SATELLITE IMAGE CLASSIFICATION USING DEEP LEARNING ALGORITHM

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Abstract: Estimation of economic for any area is the most important task. It includes lots of man power work. It also require authentication in entire process to achieve high accuracy. Economic condition classification with latest Artificial Intelligence (AI) technology is a challenging task. CNN is proved for better accuracies with supporting to the deep learning methods. It is also complemented with the light weight library in python for image processing as OpenCV which help us to classify the image and improves the speed of execution. Satellite image has various parameter likes Agricultural Land, Water Resources, Road sources and structure to calculate economical area with better accuracy. So, considering this satellite image of an area, there is a profound need to detect status of the remote area. In this survey paper, we have several major tasks to design our project. First of all, we have to find datasets related to satellite image and then designing of user-friendly desktop application and another task is to authenticate the user and pre-process the input satellite image. Final task is to classify the status of area.

Keywords: *PyQT, NumPy, OpenCV, Satellite Image, LandSat 7, Google Earth, MySQL*

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I INTRODUCTION

Socio-economic survey is most prime task for any government. Economic condition survey should be authenticate and reliable for development. For development of any area, government took survey of that area that require lots of man power and paper work. There are so many regions in the world where humans are exist but they have no facilities for their livelihood. They don't even have basic necessity of life like water, food and so on. Some region has lack of only one factor and some regions have lack of all the factors. Some region has water but not electricity while another region has home but not any other necessities. For such type of regions, some organizations are ready to help them with the support of government of that country but due to lack of communication from that region, the organization knows only the location of that region. They don't even know what the basic necessities of that region are? In that case, the organization can only have the satellite image of the region and they try to determine necessities by observing satellite image. But by only observing that region through satellite image we cannot estimate the presence of the factors on that region. So to solve this kind of problem we are introducing an application to predict socioeconomic status of a region. The system which we are designing has the ability to identify some major factors which are very basic necessities of a region and they are electricity, water supply, agricultural field. One more factors we are using for estimate status of region is roof top of the house. Roof top is a very essential factor for our system.

For prediction of socio-economic status, our system takes satellite image and then this satellite image is compared with our trained model which contains all these major factors present within it and after comparing these factors we get prediction of the status of that satellite image in the form of percentage of presence of factors in the image and by considering this percentages of factors we are predicting socio-economic status.

To achieve required result, application is design through python language and using its libraries. So, to design user friendly desktop application, PyQT library method is used in python language. To preprocess datasets of satellite images, we are using OpenCV library method and through preprocessing of image, we converts our input satellite image into grayscale image, contour image and smoothen image. To authenticate the

user, we are using MySQL database connectivity.

II LITERATURE SURVEY

[1]   Multi-Task Deep Learning for Predicting Poverty from Satellite Images (2018)

We propose a two-step approach for predicting poverty in rural regions of India from satellite imagery. First, we train a multi-task fully convolutional model to predict three developmental parameters – the main material of the roof, source of lighting and source of drinking water – from satellite imagery. Using only satellite imagery as input, we are able to estimate income and poverty close to the true values collected on the ground by significant manual effort and monetary expense.

[2]   Infrastructure Quality Assessment in Africa using Satellite Imagery and Deep Learning

Data on infrastructure quality outcomes in developing countries is lacking, and this work explored the use of globally available remote sensing data for predicting such outcomes. Using Afrobarometer survey data, we introduced a deep learning approach that demonstrates good predictive ability. For all these endeavors, data will form a core issue. The quality of a deep model heavily relies on adequate data available, and a large focus should be towards making better use of existing image and survey data, through strong cataloguing and collating efforts. However, our results demonstrate the proof of concept that satellite imagery can be used to predict infrastructure quality.

[3] Poverty Prediction with Public Landsat 7 Satellite Imagery and Machine Learning

Our results show that the current state-of-the-art in satellite- based poverty prediction lends itself to predicting relative wealth within a single country where some ground truth data is available, but may struggle with extrapolating across country borders. Using some combination of nightlights and predictions from the proposed models may yield further improvements.

[4]Poverty Mapping Using Convolutional Neural Networks Trained on High and Medium Resolution

Satellite Images, With an Application in Mexico

Presents the CNN predictions for urban areas using imagery for either Digital Globe or Planet, using the 10% withheld validation sample. We present R2 estimates that show the correlation between predicted poverty and benchmark poverty as measured in the 2015 Intercampus. R2 is estimated at 0.61 using the Digital Globe imagery, and 0.54 using Planet imagery. Recall we can only compare urban areas due to lack of coverage of rural areas for Digital Globe. The drop in performance is modest but not severe, especially considering that Planet imagery offers daily revisit rates of the earth's landmass. Poverty estimates for urban areas in Mexico are mapped.

III.PROPOSED SYSTEM

We implement a system for prediction of area and calculate economical area with better accuracy and additional parameters.

Following are the parameter of the system for Prediction:

• Agricultural Land

• Water Resources

• Road sources

• Structure

In the diagram Fig.1, there is flow of our project.

[1]The whole architecture is made by PyQT library used in python language. PyQT library gives all the necessary stuff related to GUI design. PyQT provides us display screen, buttons and so on. So, in this way PyQT helps us in design GUI.

[2]After designing of GUI, another task is to authenticate valid user for operating application. To deal with this task, we are using MySQL database to store data of username and password and through this, user can authenticate easily.

 [3]Another task is to pre-process the input image which can be done by OpenCV library of python. By using this library, image is converted into grayscale image, contour image and smoothen image.

[4]The major task of this survey paper is to collect datasets of satellite image and to achieve this result, we are working on google Earth images, LandSat 7 images and also take help of magic puzzle application on which, we are providing latitude and longitude of a particular area and as a result, we are getting satellite image of that area.

In this way, we achieve our all the tasks to achieve our project goal.
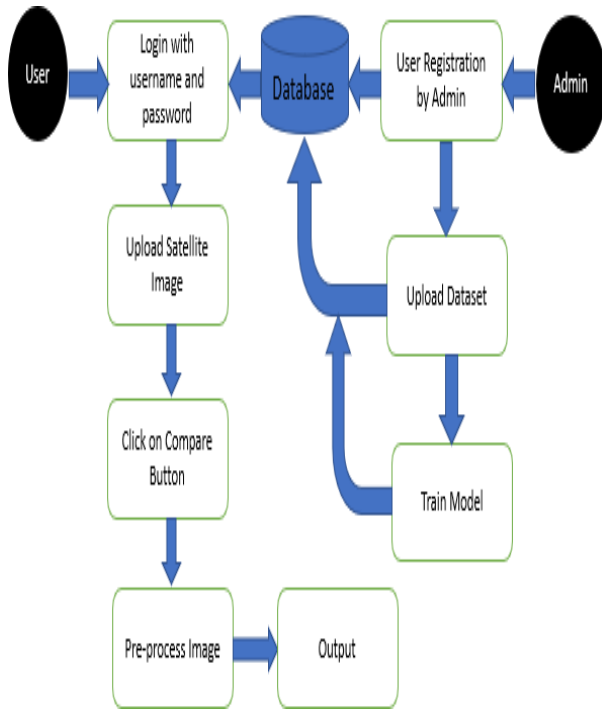
Fig.1:- System Architecture

III METHODOLOGY (CNN):

Convolutional neural network (CNN, or ConvNet) is a form deep learning and most commonly applied to analysing visual imagery. CNNs use a variation of multilayer perceptron designed to require minimal pre-processing. They are also known as shift invariant or space invariant artificial neural networks (SIANN), based on their shared- weights architecture and translation invariance characteristics. Convolutional networks were inspired by biological processes in that the connectivity pattern between neurons resembles the organization of the animal visual cortex. Individual cortical neurons respond to stimuli only in a restricted region of the visual field known as the receptive field.

The receptive fields of different neurons partially overlap such that they cover the entire visual field. CNNs use relatively little pre-processing compared to other image classification algorithms. This means that the network learns the filters that in traditional algorithms were hand- engineered. This independence from prior knowledge and human effort in feature design is a major advantage. They have applications in image and video recognition, recommender systems, image classification, medical image analysis, and natural language processing.

A CNN consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of convolutional layers, pooling layers, fully connected layers and normalization layers.
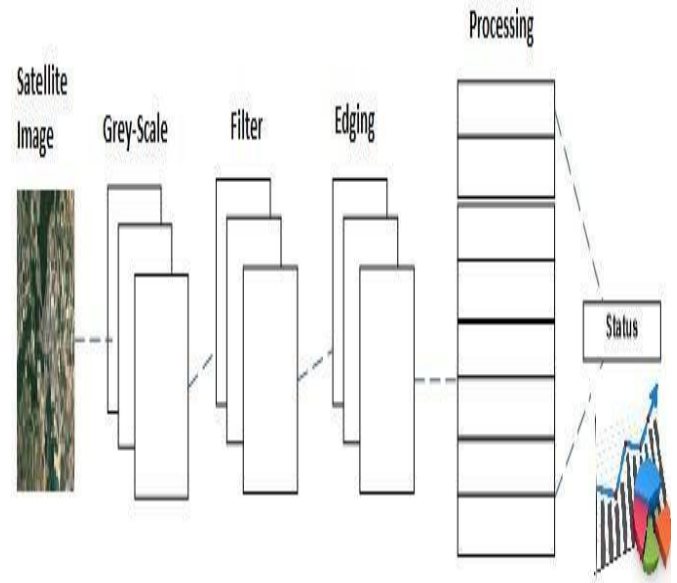

Fig2. Simple ConvNet

The Convolutional Neural Network in Fig. is similar in architecture to the original LeNet and classifies an input image into four categories: dog, cat, boat or bird. There are four main operations in the ConvNet shown in fig. above:

1. Convolution
2. Non Linearity (ReLU)
3. Pooling or Sub Sampling
4. Classification (Fully Connected Layer)

IV RESULT AND DISCUSSION

In the proposed system, we will be using supervised CNN approach which further will improves the accuracy of the prediction. CNN is proved for better accuracies with supporting to the deep learning methods. It is also complemented with the light weight library in python for image processing as OpenCV which help us to classify the image and improves the speed of execution. System has used various parameter likes Agricultural Land, Water Resources, Road sources and structure to calculate economical area with better accuracy.

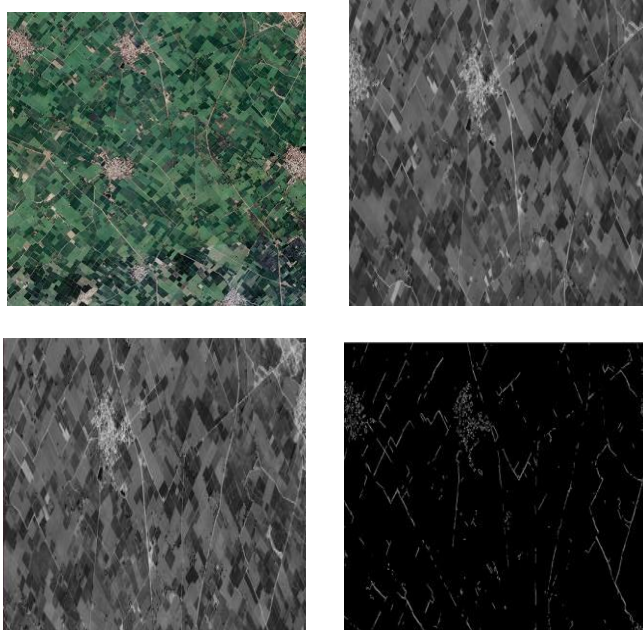Following images are pre-process images of satellite image.

Fig. Image Pre-processing

Comparative results of existing and proposed system is as follow,

Parameters	Existing System	Proposed System
AI based approach	No	Yes
Use of satellite image	No	Yes
Use of OpenCV	No	Yes
CNN	No	Yes
Improved speed	No	Yes

Table 1. Comparative Table

V CONCLUSION

Prediction of socio-economic status by using satellite image. In this type of application, we have first collect datasets of satellite image and after that make a desktop application so that user can able to predict socio-economic status. To predict status of a satellite image, we have use preprocessing of an input image so that features can be easily detected from input mage and to achieve this we are using opencv library. In this way, we are successfully implement all the tasks of the survey paper.

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