Title: **Rehabilitation and Protection of Coastal Areas**

Team Members/Collaborators

1. Ms.Kajal Jewani (Researcher, Assistant Professor,Computer Engineering Department,V.E.S.I.T.)
2. Sneha Patil (Software Developer, Student,Computer Engineering Department,V.E.S.I.T.)
3. Shilpa Vaish (Software Developer, Student,Computer Engineering Department,V.E.S.I.T.)
4. Urjita Bedekar (Application Developer, Student,Computer Engineering Department,V.E.S.I.T.)
5. Aakanksha Talreja (Data Analyst, Student,Computer Engineering Department,V.E.S.I.T.)
6. Prerna Baliga (Data Analyst, Student,Computer Engineering Department,V.E.S.I.T.)
7. Piyush Mangtani (Software Developer, Student,Computer Engineering Department,V.E.S.I.T.)
8. Prem Amal (Software Developer, Student,Computer Engineering Department,V.E.S.I.T.)
9. Yash Kasturi (Software Developer, Student,Computer Engineering Department,V.E.S.I.T.)

Project Summary

1. Gather SAR images w.r.t coastal areas with an interval span of 3 years for the same region for past 3 decades.
2. Gather factors to detect mangroves in a SAR Image.
3. Gather factors to detect the urban development in a SAR Image.
4. Segment the images to clean and extract only areas related to mangroves and urban development around such regions.
5. Map the factors in step 2 with the cleaned images in step 4 to create an outline on the images wrt to mangroves.
6. Map the factors in step 3 with the cleaned images in step 4 to create an outline on the images wrt to urban development.
7. Generate difference images between current and historical remote sensed image and color code the difference images with respect to change in water and land coverage.
8. Provide a report on various changes in the coastal area cover.
9. Analyze the alternate factors that leads to the same issues that would result with unavailability of mangroves like climate change, etc

What challenge are you addressing? What is your proposed solution?

Challenges:

1. Mangrove destruction
2. Land encroachment

Solution:

The proposed solution uses image change detection process.Image change detection is a process toanalyse multi-temporal images of the same scene for identifying the changes that have occurred.We propose a novel difference image analysis approach based on deep neural networks for image change detection problems.The deep neural network learning algorithm for classification includes unsupervised feature learning and supervised fine-tuning.Since a deep neural network can learn complicated functions that can represent high level abstractions,it can obtain satisfactory results.Theoretical analysis and experiment results on real datasets show that the proposed method outperforms some other methods.

Methodology: -

Step 1: Data gathering

The images have been collected from Google Earth Pro and Bhuvan-Indian Geo-Platform.

Step 2: To detect mangrove's cover of a region from satellite images collected

For identification of mangroves, color image segmentation method is used.It divides a colored image into a set of disjoint regions which are homogeneous with respect to some properties consistent with human visual perception, such as colors or textures.

Step 3: To detect the change in mangrove cover of a region

In this step, we use Landsat satellite images of an area and by using remote sensing technology and calculate change in mangrove cover.

(If there is some change in mangrove then step 4 comes into existence)

Step 4: To detect the change in urbanization from satellite images taken at different time.

We can detect the growth in urbanisation using Multi Sensor and Multi View Imagery techniques.

1) **K means clustering**-Used to partition a collection of data into small clusters
2) **Fuzzy rule based classification**
   To detect changes in images,the process is done in 2 parts: Clustering, Thresholding (used to separate digital image into equally exclusive and unique areas)The final output would gives us separation of Open land areas, water areas, mangrove cover. The classification is based on both, pure pixel as well as mixed pixel.
3) **Gabors filtering**- used to filter images so that to have finer distinction between textures in image.
4) **Texture segmentation**- Image segmented using texture features. GCM,GLCM,2D spatial filtering.
5) **Color segmentation**-Noise due to clouds is eliminated using pre processing technique band 9(cirrus).
6) **Pixel thresholding**- specific range (based on svm classifiers result)of Rgb pixel values are mangroves.
7) **Svm classifiers**- Used to classify an image in two classes ie whether mangrove or non mangrove.

TECHNICAL COMPONENTS

What Azure and machine learning offerings will you use?

We propose a grant of Azure services to use advance machine learning to accomplish AI image Processing on large scale and for Prediction of Catchment areas. The services we request include Virtual Machines, Storage,Azure SQL Database, App Service, Machine Learning Studio,Azure Cosmos DB, Virtual Network, Load Balancer,Network Watcher, Azure Database for MySQL, Power BI, HDInsight and API Management.

Justify the grant amount your project will need in Azure credit

Service type	Region	Description	Estimated Cost
Virtual Machines	West US	1 D2 v3 (2 vCPU(s), 8 GB RAM) x 300 Hours; Windows – (OS Only); Pay as you go; 0 managed OS disks – S4, 100,000 transaction units	$98.70
Storage	East US	Block Blob Storage, General Purpose V2, LRS Redundancy, Hot Access Tier, 1,000 GB Capacity, 100,000 Write operations, 100,000 List and Create Container Operations, 100,000 Read operations, 1 Other operations. 1,000 GB Data Retrieval, 1,000 GB Data Write	$21.84
Azure SQL Database	East US	Managed Instance, vCore Purchase Model, General Purpose Tier, Gen 4, 1 8 vCore instance(s) x 300 Hours, 32 GB Storage	$605.24
App Service	West US	Basic Tier; 1 B1 (1 Core(s), 1.75 GB RAM, 10 GB Storage) x 400 Hours; Windows OS	$30.00
Machine Learning Studio	South Central US	Free	$0.00
Azure Cosmos DB	East US	0 GB Storage; Single Region Write, Pay as you go, 4 x 100 RUs x 400 Hours	$12.80
Virtual Network		100 data transfer from East US region to East US region	$2.00
Load Balancer	West US	Basic Load Balancer is free of charge	$0.00
Network Watcher	East US	1 GB Network Logs Collected, 0 Checks for Network Diagnostics, 1 Connections for Monitoring, 1 Connection Metrics, 1 DNS or App Gateway Servers x 0 GB logs ingested, 1 GB logs collected for Traffic Analytics	$5.30
Azure Database for MySQL	East US	General Purpose Tier, 1 Gen 4 (2 vCore) x 300 Hours, 5 GB Storage, 50 GB Additional Backup storage - LRS redundancy	$58.14
Power BI Embedded	East US 2	1 node(s) x 200 Hours, Node type: A1, 1 Virtual Core(s), 3GB RAM, 1-300 Peak renders/hour	$201.62

HDInsight	East US	Hadoop Component: 2 A3 (4 cores, 7 GB RAM) Head nodes x 300 Hours, 1 A3 (4 cores, 7 GB RAM) Region nodes x 300 Hours, 0 D4V2 (8 cores, 28 GB RAM) Edge nodes x 300 Hours	$275.40
Machine Learning Studio	South Central US	Free	$0.00
API Management	East US	Developer tier, 1 units(s), 200 Hours	$13.16
Support		**Support**	$0.00
		Monthly Total	**$1,324.20**
		Annual Total	**$15,890.36**

Approximate timeline for key project milestones:

We expect it will take approximately one year to complete our project milestones

Timeline	Data Platform Milestone	Model Training Result
Jan –Feb 2019	Uploading and labeling two photos	Determine Changes
Feb – March 2019	Batch photo upload and labeling	
March – June 2019	Web UI shows upload/labeling results	Classify mangroves, water bodies
July–October 2019	Data insight and analysis	

Impact

How does your project align with AI for Earth areas of focus?

Permanent destruction of forests or water reserves to make the land available for other uses is increasing rapidly form last several years. Consequences are related to increased loss of biodiversity and land encroachment. Change detection for deforestation and water reserves is the problem of detecting the changes in the earth where people are intentionally trying to destroy the forest and water reserves areas. Images collected from Satellite needs real-time change detection of such activities timely, so that, the deforestation and water reserves can be saved before they get destroyed. It can be significantly advantageous if we can detect the changes from the Satellite images but, it is not feasible to track the changes manually in the Satellite images. There is a need of an automated system which can provide some meaningful information by processing large number of images timely and yet accurate.

How does your project transform the way we address environmental challenges?

We see this opportunity to access Microsoft Azure's resources as a critical step towards helping to conserve biodiversity.. This practice has required that the researchers spend two to three weeks of manual data entry every three months, and their error rate is still high given the time pressure and repetitive nature of the process. Our project seeks to improve this process by working with Azure and collaborators from Microsoft to use advanced machine learning models to improve the quality and efficiency of database analysis.

How will the results of your project be leveraged and beneficial to a community of users?

These results would not only benefit our work, but also the work of thousands of other practitioners and researchers,who find it difficult to analyse the changes in the environment.The application will be open-source.We will disseminate our results close to coastal areas in India and across the larger network, which will in turn help to advance land monitoring and biodiversity conservation science across various Indian states and other places.