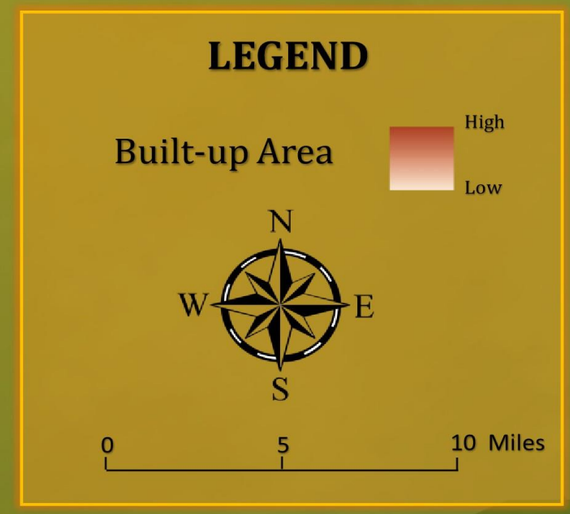
DHAKA BUILT-UP CHANGE OVER 8 YEARS

Neural Networks for Identifying Built-up Areas through Satellite Image Classification

1998

TRUE COLOR IMAGE, DHAKA

DHAKA, BANGLADESH



2003

DECREASED VEGETATION & WETLANDS

2008

INCREASED BUILT-UP AREA

2011

RAPID & DENSE URBANIZATION

Data Source: Landsat 5 Images
Downloaded from GloVis

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We presented the application of machine learning methods to satellite image classification as it's a faster and more accurate technique compared to when using local generic softwares. The given maps represent the **temporal change of built-up areas in Dhaka**, the capital city of Bangladesh, from the years **2003, 2008** and **2011.** The maps highlight the built up areas in the city. These are created by multispectral data classification techniques using **Keras NN** (Neural Network), a **Supervised Machine Learning** (ML) approach. Landsat 5 TM (Thematic Mapper) sensor images in TIFF (Tagged Image File Format) format were collected for Dhaka for the years 1998, 2003, 2008 and 2011. The data of Dhaka in 1998 was classified into built-up area and non-built up area using softwares and this result was used as the training sample for the model. The data from 2003, 2008 and 2011 were used as test data for classification. The 1998, 2003, 2008 and 2011 data was from January, December, November and April respectively, in order to ensure the coverage of all seasons in Bangladesh. The objective of the project was to show the temporal change of the built-up area in Dhaka by processing only one classified image & using ML in a time-efficient way compared to local softwares. With a more experienced operator, the classification parameters would be more accurate and the result would be closer to the real picture. The accuracy rate for our model was between 94%-95%. The method has been adapted from a model in a blogpost in this link: Neural Network for Satellite Data Classification Using Tensorflow in Python

The **results** retrieved from the map are as follows:

- The built-up areas had increased from **south to north** and **central to east** sections of the city due to the rapid urbanization from 2003 to 2011, transforming the city into **Dhaka Megacity.** The amount of vegetation and wetlands decreased considerably due to human interventions. Whereas in the **north-east** (adjacent to *Turag* river) and **south-east** (Bashundhara) of 2011 map, the built-up areas decreased due to the increase in bare-lands for construction and agricultural purposes. Bare lands are of different spectral resolution than built-up areas.
- As the 2011 image was from April which is the pre-monsoon period in Bangladesh, the rainfall, atmospheric moisture and stagnant water reflection within the image are responsible for some deviation in the resolution of the data. A greater percentage of built-up areas would have been noticed if the data from the dry season was used, as Dhaka has seen astonishing growth and rapid development due to rural to urban migration and industrialization.

Our expected audience would be any individual interested in the field of **GIS** and **Remote Sensing.** These methods can be used in not only analysis but also in preparing the data for further studies. Softwares for these, can take time and also require certain compatibility in case of certain devices. **ML techniques** are more efficient and at present, they can be performed in open source platforms leveraging online servers and reducing compatibility issues.

We have used **ArcGIS 10.3** and **ERDAS Imagine 2014** for preparing the training data and for creating the map layouts. **Keras API** and **NN architecture** was used to perform **supervised classification.** The codes were scripted in **Python in Google Colaboratory.** We have also used **Microsoft Powerpoint 2016** and **Google Docs** for preparing the final document.