Case Study: Classifying Extreme Weather from Space

You are a second-year UVA Data Science student who has just joined a research team studying global weather hazards. Your task is to build an intelligent system that can spot dangerous weather events—cyclones, dust storms, and wildfires—directly from satellite images before they pose a threat on the ground. This is not a toy problem. It is the same real-world satellite dataset analyzed by Li and Momen (2021), whose best-performing model reached 92% accuracy using InceptionV3. Your challenge is to meet or surpass them using two modern computer vision models: **MobileNetV2** and **EfficientNetV2**.

Your supervisor gives you access to a GitHub repository containing the raw data, preprocessing script, and template model files:

- https://github.com/athena12341235/ExtremeWeatherClassification

But there's a twist: the original dataset contains five weather categories, and your team wants to simplify the task to a binary classification problem. You must reorganize the data into two groups: **Extreme** events (tropical cyclones, wildfires, dust storms) and **Normal** events (convective cell clouds, convective roll clouds).

From here, you will need to explore the data and build machine learning models capable of telling extreme and normal events apart. Your mission is to produce an analysis that includes:

1. A cleaned version of the original satellite dataset
2. Exploratory data analysis that highlights visual and statistical differences between classes
3. Transfer-learning models using MobileNetV2 and EfficientNetV2
4. Evaluation results such as accuracy, precision, recall, and confusion matrices
5. Interpretability outputs showing where your models look when detecting extreme weather

Good luck, analyst—your mission starts now.