Assessment Report

on

"COVID-19 Case Prediction"

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BACHELOR OF TECHNOLOGY DEGREE

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in

Intro To AI

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COVID-19 Case Prediction

🧩 1. Problem Statement

The objective of this project is to develop a time-series prediction model to forecast future COVID-19 cases based on historical data. By applying regression techniques, the model aims to analyze trends, identify growth patterns, and provide visual insights to support public health planning and decision-making amid the ongoing pandemic..

📦 2. Dataset Description

The dataset used in this project is sourced from the Johns Hopkins University Center for Systems Science and Engineering (JHU CSSE) and contains:

- **Daily confirmed COVID-19 cases for various countries.**
- **Format: Dates as rows, country names as columns.**
- **File used: CONVENIENT_global_confirmed_cases.csv (cleaned version of raw global case data).**

Key Features:

- **Date-wise cumulative confirmed cases.**
- **Multiple countries included; India was selected for forecasting.**
- **Data range: From January 23, 2020 to the last recorded date.**

🧠 3. Objective

The primary objective of this project is to:

Forecast future COVID-19 cases in India using regression-based time series modeling techniques.

Specific goals:

- **Understand growth trends in COVID-19 case counts.**
- **Predict the number of future cases for the next 30 days.**
- **Visualize the results for decision-making or trend analysis.**

🔍 4. Data Preprocessing

The raw data required several transformation steps:

✅ Steps:

1. **Removed metadata rows (first row was not actual data).**
2. **Converted the 'Country/Region' column to DateTime format.**
3. **Set the Date as the index of the dataframe.**
4. **Selected India's column to isolate case counts.**
5. **Handled missing values by dropping them using .dropna().**
6. **Created features for regression:**
    - **Independent variable: Day index (0, 1, 2, ..., N)**
    - **Dependent variable: Confirmed COVID-19 case**

📐 5. Model Building

We used Linear Regression, a simple supervised learning method, to model the trend of cases.

📌 Steps:

- **Model: LinearRegression() from sklearn.linear_model**
- **Training data: All days except last 30 days**
- **Future prediction: Next 30 days beyond the available data**

🛠 Tools & Libraries:

- **pandas: For data manipulation**
- **numpy: For numerical operations**
- **scikit-learn: For machine learning model**
- **matplotlib: For visualization**

🎯 6. Results

- **The model successfully learned a linear trend in India's COVID-19 case counts.**
- **Future predictions followed the established upward trajectory.**

📈 Plot:

A graph was generated showing:

- **Blue line: Actual cumulative cases**
- **Orange dashed line: Predicted trend (including 30 future days)**
- **Gray dotted line: Train/test split point**

🛠️ Approach to Solving the Customer Churn Prediction Problem

📥 Data Collection

Source: Johns Hopkins University (JHU CSSE COVID-19 dataset).

File used: CONVENIENT_global_confirmed_cases.csv

Type: Time-series data (date-wise cumulative confirmed cases per country).

Country Selected: India

🖌️ Data Preprocessing

- **Remove metadata rows and irrelevant columns.**
- **Convert date strings to datetime format.**
- **Set Date column as the index.**
- **Select country-specific data (India).**
- **Convert cumulative case numbers to numeric format.**
- **Handle missing/null values using .dropna() or imputation.**
- **Create time index as feature (e.g., day 0, 1, 2, ..., N).**

📊 Exploratory Data Analysis (EDA)

- **Plot raw case trends using Matplotlib/Seaborn.**
- **Observe growth pattern (e.g., linear, exponential).**
- **Optionally, perform log transformation if exponential growth is observed.**

🧠 Model Selection & Building:

- **Linear Regression (baseline model).**
- **Polynomial Regression (to capture non-linearity).**
- **Advanced options: ARIMA, Facebook Prophet, LSTM (if needed).**
- **For Linear Regression:**
- **X (feature): time (in days).**
- **y (target): cumulative confirmed cases.**

Model Training:

- **Train on majority of data (e.g., all but last 30 days).**
- **Predict future values using extrapolated time steps.**

💉 **Model Evaluation:**

- **MAE (Mean Absolute Error)**
- **MSE (Mean Squared Error)**
- **RMSE (Root Mean Squared Error)**
- **R^2 Score (goodness-of-fit)**
- **Evaluate predictions on both train and test splits.**

📈 **Visualization**

- **Plot actual vs predicted case counts.**
- **Use a vertical line to indicate the train-test split.**
- **Forecast 30 future days and display as a dotted/dashed line.**

📌 **Result Interpretation**

- **Assess whether the model captures the trend well.**
- **Use R^2 to check how well the model explains variance.**
- **Identify overfitting or underfitting based on metrics.**

🛠 **Recommendations**

- **If linear model underfits, try polynomial or exponential fitting.**
- **For realistic forecasting, consider epidemiological models or LSTM/Prophet.**

📦 **Future Enhancements**

- **Use daily new cases instead of cumulative counts.**
- **Incorporate external features (e.g., lockdown dates, testing rates).**
- **Try ensemble methods or neural networks for more accurate prediction.**

CODE

```python
# Step 1: Upload the dataset.zip
from google.colab import files
uploaded = files.upload()
```

Choose Files No file chosen

```python
# Step 2: Extract the zip file
import zipfile
import os

zip_path = 'dataset.zip'
extracted_path = 'covid_dataset'

with zipfile.ZipFile(zip_path, 'r') as zip_ref:
    zip_ref.extractall(extracted_path)

os.listdir(extracted_path)
```

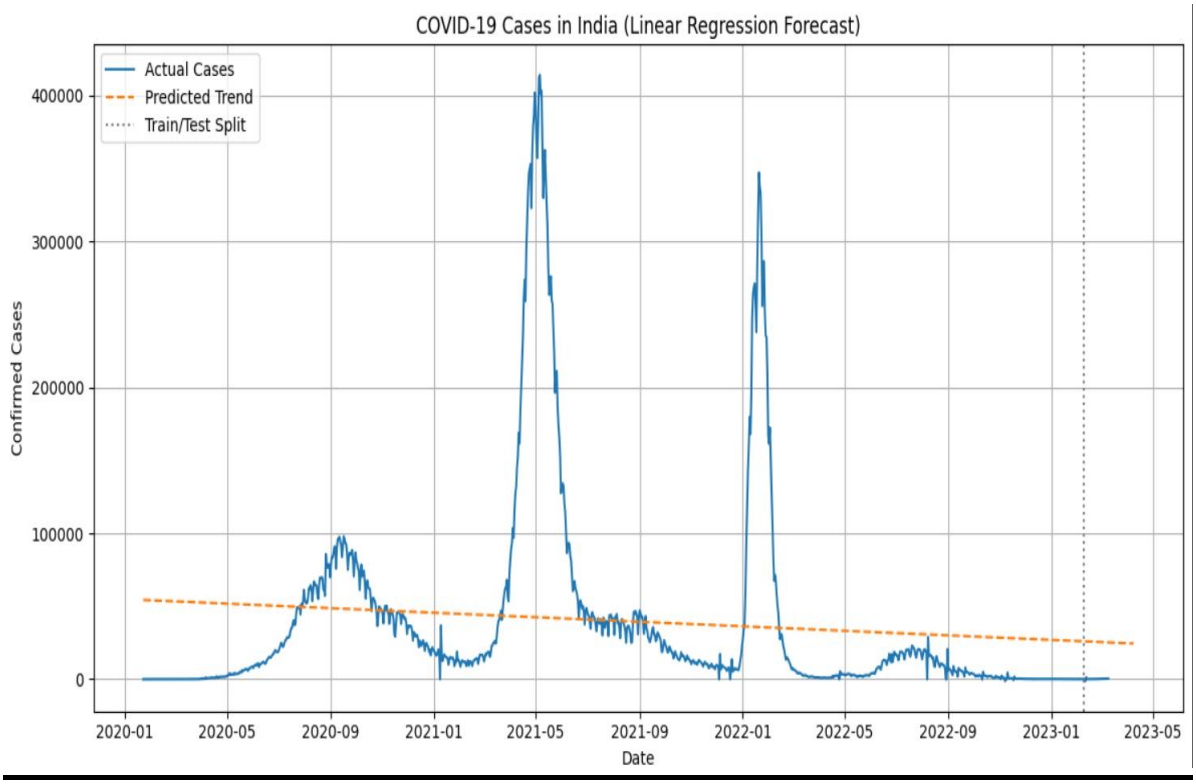
-

```python
# Step 3: Load global confirmed cases data
import pandas as pd

file_path = os.path.join(extracted_path, 'CONVENIENT_global_confirmed_cases.csv')
df = pd.read_csv(file_path)

# Drop the metadata row and fix headers
df = df.drop(index=0)
df.rename(columns={'Country/Region': 'Date'}, inplace=True)
df['Date'] = pd.to_datetime(df['Date'])
df.set_index('Date', inplace=True)
df = df.apply(pd.to_numeric, errors='coerce')

# Extract India's time series
india_cases = df['India'].dropna()
india_cases.head()
```

```python
# Step 4: Linear Regression and Prediction
from sklearn.linear_model import LinearRegression
import numpy as np
import matplotlib.pyplot as plt

# Prepare features (days since start)
X = np.arange(len(india_cases)).reshape(-1, 1)
y = india_cases.values

# Train/test split
train_size = len(X) - 30
X_train, y_train = X[:train_size], y[:train_size]

# Train linear regression model
model = LinearRegression()
model.fit(X_train, y_train)

# Predict for historical + 30 future days
X_future = np.arange(len(india_cases) + 30).reshape(-1, 1)
y_pred = model.predict(X_future)

# Create date range for full prediction
future_dates = pd.date_range(start=india_cases.index[0], periods=len(X_future))
```

```
# Plotting
plt.figure(figsize=(12, 6))
plt.plot(india_cases.index, y, label='Actual Cases')
plt.plot(future_dates, y_pred, label='Predicted Trend', linestyle='--')
plt.axvline(india_cases.index[train_size], color='gray', linestyle=':', label='Train/Test Split')
plt.title('COVID-19 Cases in India (Linear Regression Forecast)')
plt.xlabel('Date')
plt.ylabel('Confirmed Cases')
plt.legend()
plt.grid(True)
plt.tight_layout()
plt.show()
```

RESULT


COVID-19 Cases in India (Linear Regression Forecast)
Actual Cases
Predicted Trend
Train/Test Split
Confirmed Cases
400000
300000
200000
100000
0
2020-01
2020-05
2020-09
2021-01
2021-05
2021-09
2022-01
2022-05
2022-09
2023-01
2023-05
Date