ABSTRACT

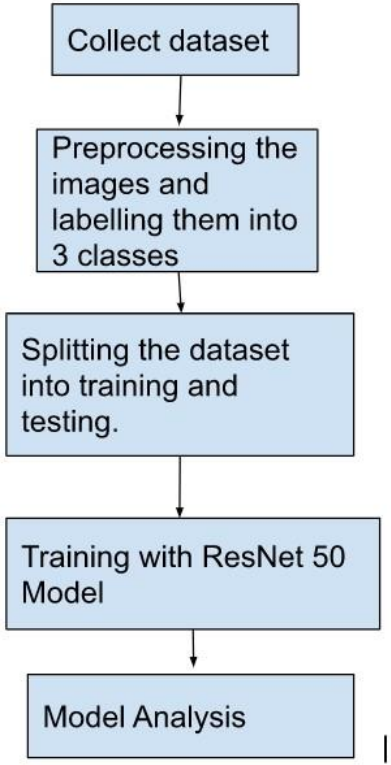
- In remote sensing context, many automatic change detection algorithms have been proposed to obtain changed and unchanged pixels between images.
- Change detection helps in identifying the differences in satellite images taken at different points in time.
- The proposed method uses a photoelectric invariant technique,along with hybrid wavelet transform and mean shift clustering.
- Then a fusion method is used to get final change mask which is further used for the finding finding the change in real time.
- Also, The input satellite images are classified into using a customized labeled dataset.

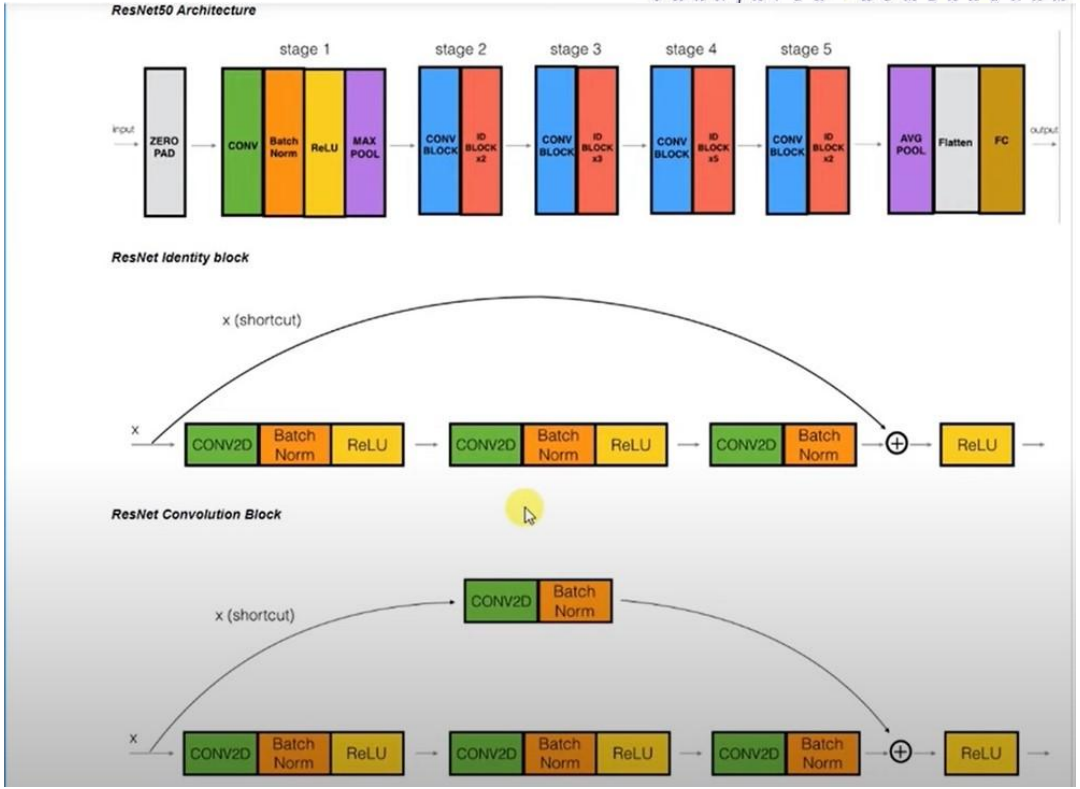
PROPOSED METHOD

The proposed method uses the following steps:

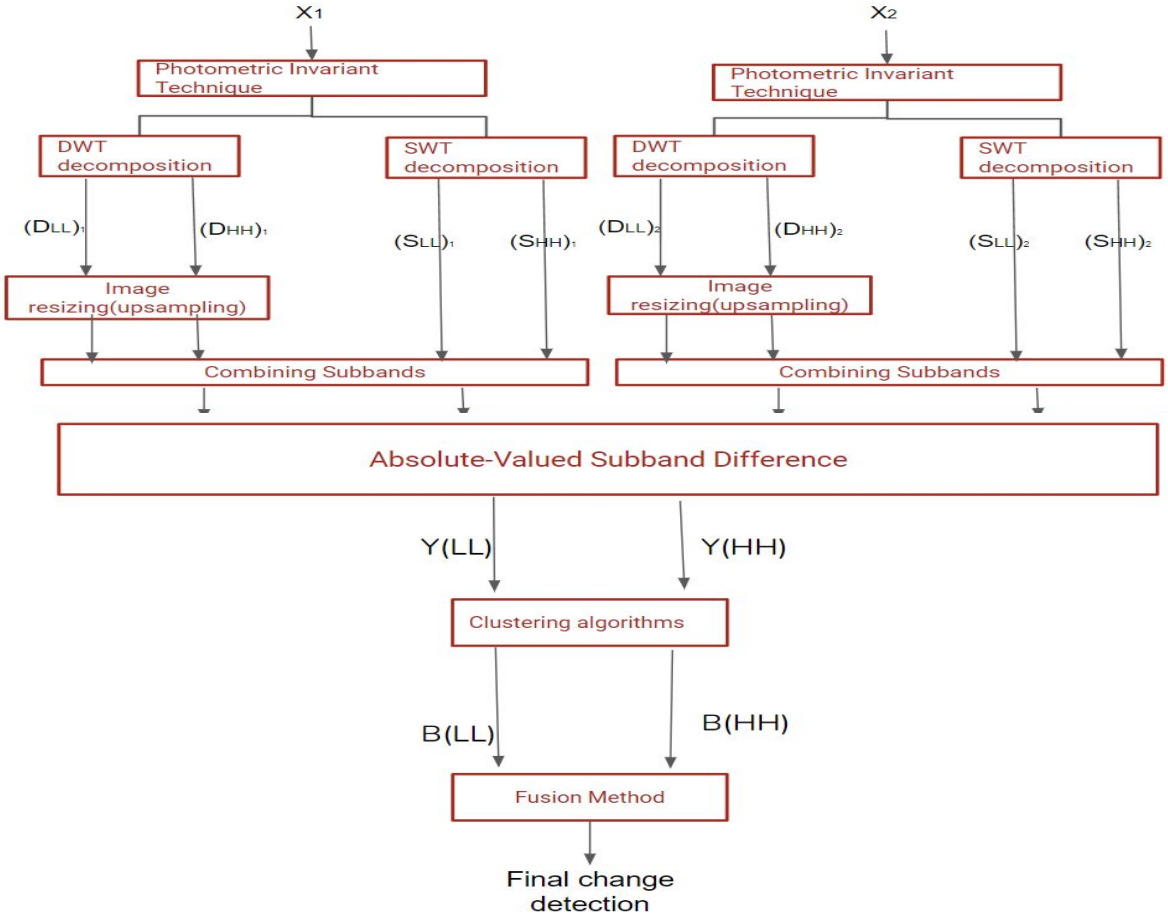
- Firstly, a photometric invariant technique is used to transform the Landsat images from RGB to HSV colour space.
- A hybrid wavelet transform based on Stationary and Discrete Wavelet Transforms is applied.
- After that, mean shift clustering method is applied to the subband difference images, computed using the absolute-valued difference technique.
- Then, the proposed method optimizes using PSO to evaluate changed and unchanged regions of the smoothed difference images separately.
- Finally, a fusion approach based on connected component with union technique is proposed to fuse two binary masks to estimate the final solution.
- The input images are also classified into a labeled dataset using ResNet model and its accuracy is predicted.

METHODOLOGY





Workflow


X1
Photometric Invariant Technique
DWT decomposition
SWT decomposition
(DLL)1
(DHH)1
(SLL)1
(SHH)1
Image resizing(upsampling)
Combining Subbands
X2
Photometric Invariant Technique
DWT decomposition
SWT decomposition
(DLL)2
(DHH)2
(SLL)2
(SHH)2
Image resizing(upsampling)
Combining Subbands
Absolute-Valued Subband Difference
Y(LL)
Y(HH)
Clustering algorithms
B(LL)
B(HH)
Fusion Method
Final change detection

(DATASET-Clustering)

SASTRA
ENGINEERING · MANAGEMENT · LAW · SCIENCES · HUMANITIES · EDUCATION
DEEMED TO BE UNIVERSITY
(U/S 3 of the UGC Act, 1956)
THINK MERIT | THINK TRANSPARENCY | THINK SASTRA
THANJAVUR | KUMBAKONAM | CHENNAI

INPUT IMAGES: SASTRA University (10°43'45.66"N 79°01'08.01"E) taken from Google Earth Pro

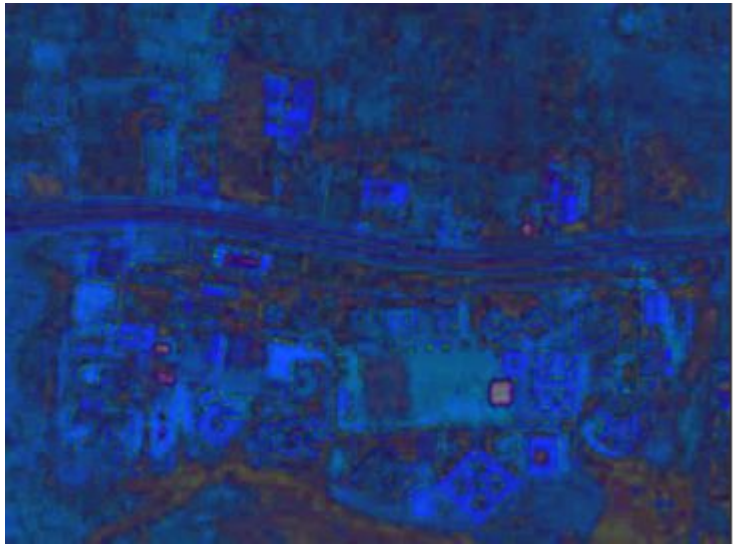
2013

2023

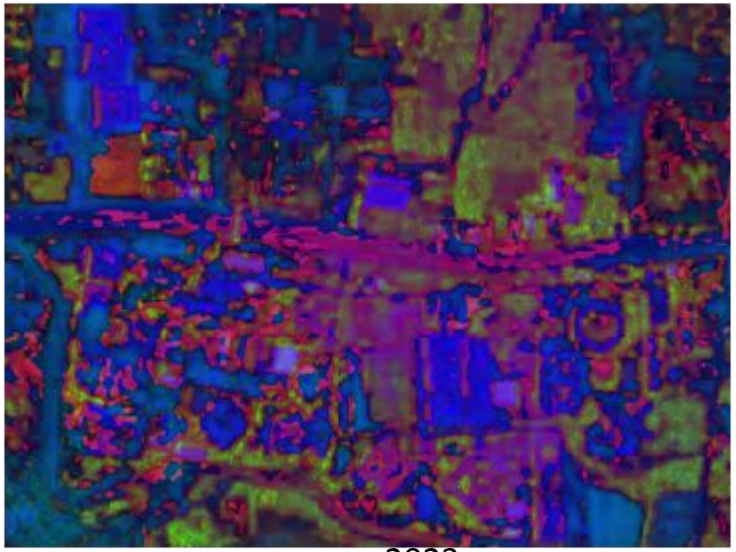
DATASET-Classification

- The dataset consists of pre processed images collected over a 10 year period.
- In pre processing, the input images are cleared of clouds and each image is divided into 192 images of 64x64 size.
- Each image is categorized into one of the 3 labels(i.e Residential, Industry and Herbaceous Vegetation).
- DATASET

ColorSpace Transformation (Unsupervised Learning)

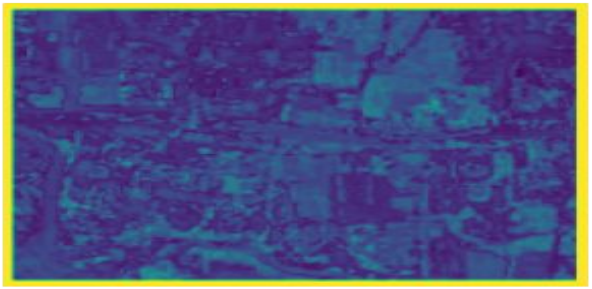


2013

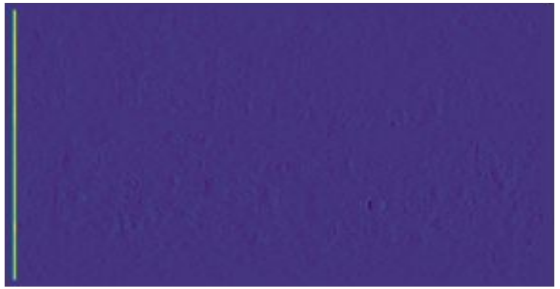


2023

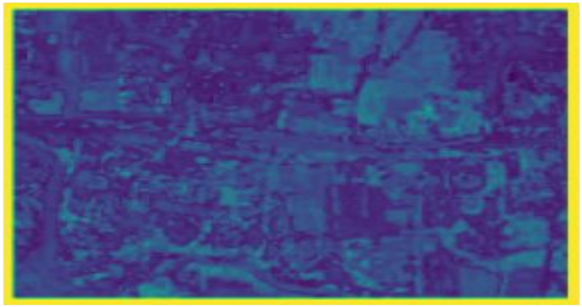
Discrete Wavelet Transform



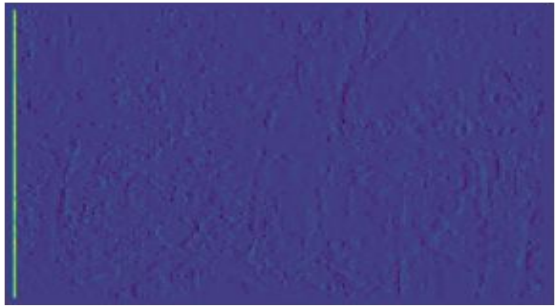
2013-LL



2013-HH

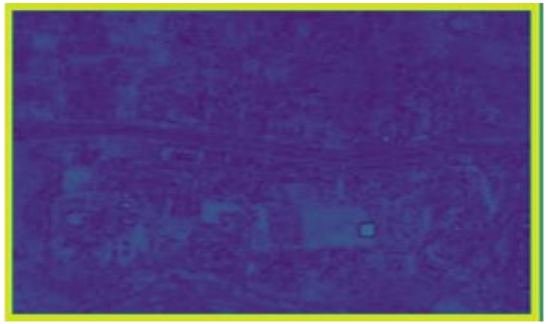


2023-LL



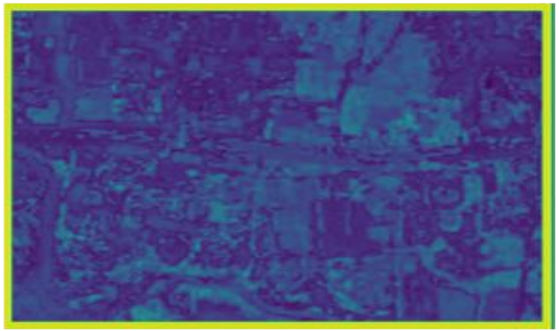
2023-HH

Stationary Wavelet Transform



2013-LL

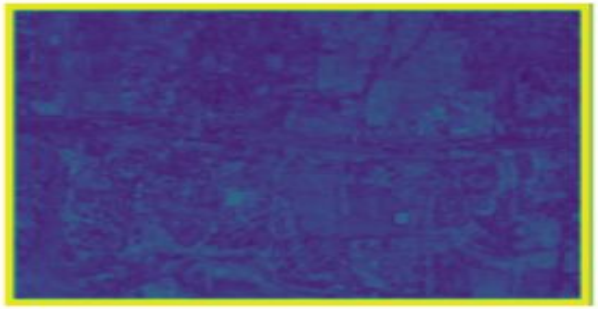
2013-HH



2023-LL

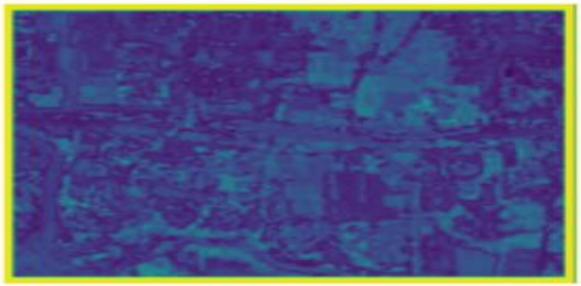
2023-HH

Combining Subbands



2013-LL

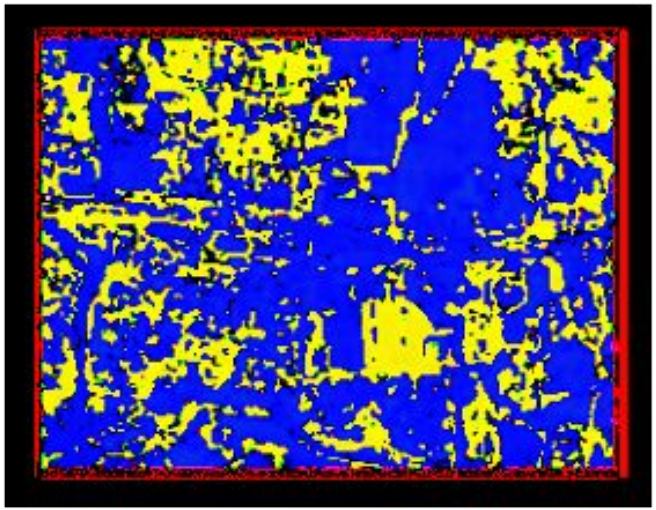
2013-HH



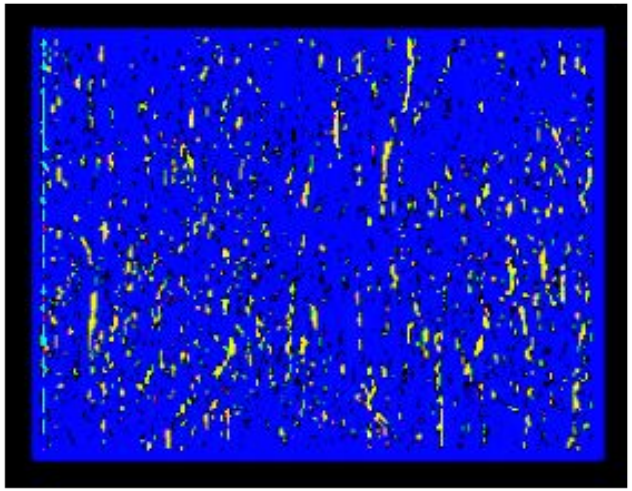
2023-LL

2023-HH

Absolute Valued Subband



LL

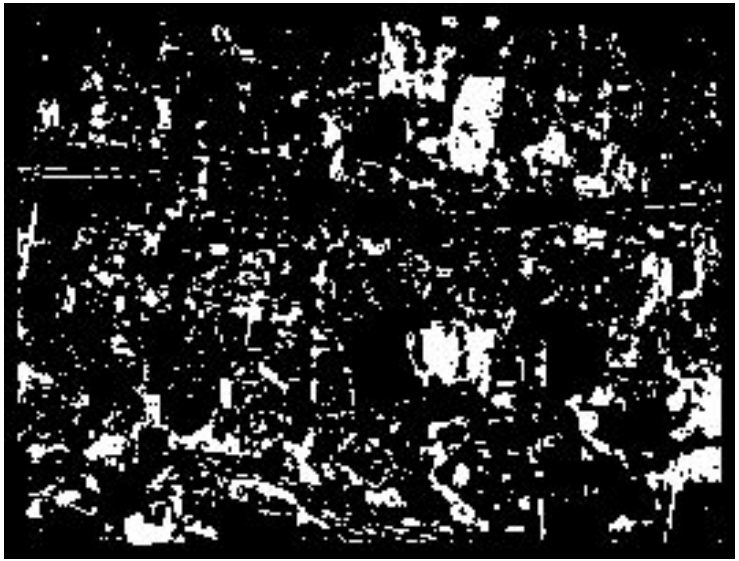


HH

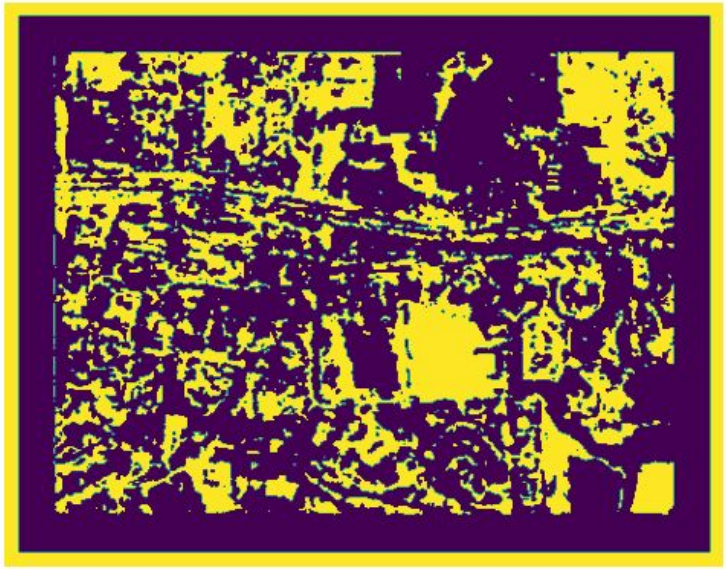
K-Means

Mean Shift Clustering

DT-CWT



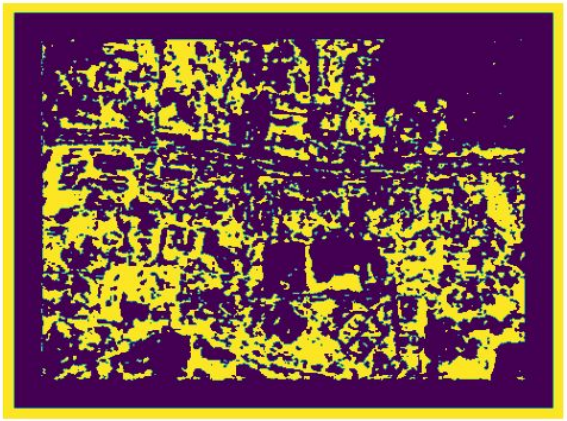
Particle Swarm Optimization



2013-2018

2013

2018



INPUT

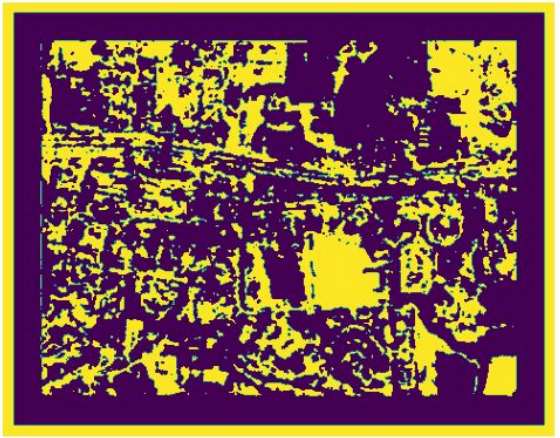
OUTPUT(change)

2018-2023

2018

2023

INPUT

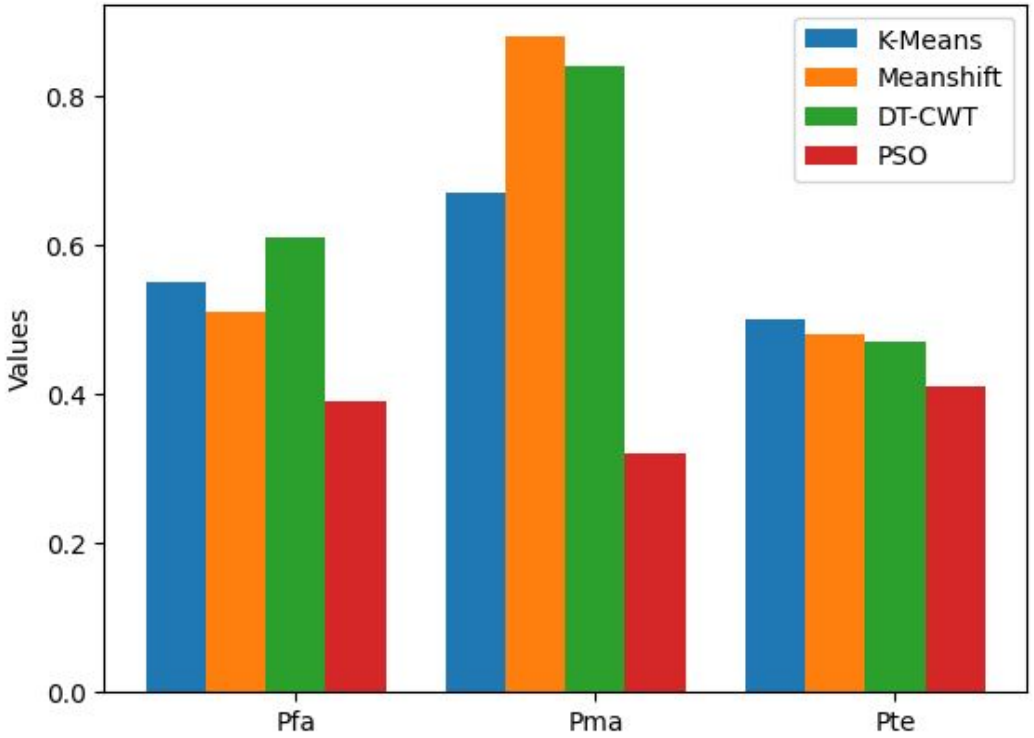


OUTPUT(change)

Performance analysis

	K-Means	Mean-shift	DT-CWT	**PSO**
Pfa(false alarm)	0.65	0.5	0.56	**0.41**
Pmd(missed detection)	0.75	0.87	0.85	**0.38**
Pte(total error)	0.61	0.61	0.58	**0.53**

Performance analysis



RESULT ANALYSIS

- The accuracies of 4 different clustering methods(K-Means, Mean Shift, DT-CWT, PSO) are compared using a table consisting of Pfa, Pma Pte as comparison metrics.
- In image clustering, the clustering method with least metric value is considered the most effective.
- In image classification, the input dataset is fed into a deep learning algorithm(ResNet model) for better effective and efficient classification.
- The accuracy at each epoch is varied and the final epoch's(10) accuracy of 81% is achieved.
- The accuracy follows an increasing trend when plotted against epoch.
- The loss over each epoch is significantly decreasing with increase in epoch.
- In the confusion matrix, the true positives(diagonal elements) are high implying the overall accuracy is maximum.

CONCLUSIONS

- From the histogram the PSO method has the least Pfa, Pte and Pma values, implying that it is the most effective method.
- In image classification, the accuracy is optimal considering the dataset size and number of parameters.
- The final change mask can also be used for image segmentation in order to quantify the individual changes.
- The classification output can be used in calculating land cover land change over the years.

THANK YOU