Modeling Earthquake Damage

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Project 5
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THE TEAM

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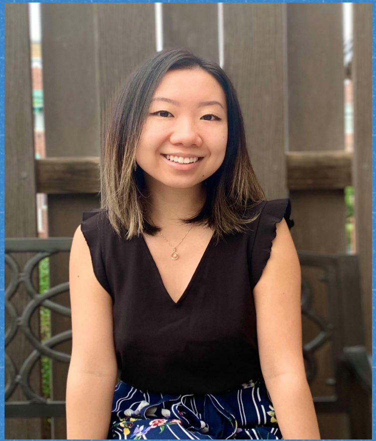

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AGENDA

1. Background
2. Problem Statement
3. Data Cleaning
4. EDA
5. Modeling
6. Streamlit Demo
7. Conclusion / Recommendations
8. Limitations & Future Project Refinements

GORKHA EARTHQUAKE

Date: April 25, 2015

Location: 50 miles NW of Kathmandu

Intensity: 7.8 on the Richter scale

Deaths: 8,900

Injuries: 22,000

Homes affected:

over 1,000,000

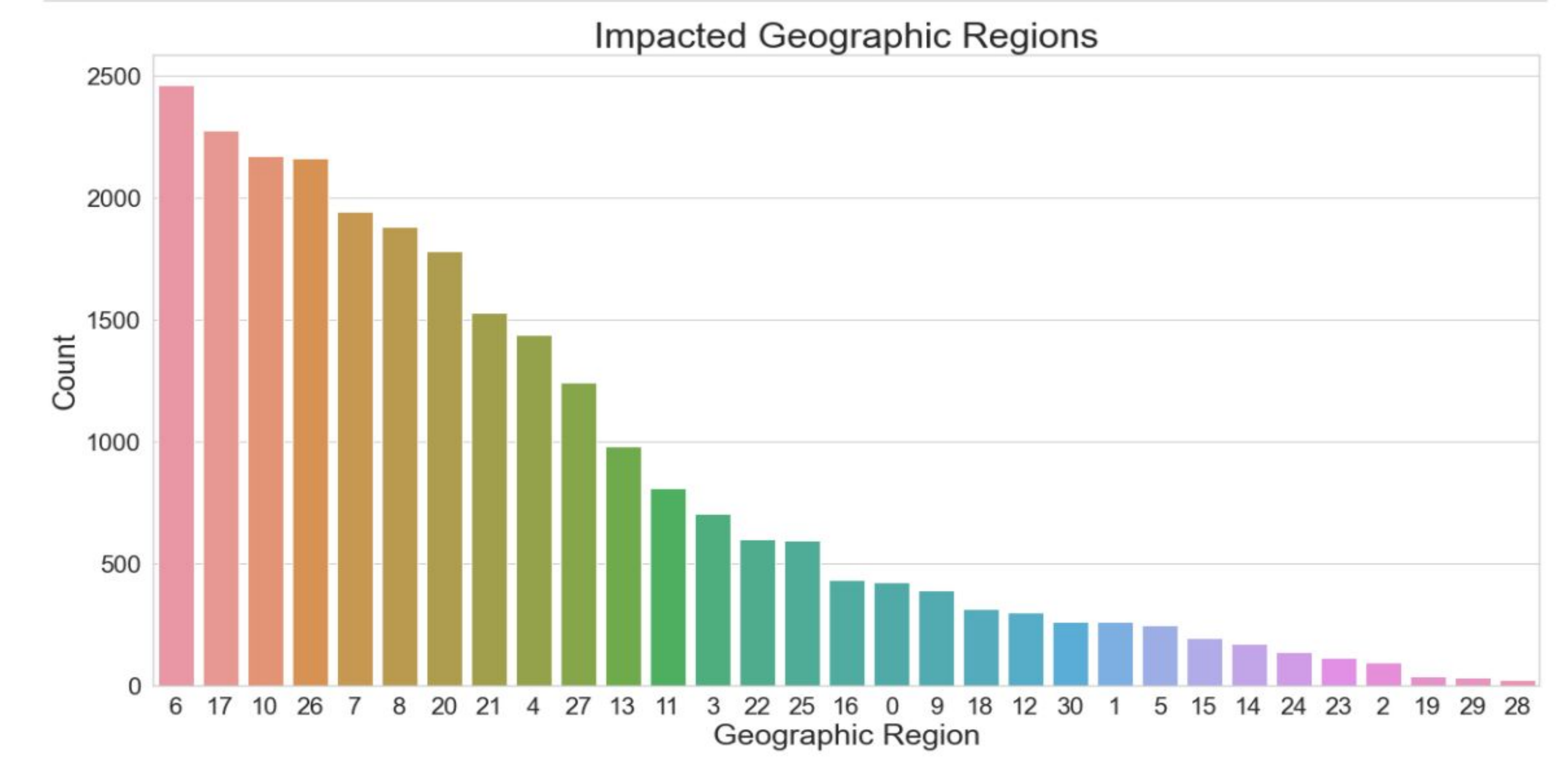
PROBLEM STATEMENT

Is it possible to predict the level of damage sustained by a building in the 2015 Gorkha earthquake in Nepal using classification modeling against the building’s features?

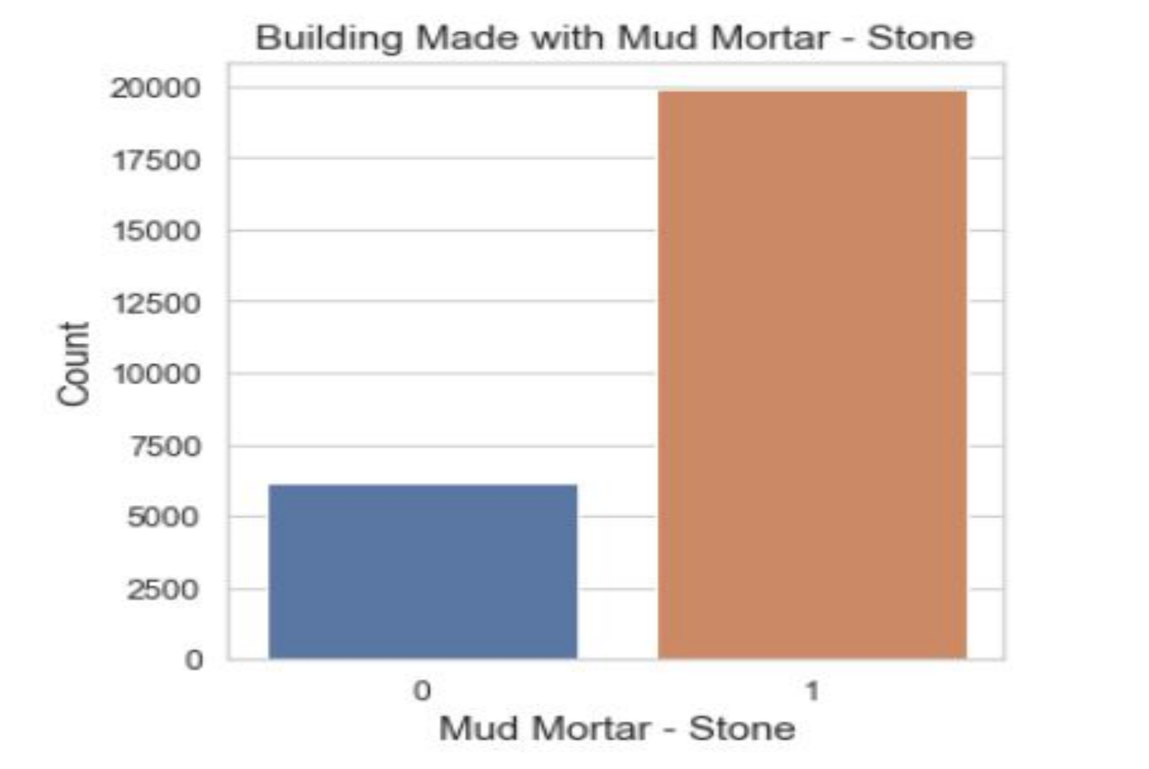
DATA COLLECTION & CLEANING

- Gathered data from drivendata.org
- Label Encoded features
- Checked for null values
- Utilized 10% of Dataset

DATA VISUALIZATIONS

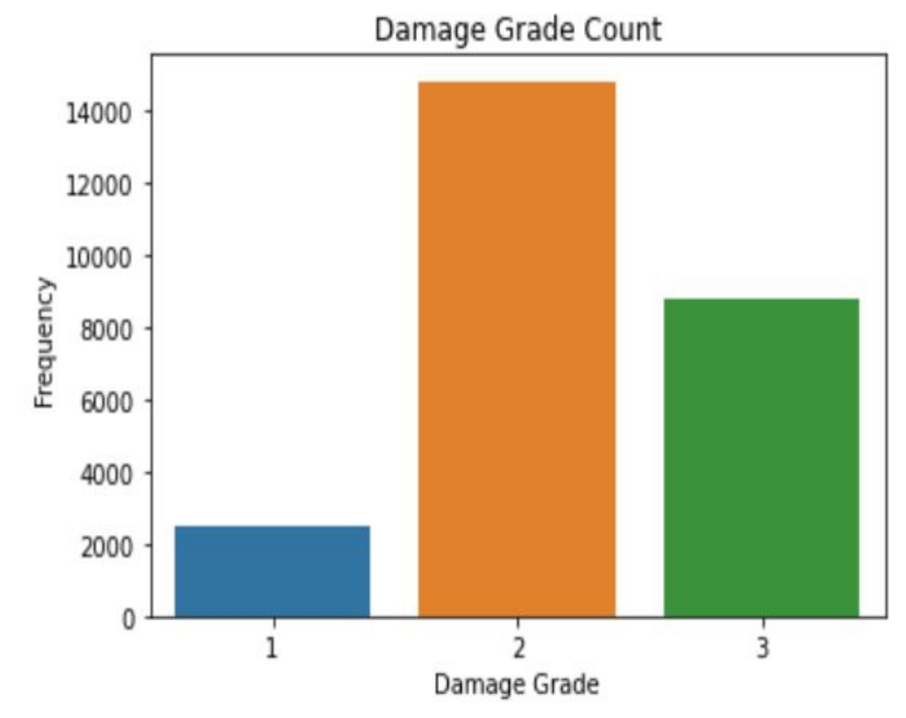


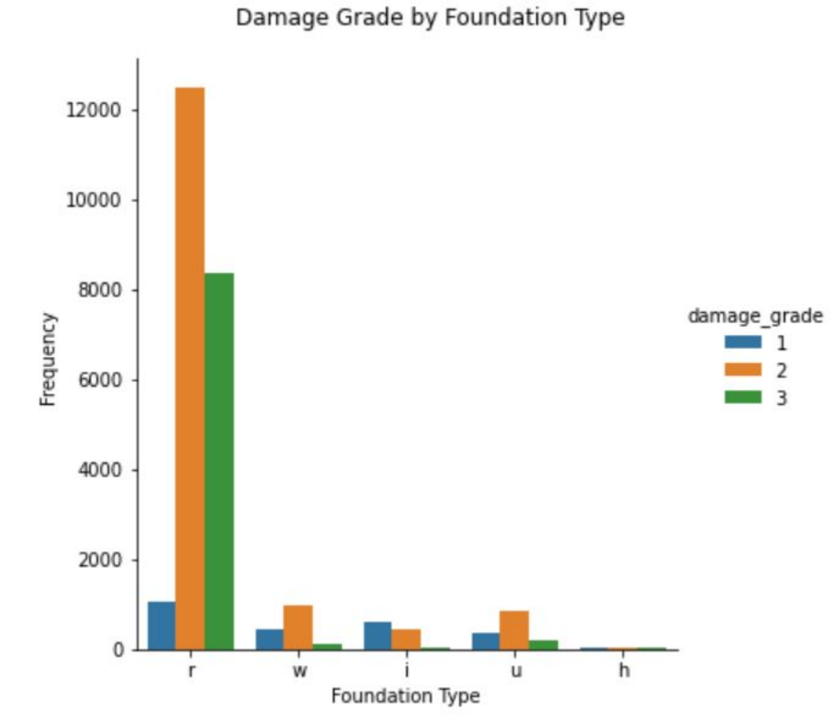
DATA VISUALIZATIONS (CONT’D)



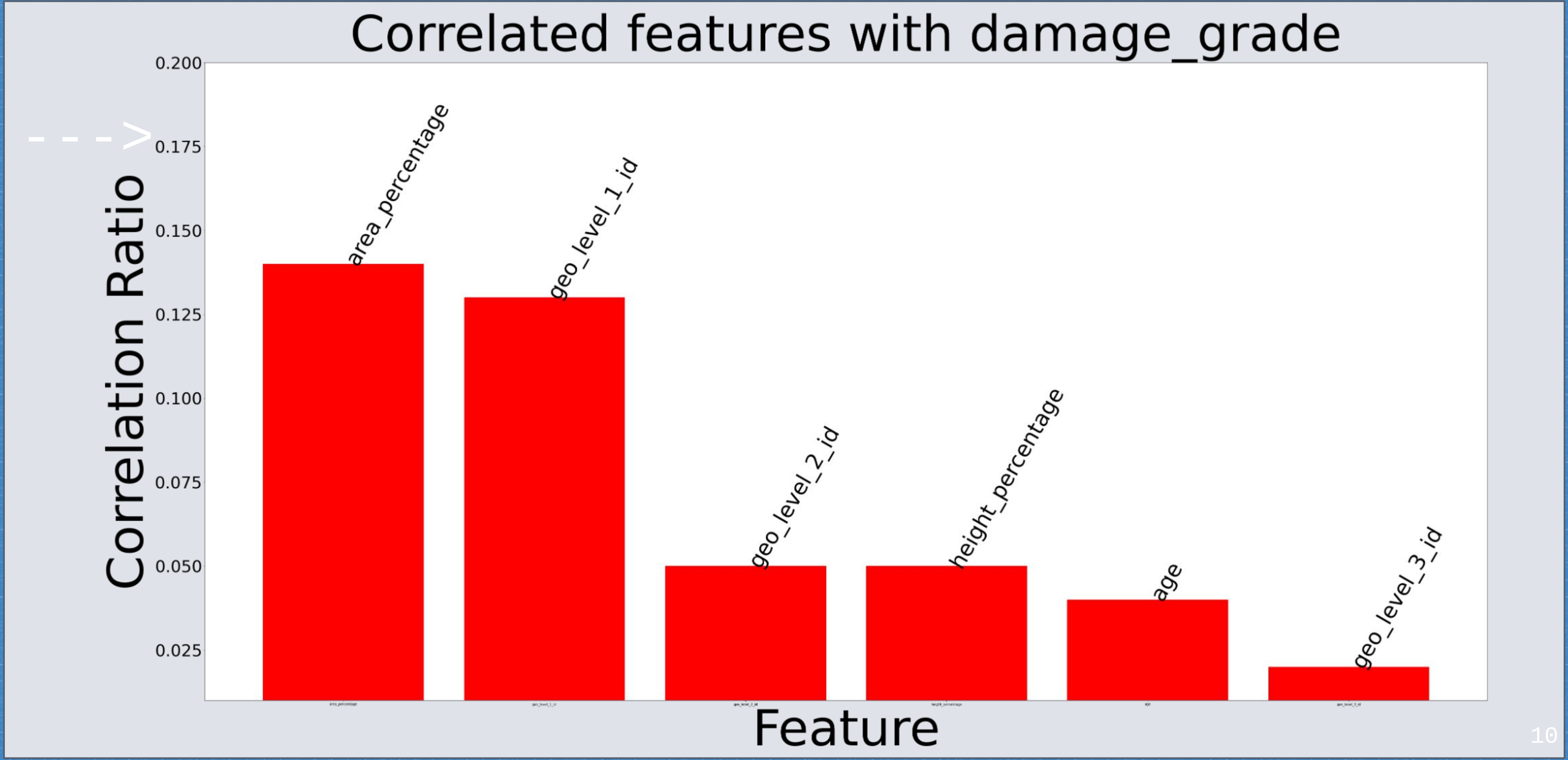
Sample size = 26,000
Mud = 20,000
Remainder = 6,000

DATA VISUALIZATIONS (CONTINUED)





FEATURE CORRELATIONS



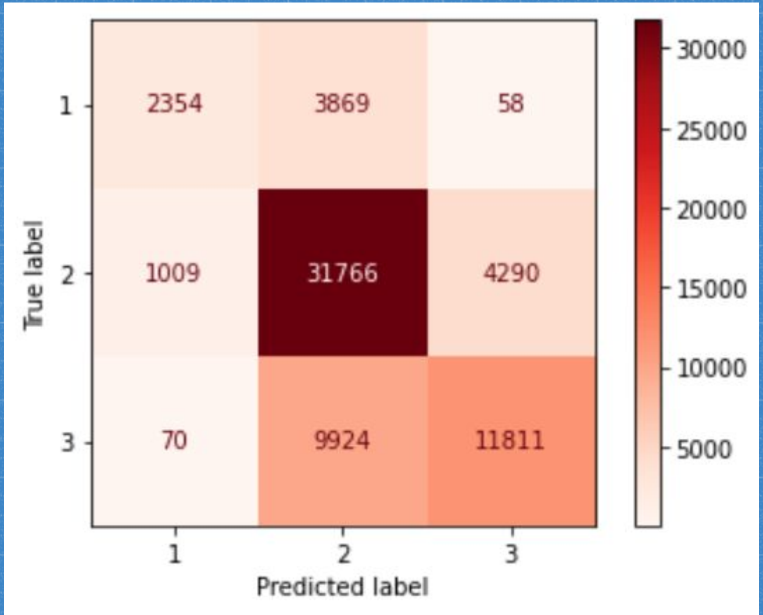
CLASSIFICATION MODELS TESTED

MODEL NAME	ACCURACY SCORE
Logistic Regression	0.583
KNearestNeighbors	0.571
Random Forest Classifier	**0.689**
Extra Trees Classifier	0.678
Decision Tree Classifier	0.665
Bagging Classifier	0.668
AdaBoost Classifier	0.660
Neural Network	0.568
Baseline Accuracy Model	***0.567***

BEST MODEL

- **Random Forest Classifier**
  70% Accuracy Score (All Data)

- Label Encoding
- Standard Scaler
- GridSearchCV -- Best Params
  - Max_depth = 11
  - Max_features = 35



BEST MODEL (CONT'D)

Feature Importances
Geo Level ID 1
Geo Level ID 2
Geo Level ID 3
Superstructure Mud Mortar Stone
Age

Permutation Feature Importances
Foundation Type
Age
Roof Type
Count Families
Superstructure Mud Mortar Stone

Streamlit Demo

CONCLUSIONS

- Neural Networks, KNN models did not perform well
- Logistic Regression, Boosting, Tree models did perform better
- Random Forest Classifier best classified the earthquake damage grade based off the features modeled
- Most important features: foundation type, building age, roof type, family count, mud mortar/stone superstructure

RECOMMENDATIONS

- Emphasize proper roof/foundation type for new construction
- Consider building superstructure
- Reinforce older buildings
- Reinforce multi-family housing buildings
- Focus efforts on heavily-impacted geographic areas

LIMITATIONS & FUTURE PROJECT REFINEMENTS

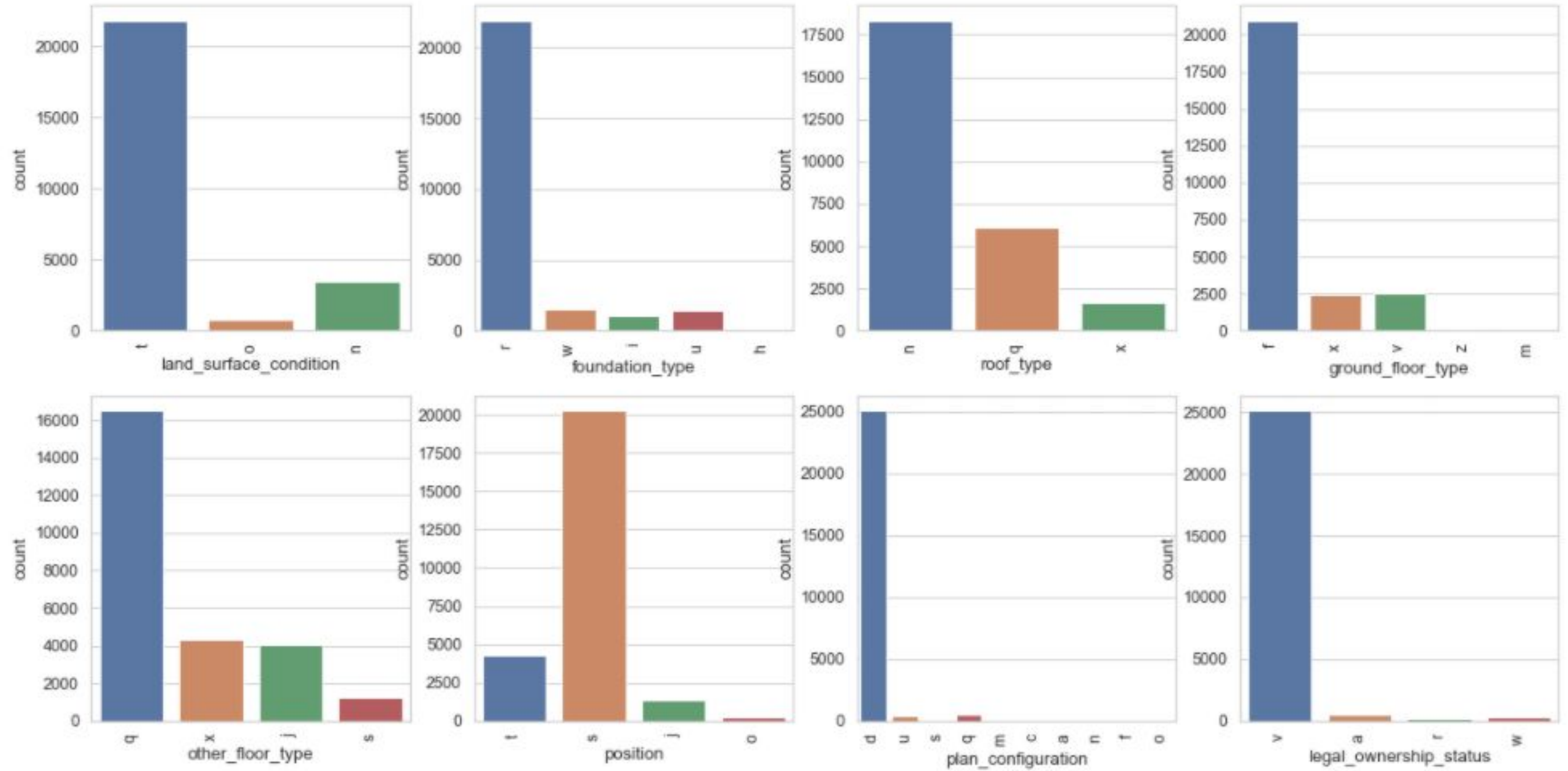
- Data Dictionary was limited in description
- Integrate imbalanced learning strategies
  - SMOTE, ADASYN, RandomOverSampler
- Integrate Boosting across the other tested models
  - AdaBoost, GradientBoost, HistGradientBoost

RESOURCES

- Project and Data source
  - Richtor's Predictor: Modeling Earthquake Damage
  - https://www.drivendata.org/competitions/57/nepal-earthquake/page/134/
- GA Instructional Team
  - Jeff Hale
  - Jacob Koehler
  - Eric Bayless

THANK YOU!
Questions?

Appendix


land_surface_condition
foundation_type
roof_type
ground_floor_type
other_floor_type
position
plan_configuration
legal_ownership_status
count