# Climate Change Awareness using an Intelligent Deep Learning Approach

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## Abstract

*Today we have large amount of unclassified data for climate change which prevents us from to creating a good reach of climate change awareness to community. To solve this we classify all data and teach younger generation about climate change. For this, we have developed a data analytic application which analyze a raw video feed from satellite image and video from scientist from glacier in Greenland to tropical forest in amazon, for analysis and classification of climate change. Based upon trained model, we classify the video and user is allowed to interact with application to learn more about climate change.*

## 1 Introduction

The climate-change awareness that have emerged in the wake of massive fossil-fuel based industrialization indicate the need for a transition to sustainable energy, but attempts to create awareness and encourage people to follow pro-environmental behavior often have been limited and narrow reach of people and achieve only limited success. This problem of limited access is due to lack of awareness in people about its risk and danger that directly connected to climate change to them, upcoming generation and ecosystem.

The main objective of the project is to create awareness for the climate change impact, presenting adaption solution. This project provides science-based environmental education resource with credible information in form of video and image with support of voice assistant which is trained to answer question related to environment and climate change, thereby creating in-depth experience for the user.

This motivated us to create a responsive model with detailed support assistant by bringing all facts and its potential harmful effects on ecosystem.

## 2 Related Work

Climate Analytics is a non-profit climate science and policy institute based in Berlin, Germany which analysis and monitor climate cause and impact through various data analytical application such as HLSM High-Level Support Mechanism for LDC and SIDS on Climate Change, A stress test for coal in Europe under the Paris Agreement. More details can be found in http://climateanalytics.org/what-we-do/science-assessment-and-analysis.html

## 3 Proposed Work

First, we take climate change dataset from ImageNet (1) and we train our model using Retrain Inception Final Layer model in Tensor Flow. Then we upload video in user interface and we extract mainframes from using image annotation tools such as Open IMAG. These collected mainframes are passed as test data to our trained model and image classification using softmax regression and the results are stored in Mlab database. For user convenience, we implemented Google Conversation API using api.ai and created intents according to our theme. In simulation when these intents are triggered we fetch the desired results from Mlab database which is deployed in Heroku-cloud application.

## 4 Implementation and Evaluation

### System Design

For designing our system, we came across many new technologies and learning algorithms, but we have chosen ours to more closely to align with our model created. We have also made an extensive research on different learning algorithms and have finally decided to go with retrain inception model

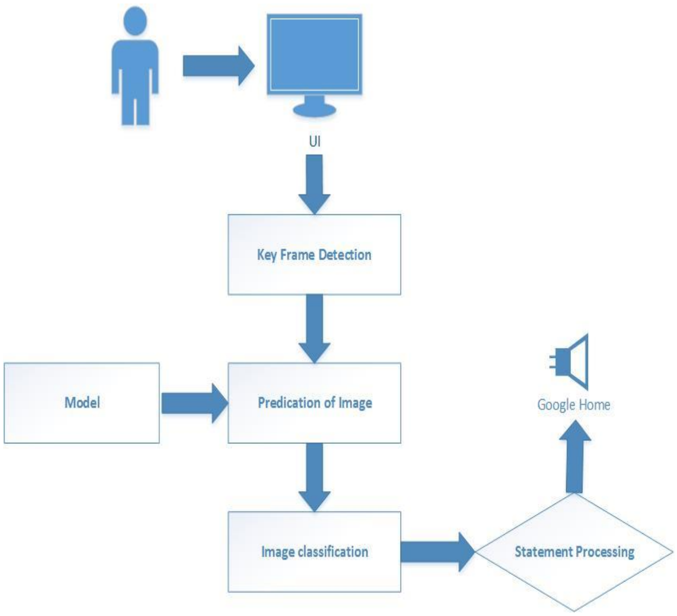


*Figure 1: Workflow Diagram*

Figure 1 shows the image for the complete workflow of our project. We have used Open IMAG, Tensor flow and Google Conversation to implement a responsive yet attractive user interface for users.

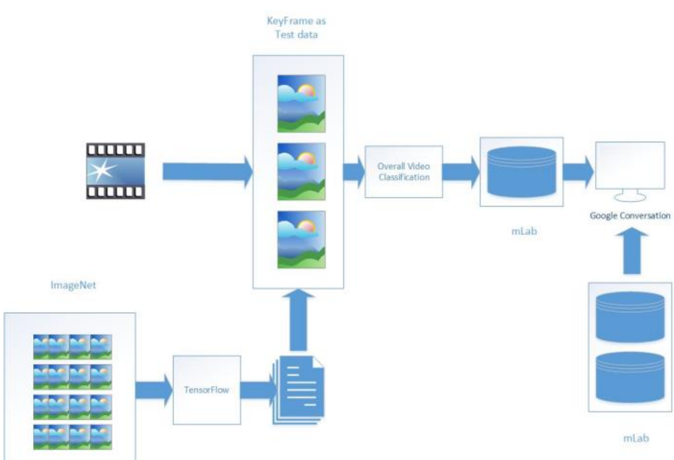


*Figure 2: Architecture Diagram*

Figure 2 shows the architecture and individual components used in our project. MLab is used to access MongoDB via REST service.

### Implementation Details

We have effectively handled the technologies and tools that are required. For the training we have used dataset from ImageNet. Since the execution time extensively depends on the hardware of the system, we have to be careful on the concept of "bottleneck". We have summarized our logs generated from our model in Tensor Board (2; 1; 1), a visualization tool for learning models.

### Evaluation Plan

Datasets: The images are downloaded from open source ImageNet based on our desired classes.

Deforestation – 532 images.
Glacier Melting – 1185 images.
Sea Level Rise – 1182 images.
Soil Acidification – 1032 images

System Specification:

Processor: 7th Gen Intel® Core™ i7-6500U CPU @ 2.50 GHz 2.60 GHz
Installed Memory(RAM) : 8.00 GB
System Type: 64-bit Operating System, x64-based processor
Operating System: Ubuntu 16.04

### Evaluation and Results

| | Apache Spark | Tensor Flow |
|---|---|---|
| Model | Random Forest | Retrain Inception Final Layer |
| Dataset | Own Dataset – approx. 200 images for each class | Image Net – approx. 1000 images for each class |
| Accuracy | 75% | 97% |
| Training Runtime – 500 steps | 15 min | 120 min |
| Testing Runtime | 14 sec | 20 sec |
| Space Requirements | 130 MB | 730 MB |
| Scalability | Scalable | Scalable |

*Table 1: Comparison between Spark and Tensor Flow*

Table 1 shows different approaches we have used to get the better of the two approach. We found that accuracy on Tensor Flow to be more precise than Spark, but the training runtime appears to be more on Tensor Flow. By analyzing these results, we decided to use Tensor Flow

## 5 Discussion and Limitation

Having a huge set of data collected from ImageNet and other reliable resources, it is the responsibility of the model to generate the accurate predictions possible. Fortunately, with the availability of plethora of advanced learning models available, we had the flexibility to choose the best from the pool. We have used Inception model which is used to predict the image with highest accuracy possible. Our trained model uses data from different sources which makes our testing a better suited for different data. Our model was created in a robust way to handle multiple data with different objects. In future, to improve our project to more environmental awareness, we can use any new approach in learning algorithms.

## 6 Conclusion

Finally, our project creates an awareness among users about the changes in climate by effectively using different algorithms, techniques and tools. We strongly suggest that more researchers try to come up with predefined model for different legible issues that our society faces. Instead of making a specific model for individual dataset, we can use a generalized approach to add more use case to our project.

## 7 References


1. *ImageNet: A Large-Scale Hierarchical Image Database.* **Jia Deng, Wei Dong, Richard Socher, Li-Jia Li, Kai Li and Li Fei-Fei.** s.l. : Dept. of Computer Science, Princeton University, USA.

2. *TensorFlow: Large-Scale Machine Learning on Heterogeneous Distributed Systems.* **Mart´ın Abadi, Ashish Agarwal, Paul Barham, Eugene Brevdo, Zhifeng Chen, Craig Citro.** s.l. : Preliminary White Paper, November 9, 2015.

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