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Feature Extraction Based Hybrid Classifier for Classifying Remote Sensing Images

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Abstract: ***Classification Techniques are encompassed on enormous databases to abridge models depicting different data classes. Advantageously, such kind of analysis can render a deep-seated perceptivity for appropriate understanding of different large-scale databases. Studies related to acquaintance and developments of knowledge are also very proficient and are one of the first and foremost utility in the remote sensing field with satellite imagery datasets. The decision making process in any remote sensing research is predominantly bet on the effectiveness of the classification process. In order to identify six land type classes, efficient classification techniques were developed and embraced to a landsat satellite database inculcated with Irvine machine learning repository at university of California. The ultimate intention of this paper is to guesstimate and take account of the proficient performance of proposed algorithm (Hybrid GASVM) in the analysis of the classified lands from this large set of satellite imaginary and also compared proposed algorithm with traditional classifier algorithm like Multilayer perception back propagation neural network, support vector machine and K-Nearest neighbor. In accordance to measure the classification accuracy, Average producer accuracy, Average user accuracy, kappa statistic, various performance measures were applied.***

Index Terms: ***Image classification, Machine learning algorithm, confusion matrix, unsupervised learning***

I. INTRODUCTION

Classification is significant data mining technique that encompasses extracting captivating patterns elucidating knowledge from real world databases. Various methodologies has been developed both industrial and research organizations for the software applications related to classification. There are various data classification techniques embraced to analyze large databases and constitute provisional classification and patterns in the databases for industrial, research and commercial purposes. Remote sensing is a field of research and study has encompassed an apportionment of research works more than two decades [2]. This field has enriched its own proficient automated techniques for data analysis, including artificial neural network, genetic programming, statistical machine learning, decision trees and other analysis methods. The sensed imagery is rendering an useful plot for applications including land monitoring, estimation of environmental damage, urban planning, radiation monitoring, growth regulation, soil evaluation and classification finally crop production assessment[3]. Classification technique is obviously an indispensible part of these applications. Remote sensing applications manipulate different classification techniques for soil survey analysis. It is conventional to acquire a practical knowledge of soil globally by means of soil surveys or soil mapping. This process includes the allotment of determining the soil types over a particular geographic region and, elucidating them for the workers and researchers to handle their work. The cardinal data for soil survey analysis is constructed by remote sensing accompanied by field sampling. Different machine learning techniques on natural datasets to anticipate the class labels of different soil types.[3] A described and detail study is also portend on classification and characteristics of the satellite imagery database and therefore created models for predicting the land cover classes across a sample geographic area. The remainder of this paper is prearranged in this manner: Sector 2 provides the outline of the existing work of remote sensing image classification. Section 3 presents the methodology of proposed system and in section 4 contains results and discussion of image classification. Finally, section 5 concludes the paper.

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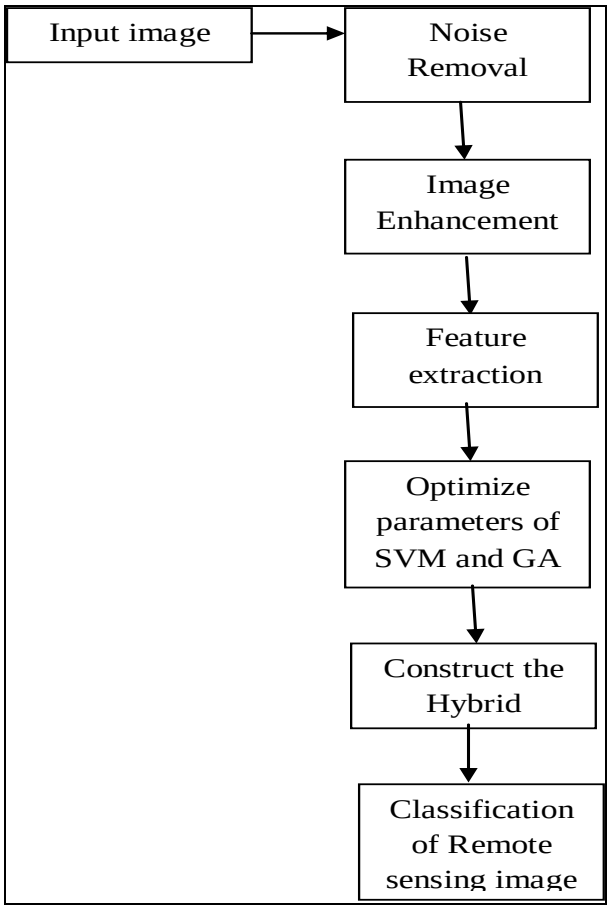
II. REVIEW OF LITERATURE

According to S.Padmapriya et al proposed a novel method for classification of medical images using hybrid classifier based on K-Ratio super item set finding K-Nearest Neighborhood classifier were implemented and pertaining 95% class accuracy [1]. Soumadip et al implemented SVM and K –nearest neighbor algorithm with MLP BNN approach with six land cover classes and finally concluded that MLP BNN Algorithm is suitable for classification of remote sensing images next was K-NN followed by Support vector machine [3]. Lu and Weng studied and classified image based on large scale database based on feature extraction [10].

III. METHODOLOGY

Due to high number of spectral channel classification of remote sensing image is challenging work.

The concepts employed in the topical system for virtuous image classification are exhaustive in this section are proposed algorithms, pre processing techniques and Study area are described and architecture of the proposed work shows in figure1.



A. Pre processing

Pre processing is one of the fundamental and commencing stages of image processing. The primary goal of this module includes removing the noise from the original figure. This method is encompassed in order to figure out the noises and to size up the clean closured figure 'f'. This process will visibly derive the outcome of minimal mean square error.

$$e^2 = e1\{(f - \overset{\Delta}{f})^2\} \quad (1)$$

Where e1 {} is the predictable value of the case.

B. Image Enhancement

This module of image processing is inculcated to enhance the aspect and peculiarity of the images. The germinal phase of this module is pre processing. The trait of this process is to convert the normal closure of the image to gray scale using histogram equalization.

C. Hybrid Classifier

This method is embraced with a hybrid model that exclusively encompasses GA and SVM, to segregate the samples preferably for selecting minimum number of variables that are highly significant. A Mean Squared Error (MSE) is facilitated by win SVM to measure the distance between the samples incorrectly emerged and classified on the ideal hyper plane. Here forth the derived MSE value is deterministic; hence it is considered as one of the conditions that are accordingly acquired while matching up various executions. When making dichotomous classification of data, SVM plays a vital role, the significant role is discriminate between two classes. Further, this notion is generally classified to discriminate a collection of n groups, to which few datum acquires its position. In this proposed method, in order to improve the consecutive method: evaluating that in the overall data set n categories (C_1, C_2….C_n) are promptly defined for each and every probable C_i category located in the input set, as an SVM is produced, later on it is attempted to evaluate and classify whether a datum have its place to the provided category or the residual set. Finally, for identifying the unique type of data to be in the proper place, each and every defined SVM and the chosen output are possibly built which could render the specification of a higher amount of datum belonging to specific class. On the other hand in order to emerge the above stated hybrid model, the usual operation of GA which is done conventionally that possibly modifies to produce a prominent outcome of individuals of changing length. Finally, an initialization function is built in a report manner. The algorithm is described below.

Algorithm: Hybrid GASVM ()

Input: Set of Remote sensing Images
Output: Classified Remote Sensing images
Procedure:
Initialize t=0;
{
Initialize population p1(0);
Evaluate p1(0);
do
{
$t_0=t_0+1$;
Select p1(t_0) from p1(t_0-1);
Perform crossover on p1 (t_0);
Mutate p1(t_0);
Estimate p1(t_0); //Learn the resultant population from the crossover using SVM and calculate accuracy
}
Until (termination criteria);
Return feature set F and hyper-parameter C;
}

As soon as the GA population is formed, it is evaluated by means of a fitness function. Here SVM is used as a fitness function for the genetic algorithm. Therefore, for every individual, and based upon the individual positions, a training and validation set is produced from the groundwork data. These sets are applied to the SVM by which, prediction is made, would fabricate a Mean Squared Error (MSE) to be utilized as a assess for identifying the fittest individual.

IV. AND DISCUSSION

The target of this tract is to deliberate and interpret the outcome of the following fragments that includes Multilayer perception of back propagation neural network, Support Vector Machine and K-Nearest Neighbor is compared with Hybrid Genetic Algorithm with SVM (Hybrid GASVM).

In order to prove the optimization of the proposed system, LANDSAT-7 ETM+ Dataset images are contemplated to assess its attainment. This multi spectral image contains vegetation and exposed land. This dataset consist of following classes such as paddy field, forest, grass land, dry salt flat and dry land.

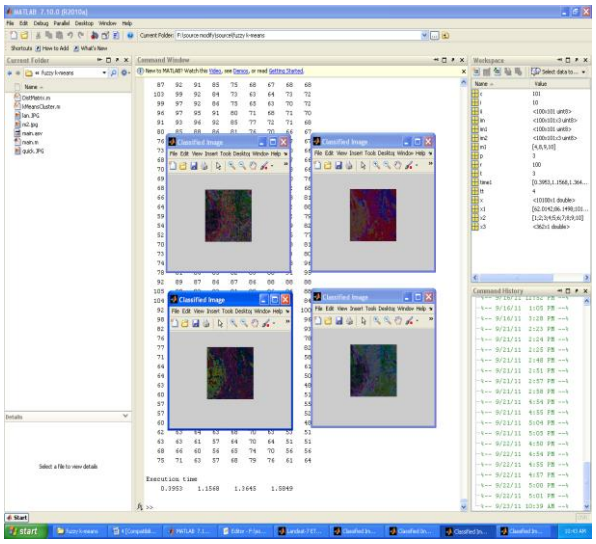


Fig 2: Classification results of SVM

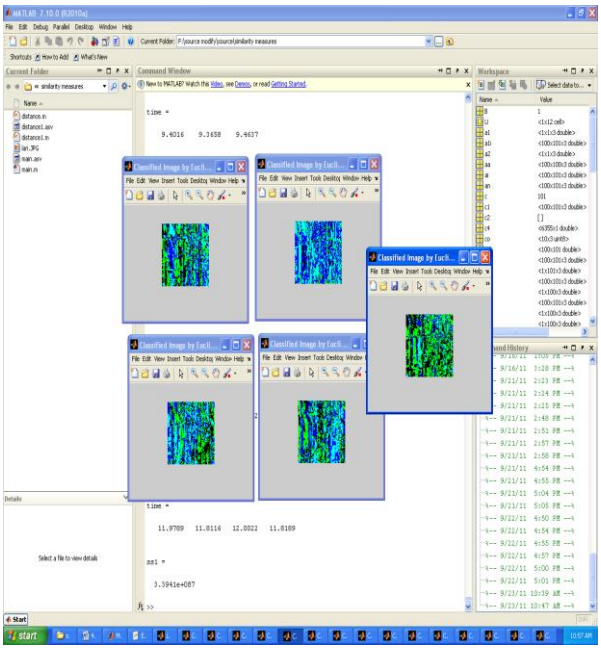


Fig 3: Classification results of K-NN

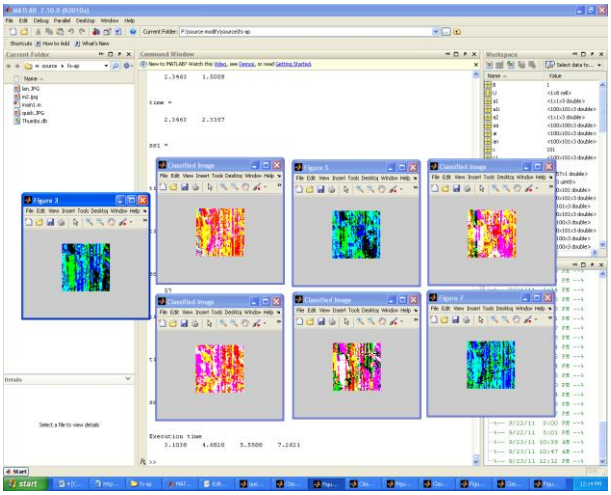


Fig 3: Classification results of MP-BPNN

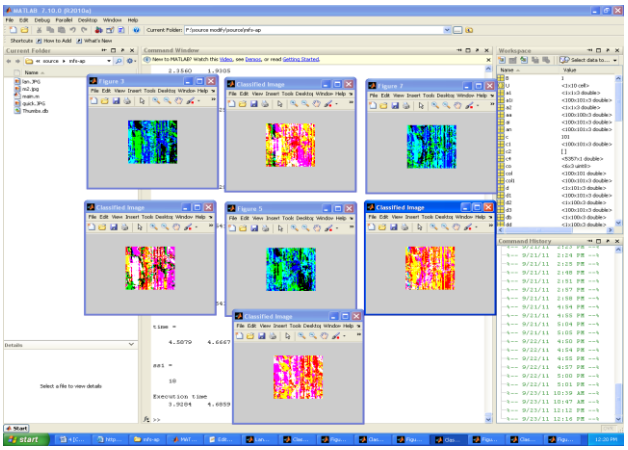


Fig 4: Classification results of Hybrid GASVM

Parameter/ Methods	SVM	K-NN	MP-BPNN	GASVM
Execution numbers	1	1	1	1
Execution time	68	62	57	53
Overall accuracy	85.22	86.63	93.13	96.57
Kappavalue	0.686	0.692	0.785	0.811
APA	74.1	75.2	82.37	85.63
AUA	74.1	76.63	83.13	85.51
ASMAI	0.588	0.612	0.702	0.735

Table 1: Performance Analysis of Proposed System

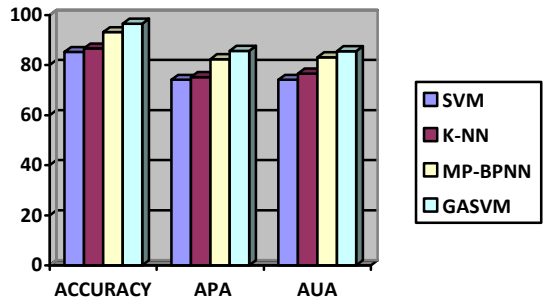


Fig 5: Classification results of Performance measures

The speculator outcome from the table 5 depicts that the proposed Hybrid GASVM represents a high accuracy and preferable classification results than SVM, K-NN, and MP-BPNN. The methods that are furnished above comparatively incorporated wrongly categorized outcomes. In order to illustrate more desirable comparison based on the classification accuracy a stratified random sampling is done using 670 reference pixels. Ultimately a prominent performance measures are shown in the table 5 that exclusively evaluates the following parameters: Accuracy, Kappa value, Average Producers Accuracy, Average Users Accuracy. These assessment factors are extensively used in the substantial verification of the land use and land cover classification.

V. CONCLUSION

In the prospective research work, a Novel Genetic Algorithm with Support Vector Machine has contemporarily incorporated. The indispensible concepts of hybrid classifier employ the optimization of Genetic Algorithm and SVM parameters. The prominent outcome is based on LANDSAT -7 ETM+ dataset images depicts that the proposed approach makes an appropriate and desirable exposition of evaluation parameters than the SVM, K-NN, MP-BPNN Classifiers. The proposed approach attains 96.57% accuracy.

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