexibility is high for both SVM and Neural Network and low for fuzzy logic.
Precision, recall and accuracy of the SVM, Neural Network and Fuzzy Logic
There is Performance Parameter we can get from equation listed below.
Here for SVM,
TP = 58, FP = 36, TN = 864, FN = 42
Precision = 58/58+36 = 0.61
Recall = 58/58+864 = 0.06
Accuracy = 58+864/58+864+42+36 = 0.922

For Neural Network,
TP = 56, FP = 36, TN = 866, FN = 44
Precision = 56/56+36 = 0.60
Recall = 56/56+866 = 0.06
Accuracy = 56+866/56+866+36+44 = 0.920

For Fuzzy Logic,
TP = 62, FP = 22, TN = 778, FN = 38
Precision = 62/62+22 = 0.73
Recall = 62/62+778 = 0.07
Accuracy = 62+778/62+778+22+38 = 0.92
These are the results which obtained in this paper.
So according to all performance parameters SVM technique is good from these three techniques.

CONCLUSION

CBIR is popular for searching , browsing and retrieving images according to it's visual features. There are so many techniques to retrieve the images. According to results and performance parameters there is SVM[Support Vector Machine] is the good technique to retrieve the image.

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