Forest Cover Type Prediction

- Diana Chacon
- Jyoti Kumari
- Malachy Moran

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Berkeley
UNIVERSITY OF CALIFORNIA

Agenda

Introduction
Data
Data Loading, Processing and Exploratory Data Analysis
Models
Results
Conclusion

Introduction

- Study area is located in the Roosevelt National Forest, CO.
- Each observation corresponds to 30m by 30m patch determined from US Forest Service (USFS) Region 2 Resource Information System data.
- Goal is to predict the forest cover type:

1. Spruce/Fir
2. Lodgepole Pine
3. Ponderosa Pine
4. Cottonwood/Willow
5. Aspen
6. Douglas-fir
7. Krummholz

Data

Training set – 15,120 observations (Features and Cover Type)
Test set – 565,892 observations (Features) ⇨ **Predict Cover Type**
Training Data Fields (56):

- ID
- Elevation
- Aspect
- Slope
- Horizontal_Distance_To_Hydrology
- Vertical_Distance_To_Hydrology
- Horizontal_Distance_To_Roadways
- Hillshade_9am (0 to 255 index)
- Hillshade_Noon (0 to 255 index)
- Hillshade_3pm (0 to 255 index)
- Horizontal_Distance_To_Fire_Points
- Wilderness_Area (4 binary columns, 0 = absence or 1 = presence)
- Soil_Type (40 binary columns, 0 = absence or 1 = presence)
- Cover_Type (7 types, integers 1 to 7)

Data Loading, Processing and EDA

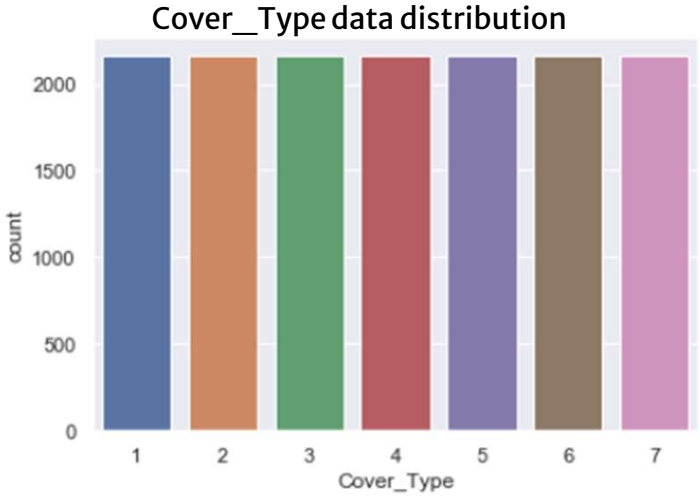
The train and test dataset were loaded

Only train dataset was used

Shuffle data

Split into training data (67%) and development data (33%)

- train_data (13608, 54)
- train_label (13608,)
- dev_data (1512, 54)
- dev_label (1512,)

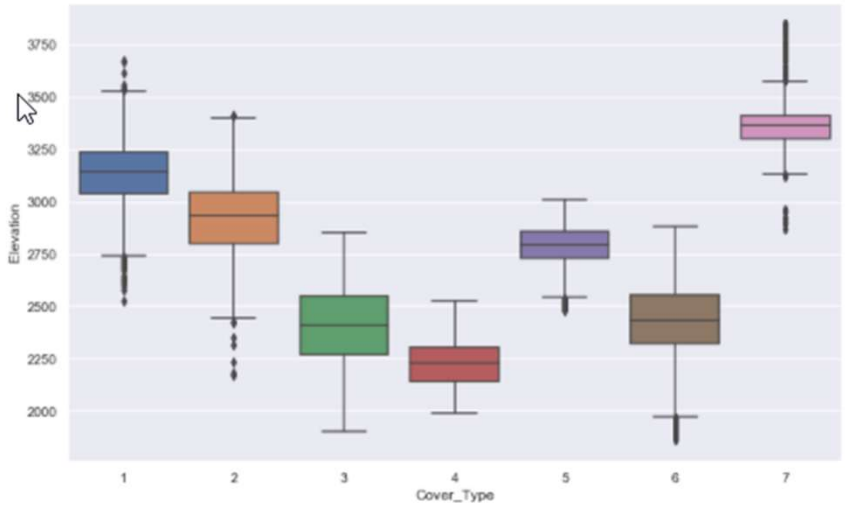


Check for unique values, na values, outliers or miscoded values

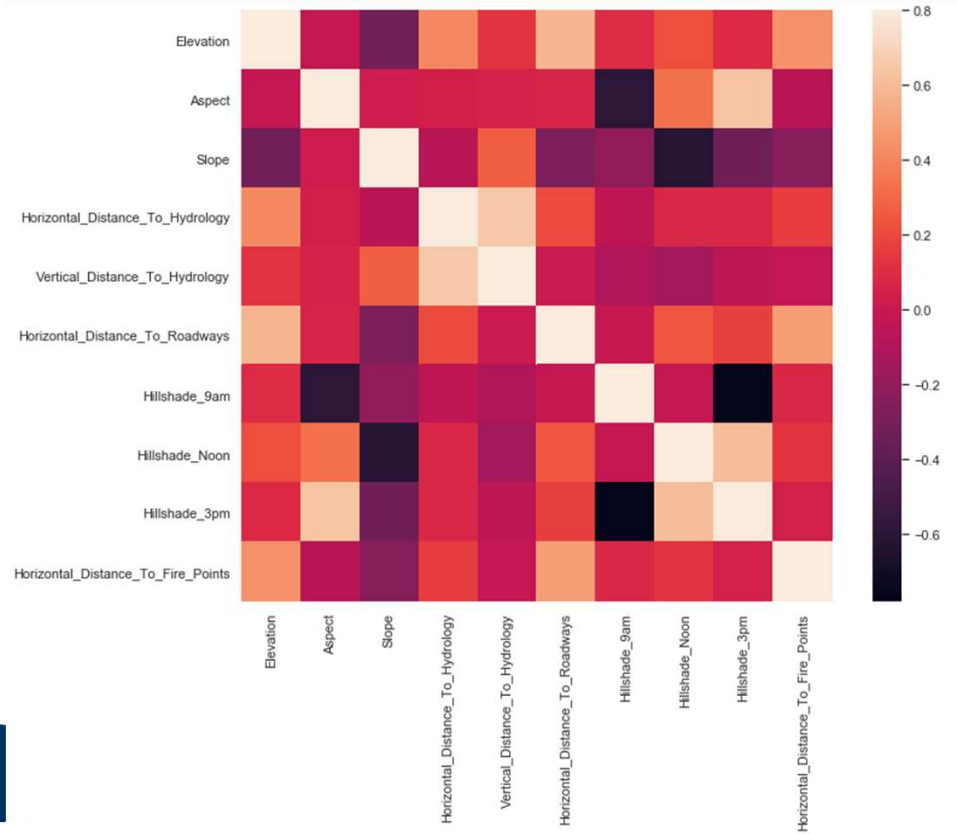
Distribution of 'Cover_Type Data'

Data Loading, Processing and EDA

Check the distribution of the numeric variables across cover types



Check the numeric predictor variables and see which are correlated



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Data Loading, Processing and EDA

Dataset is a combination of continuous and binary features

Data Preprocessing:

- preprocessing.MinMaxScaler
- preprocessing.StandardScaler
- binarize_data_for_tree() function

Models

Classifiers and algorithms for Supervised/unsupervised Learning

Model	Best Accuracy	Train Time(seconds)
K-Nearest Neighbors(kNN)	85%	0.27
Naive Bayes (Bernoulli)	61%	0.05
Logistic Regression	68%	12.98
Stochastic Gradient Descent	66%	0.23
Neural networks	59%	2362.66
Support Vector machine*	85%	658.90

*SVM with non-scaled data performs worst with an accuracy of just 16%

Models

Classifiers and algorithms for Supervised/Unsupervised Learning

Model	Accuracy	Train Time(in seconds)
Single Decision tree	69.0%	0.04
Random Forest	69.8%	9.54
Adaboost	52.2%	555.67
Unsupervised learning		
Gaussian Mixture Model	70.6%	98.72

Decision Tree and Random Forests

3 Models Fit:

- Single Decision Tree
- Random Forest
- Adaboost

Hyperparameter Tuning

Decision Tree:

- GridSearchCV used to find best:
  - Minimum Sample Split
  - Max Depth

Random Forest:

- Decision Tree parameters re-used
- RandomSearchCV used to find best:
  - Number of estimators
  - 15% of 100 options with 2 folds

Adaboost:

- Decision Tree and Random Forest parameters re-used
- RandomSearchCV used to find best:
  - Learning Rate
  - 15% of 100 options with 2 folds

Outcomes

3 Models Fit:

- Single Decision Tree – 68% Accuracy
- Random Forest – 69.6% Accuracy
- Adaboost – 60.9% Accuracy

KNN and Best Fit Model

- KNN Models were fit on three types of data
  - Standardized Data
  - Scaled to Range Data
  - Unaltered Data
- GridSearchCV was used to find the best value for K
- Results:
  - 1 Nearest Neighbor on the unaltered data returned 84.5% accuracy

Conclusion

The highest accuracy:
Model 1 – K Nearest Neighbors and Model 6 – SVM both with an accuracy of 85%.

Although SVM has a higher accuracy than Random Forest, we would still be going ahead and submitting Random Forest Classifier with an accuracy of ~ 70% as our best model.

- Random Forest is intrinsically suited for multiclass problems, while SVM is intrinsically two-class.
- Random Forest works well with a mixture of numerical and categorical features
- For a classification problem, Random Forest gives the probability of belonging to class whereas SVM gives the distance to the boundary


Thank you!