Urban Pluvial Flooding Risk Analysis

A Data-Driven Approach to Urban Resilience

Problem Statement

- Heavy rainfall overwhelms city drainage → urban pluvial floods
- Leads to: property damage, traffic disruption, public health hazards
- Current city planning often lacks data-driven insights

A Data-Driven Action Cycle

DATA → ANALYSIS → INSIGHTS → ACTION

- Analyze synthetic dataset (rainfall, drainage, flood depth, population density)
- Identify high-risk wards/cities
- Provide actionable recommendations for flood resilience

Dataset Overview

- Variables: City, Ward, Rainfall (mm), Drainage Capacity, Flood Depth, Population Density
- Dataset: Synthetic but realistic urban flood patterns
- Covers multiple cities & micro-areas (wards)

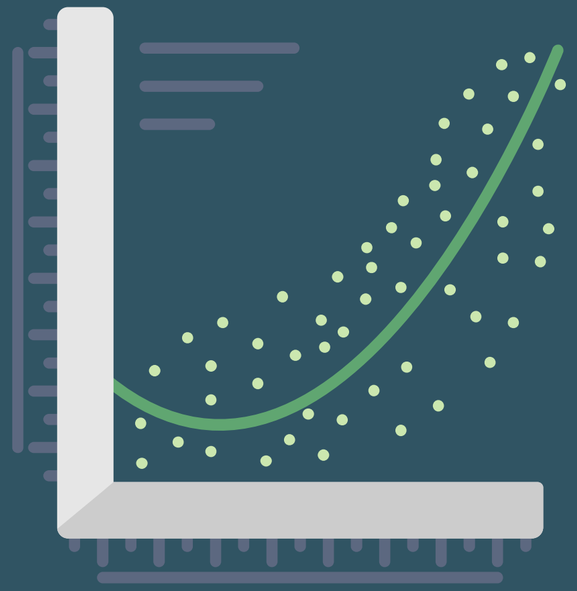
CITY	RAINFALL (mm)	DRAINAGE (index)	POPULATION (Millions)
TOKYO	1530	N/A	13.9
NEW YORK	1200	4.5	8.4
MUMBAI	2400	2.1	20.5
SYDNEY	1150	N/A	5.3

Methodology (EDA)

- Step 1: Data cleaning & preparation
- Step 2: Univariate analysis → distributions
- Step 3: Bivariate analysis → rainfall vs flood depth, drainage vs flood depth
- Step 4: Correlation analysis
- Step 5: Risk ranking of cities/wards

Key Findings

- Rainfall has a strong positive correlation with flood depth
- Wards with low drainage capacity flood the most
- High population density worsens flood impacts
- Certain cities consistently have higher average flood depths



Proposed Solutions

- Data-driven risk mapping – identify top-risk wards
- Infrastructure upgrades – improve drainage, rainwater harvesting, permeable pavements
- Predictive modeling & alerts – use weather + drainage data for early warnings
- Urban planning & zoning – restrict construction in high-risk areas
- Community awareness – waste management, household-level resilience
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Possible Project Extensions

- Interactive Dashboard (Streamlit/PowerBI): visualize risks ward-wise
- Flood Prediction Model: predict flood depth given rainfall + drainage
- Urban Simulation Tool: test “what-if” scenarios (e.g., +20% drainage capacity)
- Mobile Alert App: warn residents in high-risk wards during heavy rainfall

Conclusion

- Urban pluvial floods are data-driven, predictable, and preventable
- High-risk wards must be prioritized for resilience investment
- Combining data analysis, infrastructure, and community action can greatly reduce flood impacts