**DQN1 Case Study**

**Case Study:** **Urban Air Quality and Health Risk Prediction**

**Scenario:** Imagine you are part of a research team working for the U.S. Environmental Protection Agency (EPA). Your team has been tasked with designing an artificial intelligence (AI)-powered system that monitors real-time urban air quality and predicts health risk scores to inform preventive healthcare measures. You will explore multiple AI and machine learning (ML) approaches to model the impact of different environmental conditions (temperature, humidity, pollution) on public health.

The city has access to historical data on air pollution levels (PM2.5, NO2, CO2), weather conditions, and health-related information—such as health risk scores—based on weather and air quality conditions.

**Optimization Problem:** Urban air pollution and fluctuating weather conditions have a direct impact on public health, especially in major cities where population density and pollution levels are high. Your task is to develop a predictive model that can assess the health risk of residents based on air quality (PM2.5, NO2, CO2) and weather conditions (temperature, humidity, wind, etc.) in various U.S. cities.

The goals and requirements of this study are as follows:

1. Create a predictive model that accurately forecasts air quality levels based on weather conditions and pollution metrics (PM2.5, NO2, CO2).
2. Develop a highly efficient predictive model that assesses health risks based on urban air quality, weather data, and other relevant factors.

You will implement the chosen models for both urban air quality forecasting and health risk prediction and evaluate their performance using appropriate metrics such as RMSE, MAPE, and trend analysis. Ensure that the models accurately capture the relationships between weather conditions, pollution metrics, and health outcomes and assess their effectiveness across different time periods and urban areas.

Explore strategies to enhance model stability and accuracy in this type of scenario, such as incorporating real-time data feeds or adaptive algorithms. Then propose methods to continually update and recalibrate the models based on new data and emerging trends, ensuring they remain effective over time.

The model you create will help public health officials and city planners make data-driven decisions to improve air quality, manage environmental risks, and preemptively address health crises.