Cairo University

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Satellite Imaging Project

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Team 9

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Spring 2023

Project Idea:

Detecting post-flood damages in satellite imagery is a challenging yet important task that has real-world applications. The idea behind the project is to leverage machine learning and computer vision techniques to automatically detect and classify the presence of flood damage in satellite images.

Project Pipeline:

➢ *Deep-Learning Models:*

- **MoblieNet**
- **Transfer learning using ImageNet Weights**

❖*Data Preprocessing:*

- **Data Augmentation**
- **Data Splitting**

❖*Hyper-Parameter Tuning*

Tune the number of trained layers and the optimal one is used

❖*Models Evaluation*

- ***Training: 98.5%***
- ***Test:97%***

- ***Classical Models:***
  1. *Logistic Regression*
  2. *Random Forrest*
  3. *Gaussian naïve bayes*

❖ *Data preprocessing*

- **Resizing Images to be all the same.**
- **Remove some noise from it using Blurring**

❖ *Feature extraction and Selection*

- *Histogram of oriented gradients*
- *Local binary Pattern*
- *GLCM*

PCA was tried to be used as a Selection Method

❖ *Models Evaluation:*

(with respect to macro F1-score)

Model/feature	LBP	Histogram	LBP +Histogram
Logistic Regression	**0.79**	**0.73**	**0.79**
Random Forrest	**0.79**	**0.80**	**0.79**
Naive bayes	**0.84**	**0.76**	**0.77**

(with respect to macro precision, recall, and f1-score)

Model/feature	LBP			Histogram			LBP +Histogram		
	P.	R.	F1.	P.	R.	F1.	P.	R.	F1.
LR 0	**.73**	**.89**	**.80**	**.67**	**.84**	**.74**	**.73**	**.89**	**.80**
LR 1	**.88**	**.71**	**.79**	**.82**	**.63**	**.71**	**.88**	**.71**	**.79**
RF 0	**.74**	**.85**	**.79**	**.8**	**.76**	**.78**	**.81**	**.74**	**.77**
RF 1	**.85**	**.73**	**.79**	**.8**	**.84**	**.82**	**.78**	**.85**	**.81**
NB 0	**.82**	**.86**	**.84**	**.72**	**.80**	**.76**	**.73**	**.80**	**.77**
NB 1	**.87**	**.83**	**.85**	**.81**	**.72**	**.76**	**.81**	**.73**	**.77**

(W.R.T Accuracy /Omission error/Commission error)

Model/feature	LBP			Histogram			LBP +Histogram		
	Acc	OE.	CE.	Acc.	OE.	CE.	Acc.	OE.	CE.
LR	**.79**	**28.5**	**12.5**	**.73**	**36.7**	**18.4**	**.79**	**28.5**	**12**
RF	**.79**	**26.5**	**15.2**	**.8**	**16.3**	**20.3**	**.79**	**15.3**	**21**
NB	**.84**	**17.3**	**12.9**	**.76**	**27.5**	**19.3**	**.77**	**26.5**	**19**

(W.R.T To Confusion Matrix)

Model/feature	LBP	Histogram	LBP +Histogram
Logistic Regression	[[77 10] [28 70]]	[[73 14] [36 62]]	[[77 10] [28 70]]]
Random Forrest	[[74 13] [26 72]]	[[66 21] [16 82]]	[[64 23] [15 83]]
Naive bayes	[[75 12] [17 81]]	[[70 17] [27 71]]	[[70 17] [26 72]]

(Model Evaluation using GLCM)

Model/Matrix	F1 macro	OE	CE	ACC.	Conf Matrix
Logistic Regression	.77	21.4	21.4	.77	[[66 21] [21 77]]
Random Forrest	.84	15.31	14.43	.84	[[73 14] [15 83]]
Naive bayes	.8	18.73	19.2	.8	[[68 19] [18 80]]

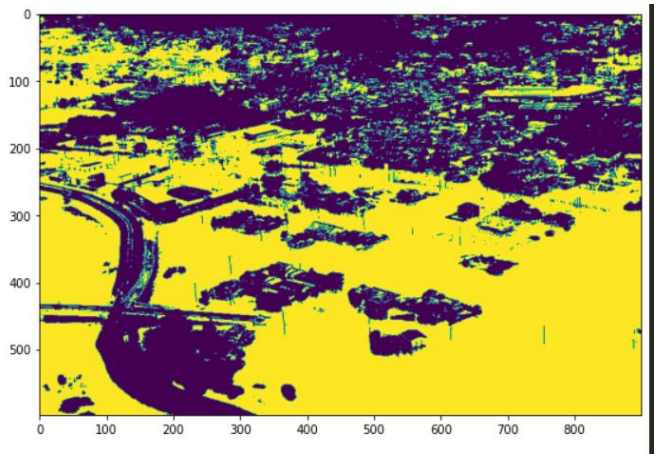
Model/feature	GLCM		
	P.	R.	F1.
LR 0	**.76**	**.76**	**.76**
LR 1	**.79**	**.79**	**.79**
RF 0	**.83**	**.84**	**.83**
RF 1	**.86**	**.85**	**.85**
NB 0	**.79**	**.78**	**.79**
NB 1	**.81**	**.82**	**.8**

❖ ***Final Model:***

The deep-learning one as it is the highest f1 score.

❖Coloring Flood Pixels:

➢ ISOData



➢ Kmeans