# 🌊 Flood Prediction and Loss Assessment in India (1970–2023)

This project presents a machine learning–driven analysis of flood vulnerability and loss & damage (L&D) across Indian states from 1970 to 2023. It integrates hydrological, meteorological, and socio-economic datasets to improve flood prediction accuracy and inform disaster risk reduction strategies.

By applying advanced machine learning models such as Random Forest, Decision Trees, Support Vector Machines, XGBoost, and Artificial Neural Networks (ANN), the study evaluates flood forecasting capabilities and their correlation with development indicators.

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## 🔍 Key Features

- Analyzes historical flood events in India (1970–2023)

- Utilizes diverse datasets: meteorological, hydrological, and topographical

- Implements machine learning models:

- Random Forest

- Decision Tree

- Support Vector Machine (SVM)

- XGBoost

- Artificial Neural Networks (ANN)

- Evaluates flood predictions and regional risk mapping

- Correlates results with development factors (e.g., HDI, income levels)

- Concludes that:

- Flood frequency and intensity are increasing

- Current development strategies have limited impact on L&D reduction

- ML-based disaster management systems offer strong potential for mitigation

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## 📁 Project Structure

├── code/ : Scripts for data analysis, training, and evaluation

├── figures/ : Visualizations: trends, model performance

├── paper/ : Research manuscript (formatted for Computers & Geosciences)

└── README.md: Project overview

## 📊 Dataset

The study uses a compiled dataset including:

- Rainfall and temperature records (1970–2023)

- River discharge and flood occurrence data

- Land use and deforestation trends

- Human development indicators and economic loss data

> \*\*Note\*\*: Due to licensing restrictions, raw datasets are not publicly hosted. Data sources include government portals and peer-reviewed studies.

## ⚙️ Model Performance

\*Model results (e.g., accuracy, F1-score, RMSE) and comparison charts will be included in `/figures/` and discussed in detail in the paper.\*

## 📌 Citation Example (Author–Date Format)

Example of in-text citation:

`(Abijith et al., 2025; Bahinipati and Patnaik, 2020; Muthukrishnan et al., 2017)`

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