Artificial Intelligence for Enhanced Rainfall Predictions: Leveraging Sequential Models and Advanced Callbacks for Climate Data Analysis

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Rainfall plays a particularly decisive role in areas prone to flooding, where deviations in rainfall patterns can dramatically impact water availability, transportation systems, environmental health, and short term urban planning. The ability to accurately predict rainfall can greatly assist government bodies, and private entities, allowing them to strategize and make informed short-term decisions in areas such as disaster management and early hazard warning systems , especially during periods of flood. In this context, Artificial Intelligence (AI) is playing an increasingly significant role in enabling precise predictions of rainfall. The study at hand leverages AI-based models to forecast next-day rainfall, focusing particularly on regions susceptible to flooding. The dataset used includes ten years' worth of daily weather observations from multiple flood-prone locations in India. The AI model makes its predictions using a range of meteorological indicators such as minimum and maximum temperatures, rainfall, evaporation, sunshine, wind gust speed, wind speed, humidity, pressure, cloud cover, and temperatures at two intervals of the day (9 am and 3 pm). The machine learning model employed is a sequential model with four layers, which incorporates dropout for regularisation. The initial model, utilising an early stopping callback, achieved an accuracy of 90.85%. In a bid to further enhance this, a Reduce Learning Rate on Plateau callback and a custom accuracy printing callback were introduced, leading to a remarkable improvement in predictive accuracy, with the enhanced model achieving a score of 94.78%. This approach can bring substantial benefits across various sectors, such as transportation, environmental planning, evacuation and rescue work in flood areas, by equipping them with reliable rainfall predictions to base their decisions upon.