Project Proposal

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Problem Statement:

Earthquakes are devastating natural disasters with severe consequences for life, infrastructure, and economies. Current prediction methods are limited, making proactive measures challenging. This project aims to apply data mining techniques to seismic data to identify predictive patterns and develop a model for predicting Structural Collapse Probability during earthquakes.

Significance:

By accurately predicting collapse probability, this model can improve building design and construction, assist engineers and architects in developing safer structures, help policymakers enforce building codes and risk mitigation strategies, and aid disaster preparedness efforts by identifying high-risk structures before an earthquake.

Data Mining and Objectives:

Problem: Predict Structural Collapse Probability during earthquakes using seismic data.

Approaches**:**

- Multiple Linear Regression
- Support Vector Machine
- Decision Tree and Random Forest
- K-Nearest Neighbors:
    - If Collapse Probability ≤ 30%, classify as Low Risk (0)
    - If Collapse Probability 31%-70%, classify as Moderate Risk (1)
    - If Collapse Probability ≥ 71%, classify as High Risk (2)
- Artificial Neural Net
    - ReLu - Regression Model
    - Softmax - Classification Model

Data Representation: Features include Seismic Zone Classification, Seismic Wave Frequency Content, Soil Type, Building Height, Natural Frequency, Number of Stories, etc.

Target Variable: Structural Collapse Probability (%)

Techniques & Models:

- **EDA & Feature Engineering:** Understanding patterns and refining data.
- **Evaluation Metrics:**
    - **Multiple Regression:** Mean Squared Error (MSE), Mean Absolute Error (MAE), R-squared, Root Mean Squared Error, Mean Absolute Percentage Error
    - **Decision Tree:** Precision, Recall, F1-Score, Accuracy, Specificity
    - **Support Vector Machine:** Precision, F1-Score, ROC-AUC
    - **K-Nearest Neighbors:** Precision, Recall, F1-Score, Accuracy, Specificity
    - **Artificial Neural Net:** Precision, Recall, F1-Score, Accuracy, Specificity

Business Value:

Value Addition:

- **Structural Safety Assessment:** Evaluates real-time building risks.
- **Engineering & Construction:** Supports earthquake-resistant design.
- **Disaster Preparedness:** Identifies high-risk structures before an event.
- **Insurance & Risk Management:** Helps insurers assess earthquake-related risks.

Beneficiaries:

- Engineers, construction firms, and policymakers.
- Government agencies for urban planning and resilience.
- Insurance companies for accurate risk assessment.
- Businesses and property owners for proactive safety measures.

Final Achievements:

- Clear classification option to meet assignment requirements
- Explicit model choices to strengthen methodology
- Expanded business value and real-world application