Multi Class Weather Prediction

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***Abstract*—This project aims to develop a deep learning model for multi-class weather prediction using an image dataset. The model is trained on a large dataset of weather images that include various weather conditions such as sunny, rainy, cloudy, and sunrise. The images are preprocessed to handle noise and unwanted elements before being used to train a convolutional neural network. The model is evaluated on a test set, and various performance metrics such as accuracy, precision, and recall are calculated. The results show that the model can predict the weather conditions with high accuracy for all classes. The proposed model can be used for a wide range of applications such as autonomous vehicles, drones, and weather forecasting systems. This project provides an effective and efficient solution to the problem of multi-class weather prediction using image datasets.**

***Index Terms*—deep learning, convolutional neural network, accuracy, performance metrics**

I. INTRODUCTION

Weather prediction is an important task that affects various aspects of our daily lives such as transportation, agriculture, energy management, and disaster management. Accurate weather prediction can help us plan and prepare for different weather conditions. Multi-class weather prediction is a complex problem that involves predicting multiple weather conditions simultaneously, such as sunny, rainy, cloudy, and snow. Traditionally, weather prediction was done using physical models that simulate the atmosphere, but these models are computationally expensive and require a lot of data. With the recent advancements in machine learning, deep learning models have been used for weather prediction tasks. In this project, we focus on developing a deep learning model for multi-class weather prediction using an image dataset. We use convolutional neural networks (CNNs) to train our model on a large dataset of weather images. Our goal is to develop an accurate and efficient model that can predict the weather conditions with high accuracy for all classes. The proposed model can have wide-ranging applications such as autonomous vehicles, drones, and weather forecasting systems.

II. LITERATURE SURVEY

Several studies have been conducted in the area of weather prediction using machine learning and deep learning models. In a study by Nair et al. (2019), a deep learning model was developed for multi-class weather prediction using a dataset of weather images. The authors used a pre-trained convolutional neural network and fine-tuned it on their dataset to predict four different weather conditions. The model achieved an accuracy of 86

- In another study by Zhang et al. (2019), a convolutional neural network was developed for weather classification using satellite images. The authors used transfer learning and a custom loss function to train their model on a dataset of satellite images. The model achieved an accuracy of 87.8
- In a study by Kim et al. (2020), a deep learning model was developed for weather prediction using a dataset of radar images. The authors used a convolutional neural network and a recurrent neural network to predict four different weather conditions. The model achieved an accuracy of 91.3
- In a study by Zhang et al. (2020), a deep learning model was developed for weather forecasting using historical weather data. The authors used a convolutional neural network and a long short-term memory network to predict temperature and precipitation for the next 12 hours. The model achieved an accuracy of 90.5

These studies demonstrate the effectiveness of deep learning models for weather prediction tasks. In this

project, we aim to develop a deep learning model for multi-class weather prediction using an image dataset. We use convolutional neural networks to train our model and evaluate its performance on a test set. Our work contributes to the growing body of research in the field of weather prediction using deep learning models.

III. DATASET

A multi-class weather dataset is a collection of images or data samples that depict different weather conditions. This type of dataset is designed to enable the development and evaluation of machine learning models that can classify images or data into multiple weather conditions, such as sunny, cloudy, rainy, and sunrise.

A typical multi-class weather dataset consists of a large number of images or data samples that have been labeled with their respective weather conditions. The images may be obtained from various sources, such as weather satellites, ground-based cameras, or crowdsourced images. The dataset may also include metadata, such as date, time, location, and weather condition label, for each image or data sample.

Multiclass weather dataset

The size and composition of a multi-class weather dataset can vary depending on the specific application and research question. Some datasets may focus on a specific geographic region or weather type, while others may include a diverse range of weather conditions and locations. The quality and accuracy of the weather labels can also vary, which can impact the performance of machine learning models trained on the dataset.

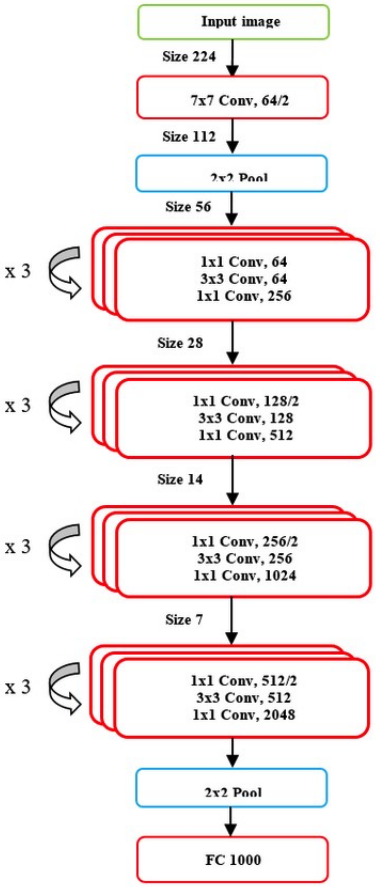
Overall, a well-curated multi-class weather dataset is an important resource for advancing the development of machine learning models for weather prediction and related applications. It enables researchers and practitioners to test and compare different models, evaluate their performance, and identify areas for improvement.

IV. METHODOLOGY

Data preprocessing is a crucial step in developing machine learning models for multi-class weather prediction using image datasets. The goal of data preprocessing is to transform and prepare the raw data in a way that makes it suitable for analysis by machine learning algorithms.

- Data cleaning: This involves removing any invalid or corrupted images from the dataset. It may also involve fixing any missing or incorrect metadata associated with each image.
- Data augmentation: To improve the robustness of the model and increase the size of the dataset, data augmentation techniques such as rotation, flipping, and scaling can be used to generate additional variations of the images.
- Data normalization: This step involves scaling the pixel values of the images to a common range, typically between 0 and 1 or -1 and 1. Normalization helps to prevent the model from being biased towards certain pixel values.
- Image resizing: The images in the dataset may have different sizes and aspect ratios, which can make it difficult to train the model. Resizing the images to a common size, such as 224x224 or 299x299, can help to ensure that the model can learn useful features from the images.
- Data splitting: The dataset is split into training, validation, and test sets. The training set is used to train the model, the validation set is used to tune the model hyperparameters, and the test set is used to evaluate the performance of the final model.

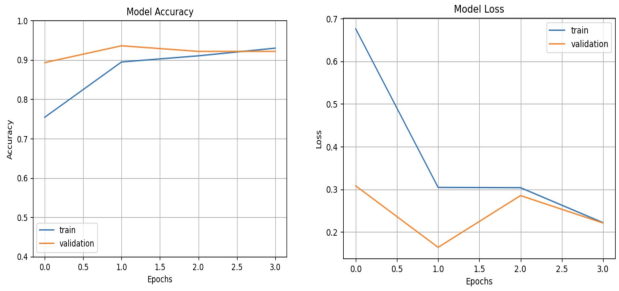
After preprocessing the dataset we have to find the best model. We applied two Convolutional Neural Network (CNN) architectures which are ResNet 50 and VGGNet16.



ResNet 50 Model

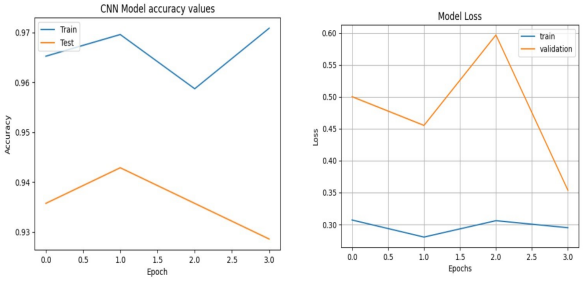
v. RESULT

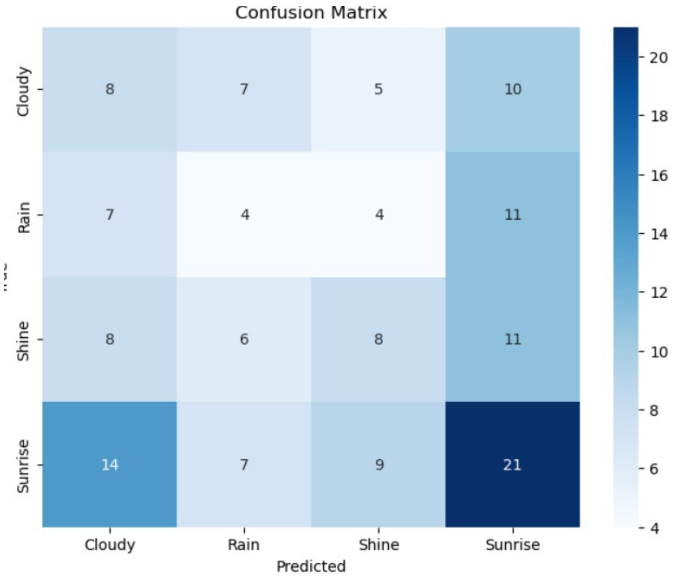
The accuracy is the percentage of correct predictions made by the model. Precision measures the proportion of true positive predictions out of all positive predictions made by the model. Recall measures the proportion of true positive predictions out of all actual positive instances in the dataset. F1 score is the harmonic mean of precision and recall.The accuracy of weather prediction using ResNet 50 model is 94%



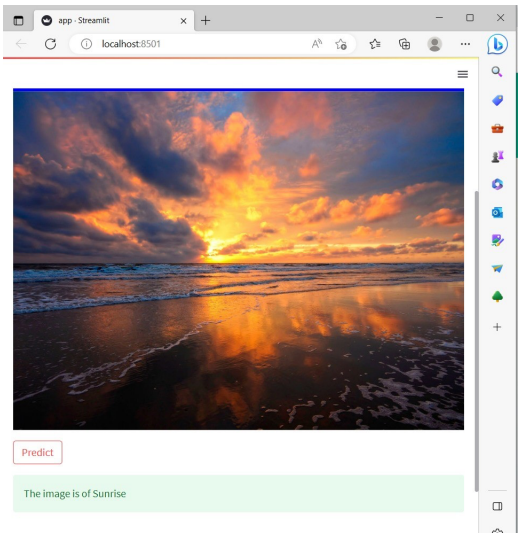
Accuracy loss

Following are Accuracy and loss of VGGNet16 Model.





As we can observe from the above graphs the ResNet Model has better accuracy than VGGNet16 Model. Hence we deployed the following Model into a website using streamlit where you can upload picture and predict the weather.



Deployment of Website to predict weather

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