

## Risk Mapping of Istanbul: *Using Earthquake Data*

# Istanbul

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# About Istanbul



## Population

16 Million



## Strategic Location

Connects Europe & Asia  
Links Black Sea to Mediterranean  
Key hub for global trade & economy



## District

39



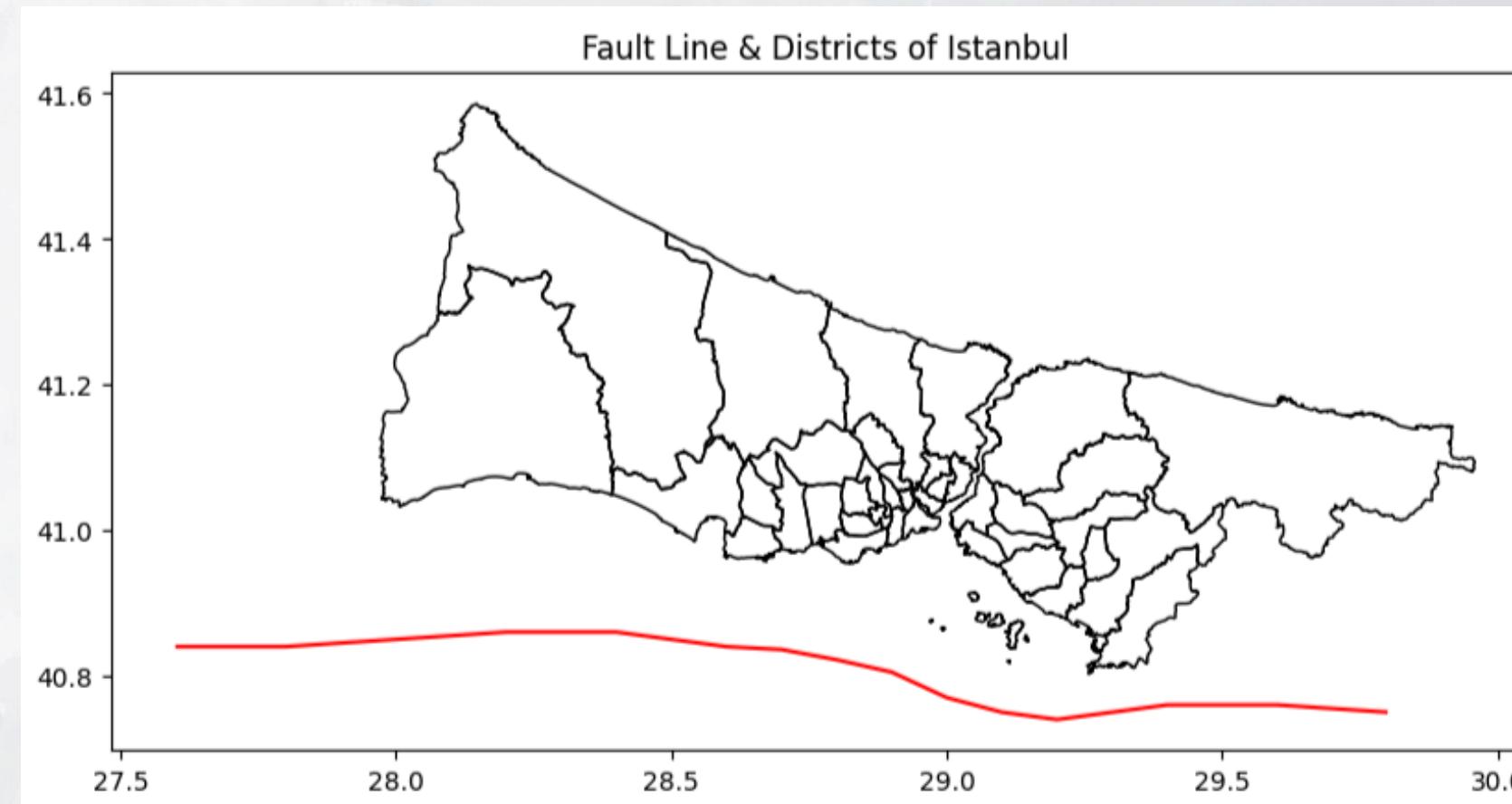
## Risk

On the North Anatolian Fault  
History of destructive earthquakes  
>65% chance of M7+ quake in 10 years!

But... Is **Istanbul** prepared for the *next big earthquake*?

# Project Objective

This project aims to estimate and visualize the relative **earthquake risk** across Istanbul's 39 districts.



Which districts are most at risk and why?



Which features contribute the most to the overall risk?

To address this question, I created and analyzed 9 district-level features.



# Dataset & Variables

Each feature was constructed by combining multiple relevant data sources.



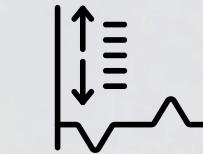
## Impact Score

Reflecting the impact of past earthquakes on the district



## Fault Line Score

Measuring the district's proximity to the North Anatolian Fault Line



## Altitude Score

The assumption that risk changes with increasing altitude



## Population Density

Risk and damage potential in densely populated districts



## Building Density

Number of buildings per area



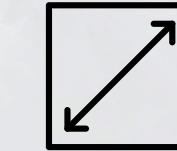
## Building Age Score

The effect of building age on risk



## Building Floor Score

Risk of collapse due to height



## Green-Free Area Score

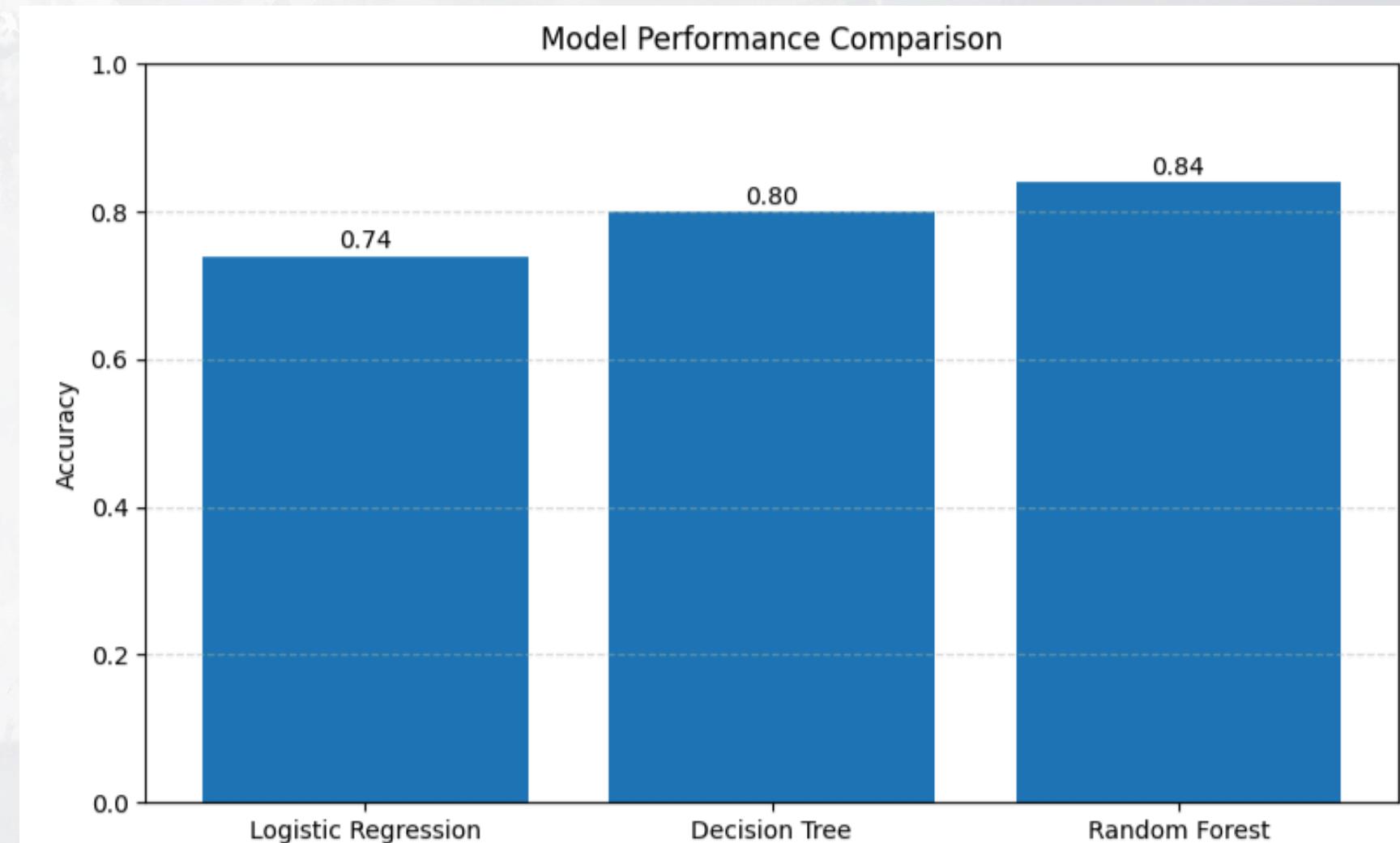
the risk posed by the lack of emergency assembly areas



## Infrastructure Score

Measuring post-disaster response capacity

# Models



1

## 1 Logistic Regression

I used Logistic Regression as a baseline model to understand the general relationship between features and risk levels.

2

## 2 Decision Tree

I used Decision Tree to visually understand how risk is determined and to keep the model fully interpretable.

3

## 3 Random Forest

I used Random Forest to improve accuracy and test whether combining trees would produce more stable predictions.

# Explainability

1

**SHAP**

I used SHAP to understand the global impact of each variable across all districts.

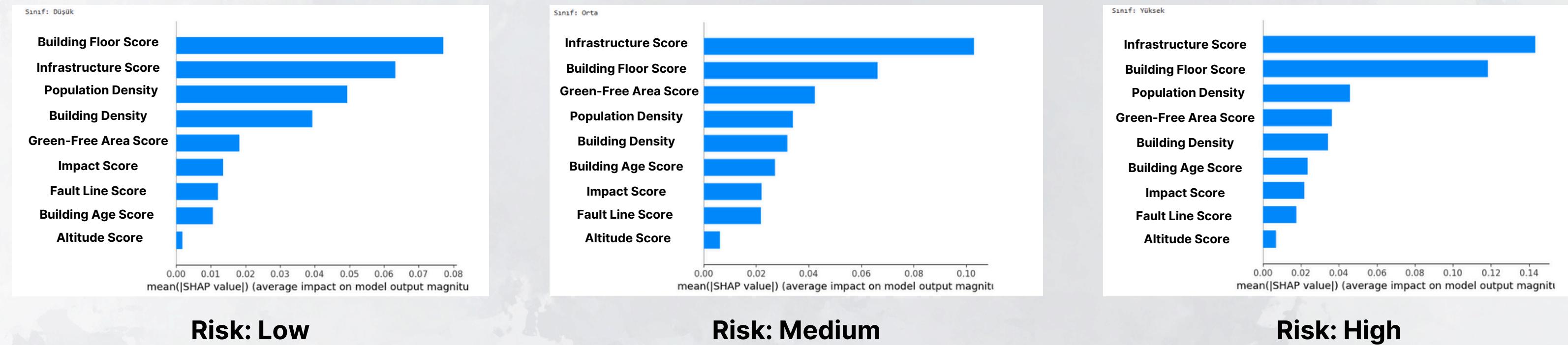
2

**LIME**

I used LIME to explain specific district-level predictions.

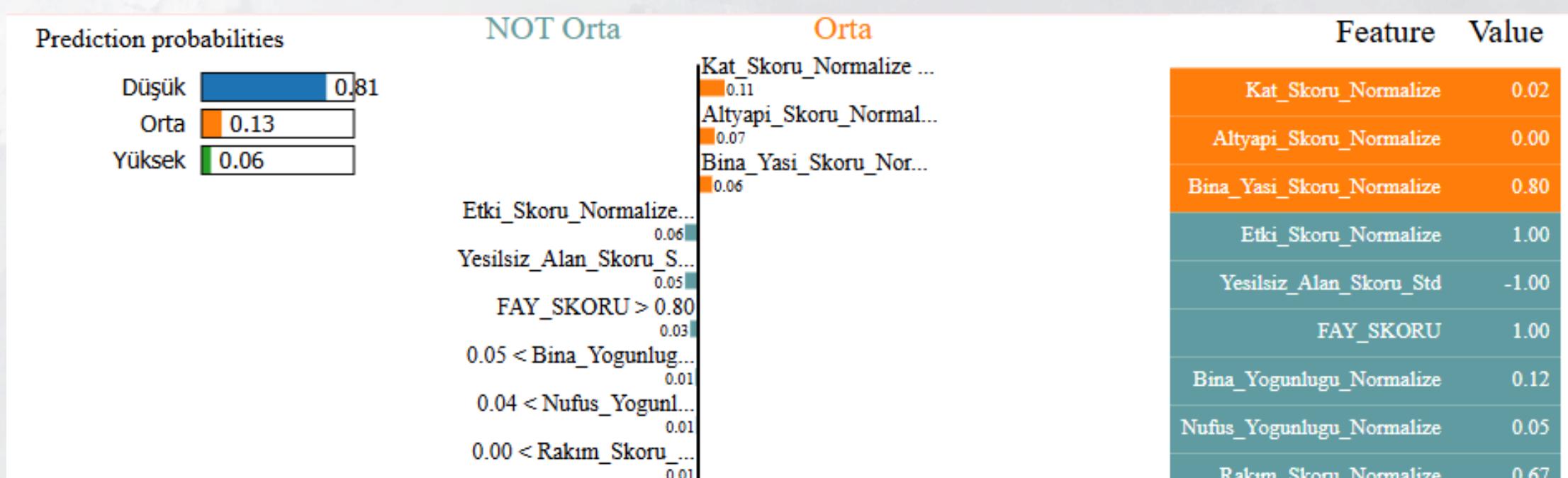
# Explainability

Shap:

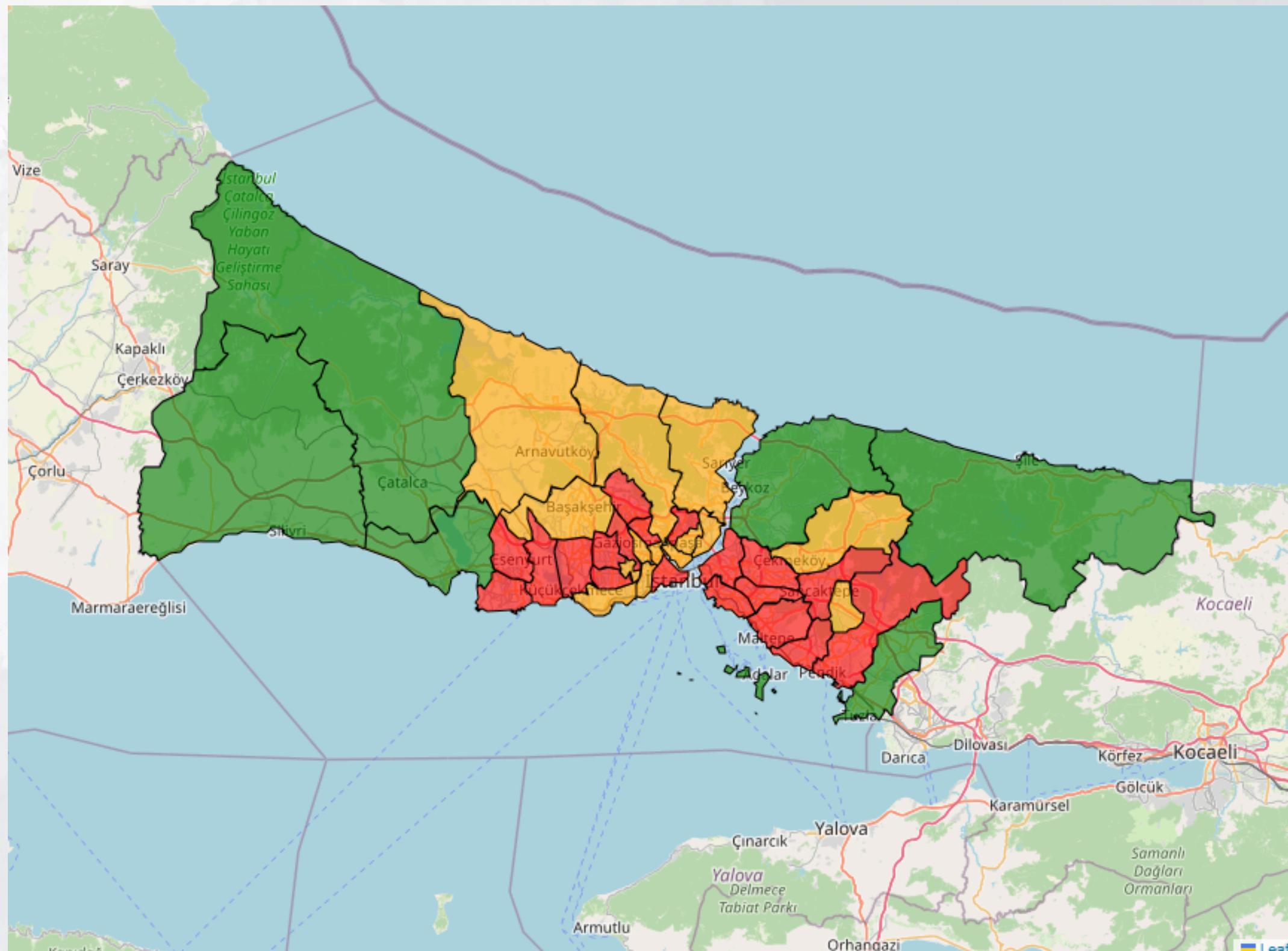


# Explainability

Lime:



# Map & Results



**Low Risk Districts:** 7  
**Medium Risk Districts:** 13  
**High Risk Districts:** 19

## ! Results:

Approximately **10 million** people live in the 19 districts identified as high risk.

This accounts for nearly **60%** of the city of Istanbul's total population, highlighting that:

A very large number of people reside in high risk areas, which could lead to severe human and structural losses in the event of a major earthquake.

## References

- İstanbul Metropolitan Municipality (İBB) - Open Data Portals
- AFAD Earthquake Catalog
- Kandilli Observatory
- TÜİK (Turkish Statistical Institute)
- MTA General Directorate



**Thank You for Listening.**