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Accuracy Assessment&Analysis of Land Use & Land Cover Classification (LU/LC) Using Machine Learning Algorithm SVM

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Abstract—*Nanded have rapid development in every aspect. By using satellite images and application of remote sensing and GIS for land use and land cover change detection were used. For the analysis, ETM+, LISS3 and Landsat 8 images acquired from official websites Bhuvan and USGS. The main challenge in land use and land cover changes using the remote sensing data which how to provide the accurate and geospatial information.Traditionally pixel based classification was used by researchers but to get more accuracy we have implemented object based approach and machine learning algorithms for accuracy enhancement.*

IndexTerms—*SVM,RS, GIS, LU/LC,AccuracyAssessment*

I. INTRODUCTION

Remote Sensing research focusing on image classification has attracted the attention of many researchers and a number of researches have been conducted using different classification algorithms. It should be noted that valuable surface information extraction and analysis is also well performed using image classification. Image classification is the process of assigning pixels of continuous raster image to predefined land cover classes. Here we have collected Landsat 8 Image from USGS website and created different LU/LC classes such as agricultural, vegetation, water body, follow land, settlement, and barren land.

II. WHAT IS SVM

Support Vector Machine" (SVM) is a supervised machine learning algorithm which can be used for both classification and regression challenges. However, it is mostly used in classification problems.

III. OBJECT BASED CLASSIFICATION

To classify raster image first we create segmentation and then generate statistics of that image and apply machine learning algorithms which will improve accuracy of classification, here we used different kernel function which eventually improve performance as well as accuracy.

Kernel Functions

1) RBF
2) Sigmoid
3) Linear
4) Polynomial

IV. STUDY AREA AND DATA USED

The scanned images of the SOI toposheets no fifty six E/3, E/4, E/8 and E/11 on the size of 1:50000 have furthermore been used for the learning space; the images are downloaded from usgs website.

Image Sensor	Year	Source
a) Landsat 8	Year 2017	USGS

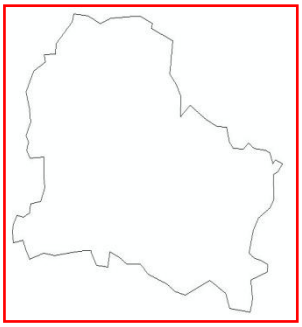
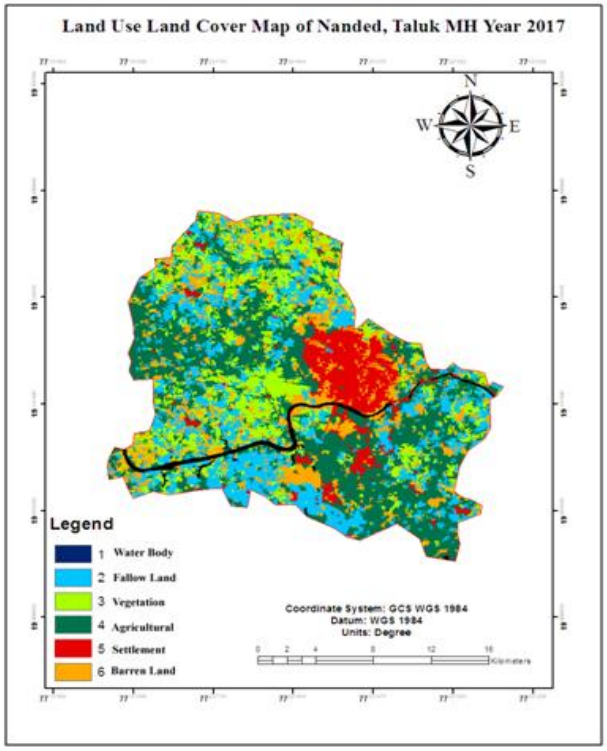


Fig.NandedTaluka Boundary

Maps Object Based Machine Learning SVM Algorithm Sigmoid as Kernel

LU/LC MAP RBF as Kernel



LU/LC MAP Sigmoid as Kernel

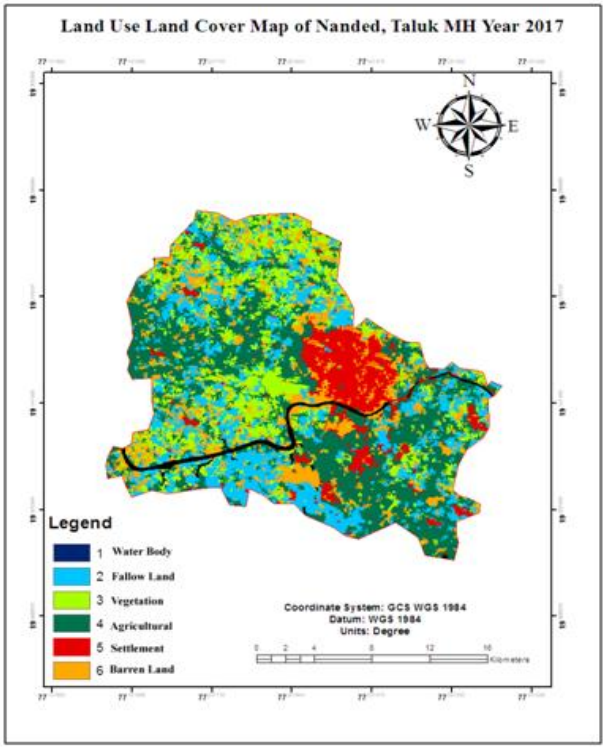
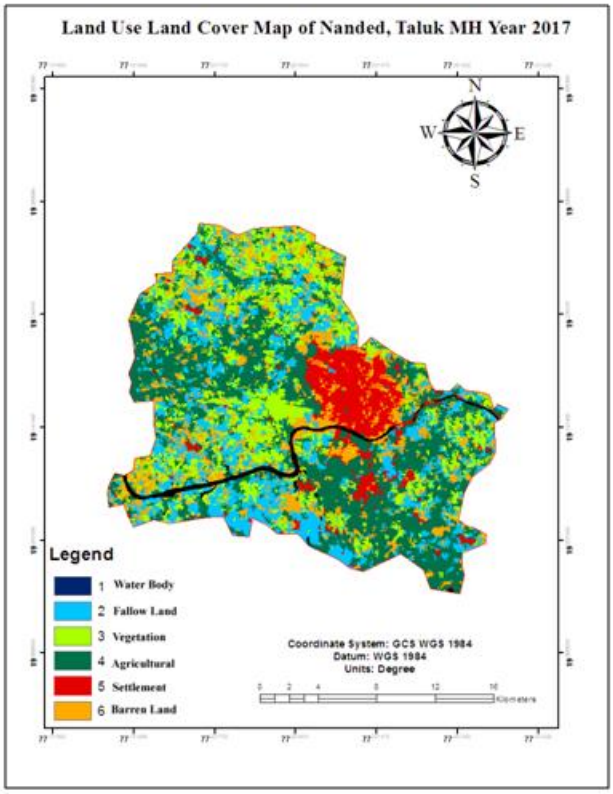


Table 1. Area Covered

LU/LC Class	Area (km^2) RBF	Area in % RBF	Area (km^2) Sigmoid	Area in % Sigmoid
Agricultural Land	92.12281104	25.08	88.52312	24.1
Water Body	8.448264171	2.3	7.456511	2.03
Vegetation	89.47813704	24.36	89.11082	24.26
Follow Land	77.50364087	21.1	75.04262	20.43
Settlement	84.62956804	23.04	93.44515	25.44
Barren Land	15.13341234	4.12	13.73761	3.74
Total	367.3158	100	367.3158	100

LU/LC MAP Linear as Kernel



LU/LC MAP Polynomial as Kernel

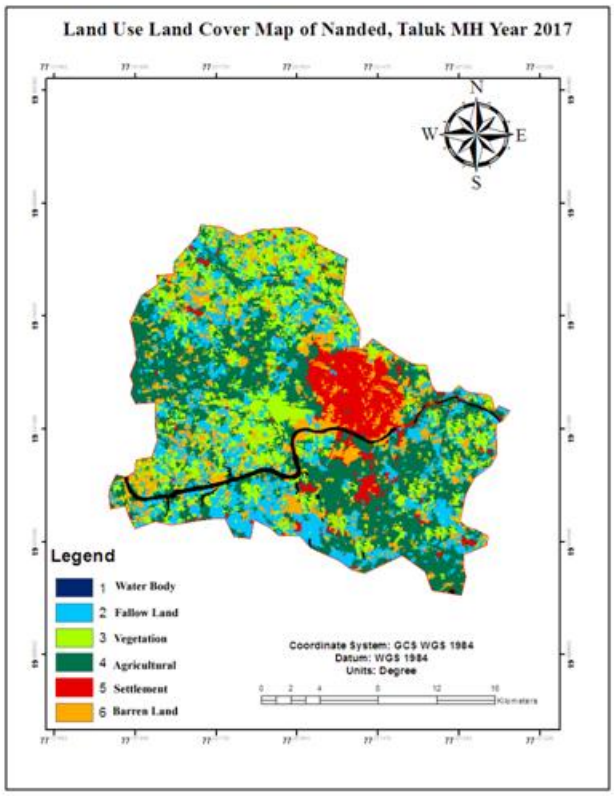
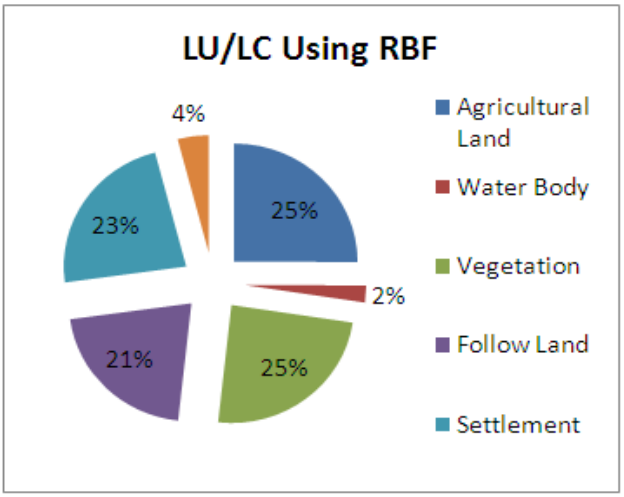
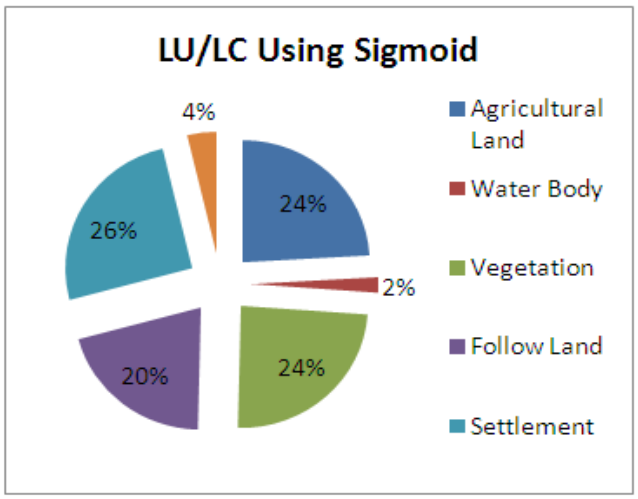
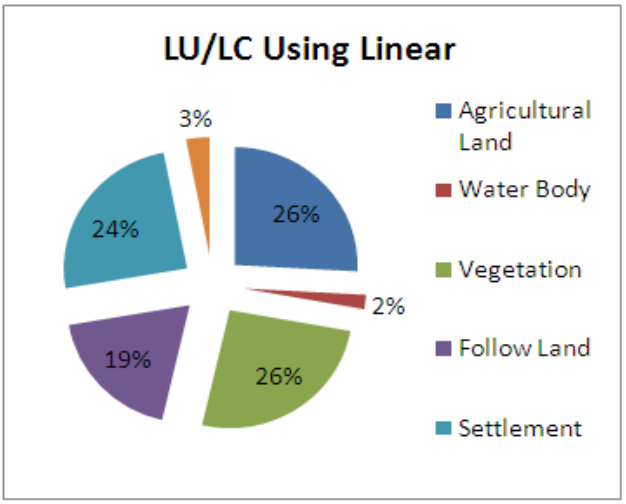


Table 2. Area Covered

LULC Class	Area (km^2) Linear	Area in % Linear	Area (km^2) Polynomial	Area in % Polynomial
Agricultural Land	94.98787	25.86	93.84919	25.55
Water Body	7.19939	1.96	7.089195	1.93
Vegetation	94.80422	25.81	91.49838	24.91
Follow Land	68.65133	18.69	76.54862	20.84
Settlement	90.32296	24.59	87.53136	23.83
Barren Land	11.35006	3.09	10.79909	2.94
Total	**367.3158**	**100**	**367.3158**	**100**







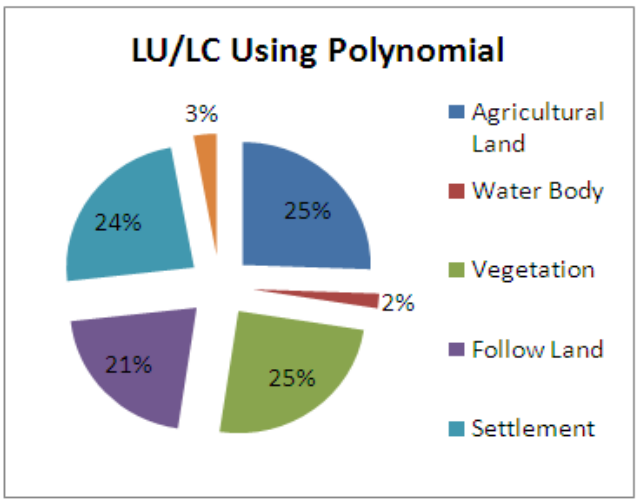


Table3 Accuracy Assessment for RBF

	AL	WB	VG	FL	S	BL	PA
AL	40	2	2	2	1	2	81.63%
WB	0	40	0	2	1	2	88.88%
VG	2	1	37	2	0	1	86.04%
FL	1	1	2	35	0	0	89.74%
S	1	2	1	0	34	2	85%
BL	1	2	2	2	0	33	82.5%
Total	45	48	43	43	36	40	
UA	88.88%	83.33%	84.09%	81.39%	94.44%	82.5%	
OE	11.11%	16.66%	16.27%	18.60%	5.55%	17.5%	
CE	22.5%	11.11%	13.95%	10.25%	15%	17.5%	

Table 4 Accuracy Assessment for Sigmoid

	AL	WB	VG	FL	S	BL	PA
AL	36	2	2	2	2	2	78.26%
WB	2	37	2	2	2	2	78.72%
VG	2	1	36	2	0	1	85.71%
FL	1	1	2	35	2	2	81.39%
S	1	1	1	0	41	2	89.13%
BL	1	2	2	1	2	24	75%
Total	83.72%	84.09%	80%	83.33%	83.67%	72.72%	
UA	16.27%	15.90%	20%	16.66%	16.32%	27.27%	
OE	17.39%	21.27%	14.28%	18.60%	10.86%	25%	

Table 5 Accuracy Assessment for Linear

	AL	WB	VG	FL	S	BL	PA
AL	37	1	2	1	2	2	82.22%
WB	2	34	2	2	2	3	75.55%
VG	2	0	40	2	2	0	86.95%
FL	4	2	3	30	2	4	66.66%
S	1	1	1	2	40	1	86.95%
BL	3	2	2	2	2	18	62.06%
Total	75.51%	85%	80%	76.92%	80%	64.28%	
UA	24.48%	15%	20%	23.07%	20%	35.71%	
CE	17.77%	24.44%	13.04%	33.33%	13.04%	37.93%	

Table 6 Accuracy Assessment for Polynomial

	AL	WB	VG	FL	S	BL	PA
AL	30	2	2	2	2	2	75%
WB	2	35	2	2	3	3	74.46%
VG	2	2	35	2	3	3	74.46%
FL	4	2	3	28	2	2	68.29%
S	2	2	2	2	42	2	80.76%
BL	3	2	2	3	3	16	55.17%
Total	69.76%	77.77%	76.08%	71.79%	76.36%	57.14%	
UA	25%	22.22%	23.91%	28.20%	23.63%	42.85%	
CE	30.23%	25.53%	25.53%	31.70%	19.23%	44.82%	

AL: Agricultural land **WB**: Water Body **VG**: Vegetation **S**: Settlement
UA: User Accuracy **OE**: Omission Error **CE**: Commission Error **OA**: Overall Accuracy

Table 7Object Based Classifiers Overall Accuracy

Object Based Classifiers	Overall Accuracy
Radial Bias Function	85.54%
Sigmoid	81.64%
Linear	77.73%
Polynomial	73%

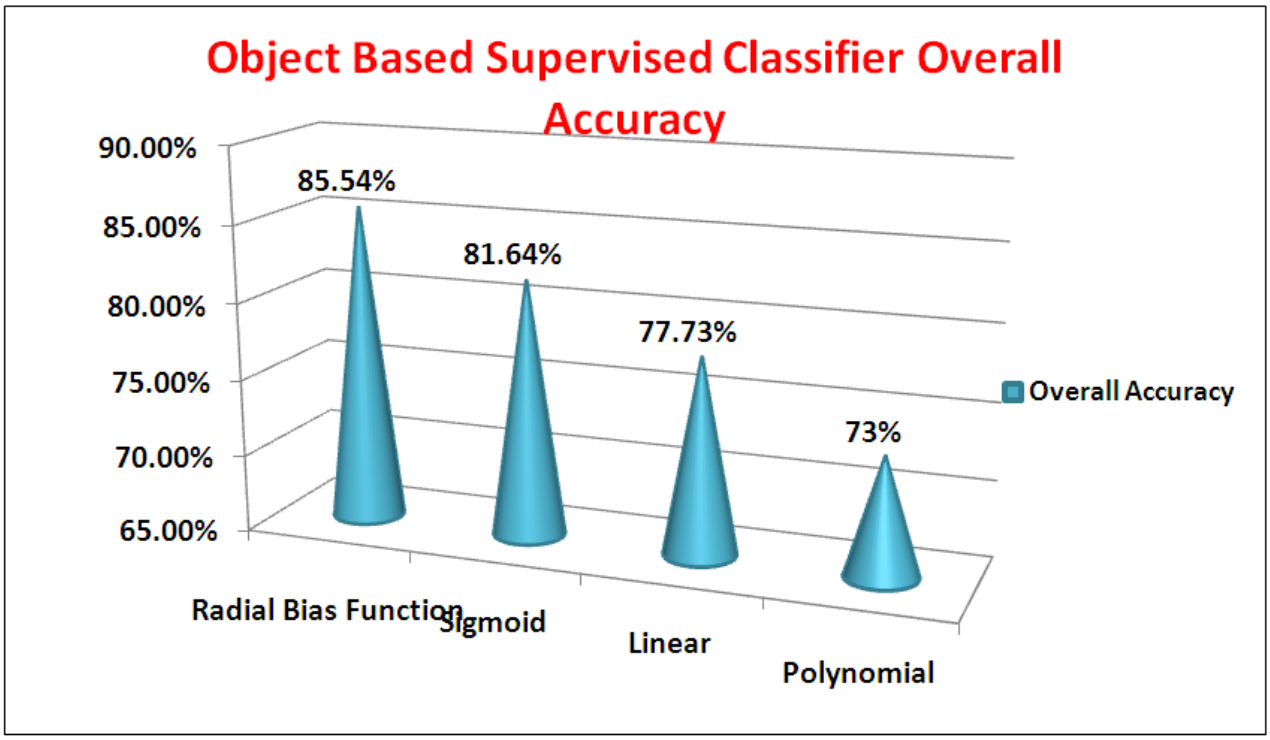


FIG. OVERALL ACCURACY OF SVM KERNEL FUNCTIONS

V. CONCLUSION

Here we have obtained result of LU/LC of Nanded area using four different kernel function RBF,Sigmoid,Linear,Polynomial, the above classifier are best for LU/LC classification. RBF play better role in LU/LC classification for nonlinear data. Here we have shown accuracy by using confusion matrix table where we have rank RBF as best in accuracy and polynomial is least accurate classifier.

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