Corning Future Innovator Program2025

Corning Digital and IT Centre India

Instructions

- Form a team of **two** – comprising of undergraduate students of any engineering disciplines. You are not eligible to enter the competition individually.
- The problem is designed to encourage interdisciplinary thinking, robust solutioning and trending digital technology.
- Comprehend the problem statement and submit the abstract in PDF.
- Teams shortlisted for the final round will be emailed by **Friday, July 11, 2025**.
- All the necessary information is provided about the problem. In case, additional information is required, make suitable assumptions, and clearly state them.

By participating, you are agreeing to the following terms and conditions:

- Any information provided to Corning shall be considered non-confidential. You shall not share any information protected under any law, patent, confidentiality, or other contract, etc.
- Nothing provided by you shall prohibit or restrict Corning's right to develop, make, use, market, license, or distribute products and services. You acknowledge that Corning may already possess or have developed products or services similar to or competitive with those provided by you.

Problem 2 – Carbon Emissions Prediction by Country or Sector

Background

Climate change, driven largely by carbon emissions, is one of the most pressing issues faced by the global community. These carbon emissions come from a variety of sources, including energy production, industrial processes, transportation, and land use, and vary significantly between different countries and sectors. Understanding the patterns and predictors of these emissions is crucial in the development of effective mitigation strategies and policies.

Emerging technologies and methodologies in data analysis and predictive modelling provide us with the tools to better understand and forecast future carbon emissions based on historical data. This predictive capability can inform policy decisions, guide resource allocation, and help track progress towards emission reduction goals.

In this project, you will work on predicting carbon emissions by a specific country or sector using available data. Such data may include past emission levels, economic indicators, population statistics, energy use, industrial output, and more. The aim is to develop a model that can accurately predict future emissions based on these factors, and in doing so, contribute to the global effort to combat climate change.

Problem: Track and predict CO_2 emissions to support climate policy. Discuss how climate change will impact countries, climates and populations.

Use Machine Learning regression/timeseries forecasting techniques. Tools: Pandas, regression, visualization

Resources

- Reference Dataset (you may leverage others): Our World in Data CO_2 Dataset

Helper Code

Autoregressive Integrated Moving Average (ARIMA): ARIMA, and its seasonal variant SARIMA, are popular for time series forecasting. Vector Autoregression (VAR): VAR is a type of model that uses multivariate time series and the interdependencies between them to make forecasts. Exponential Smoothing (ETS): ETS models, such as Holt-Winters Exponential Smoothing, are useful for data with a clear trend and/or seasonal pattern.

```
import pandas as pd
from statsmodels.tsa.arima.model import ARIMA
import matplotlib.pyplot as plt

# Load your data
# Assuming 'timeseries_data.csv' is your data file and 'Date' is your date
column
df = pd.read_csv('timeseries_data.csv')
df['Date'] = pd.to_datetime(df['Date'])
df.set_index('Date', inplace=True)

# Define the ARIMA model
```

```
model = ARIMA(df, order=(5,1,0))  # Here, (5,1,0) are parameters (p,d,q)
for the ARIMA model

# Fit the model
model_fit = model.fit(disp=0)

# Summary of the model
print(model_fit.summary())

# Plot residual errors
residuals = pd.DataFrame(model_fit.resid)
residuals.plot()
plt.show()

# Forecast
forecast = model_fit.forecast(steps=10)  # Forecast the next 10 steps
print(forecast)
```

Solution Evaluation Metric

- Evaluate the carbon emissions historical data over time and visualize.
- Create a forecasting model based on one of the forecasting ML algorithms and describe why you chose that algorithm.
- Show regionally where carbon emissions are trending up and where they are trending down.
- Report out steps taken along the way, examples of outliers and recommendations for additional enhancements to the model or other methods to improve the model.