Forest Cover Type Prediction

W207 Final Project

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Agenda

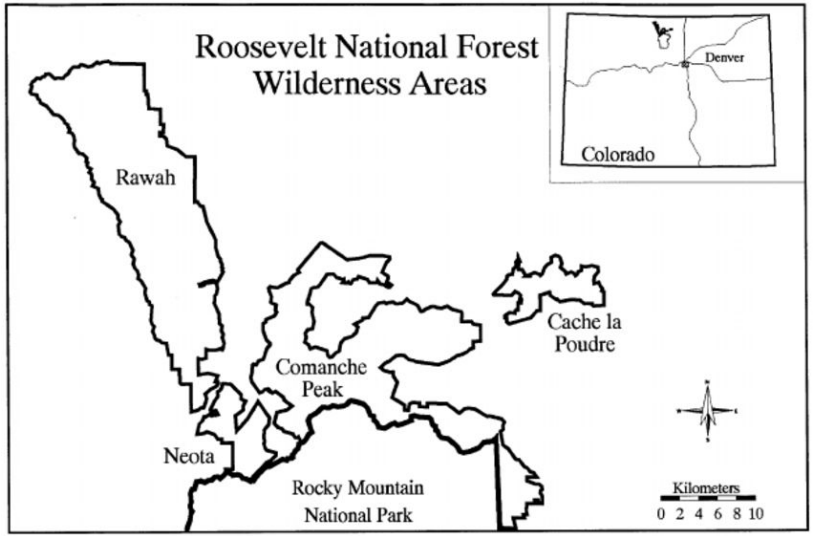
1. Exploratory Data Analysis
2. Clean/Format Data and Feature Engineering
3. Initial Machine Learning Models
4. Hyperparameter Tuning
5. Evaluation of the Best Model
6. Interpret Model Results
7. Summary & Conclusions

Problem Statement

Cover Types

Spruce/Fir
Lodgepole Pine
Ponderosa Pine
Cottonwood/Willow
Aspen
Douglas-fir
Krummholz

Areas



Classify the cover type for areas

Dataset Information

Data

- 581,012 instances
- 565,892 test set
- 15, 120 training set

Attributes

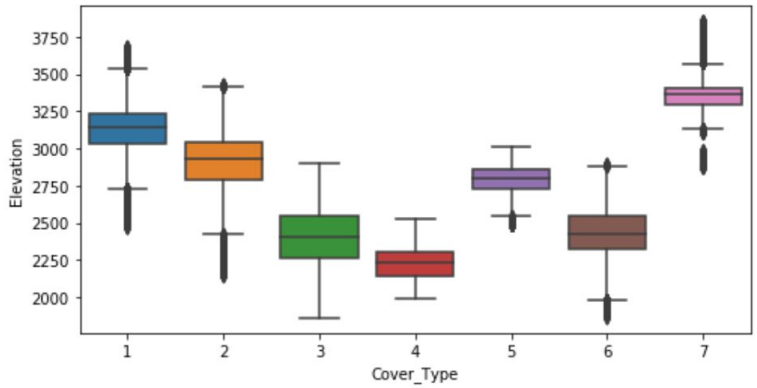
- Numeric, Categorical
- 12 categories
- 54 total columns
- 44 data columns binary

Attribute Details

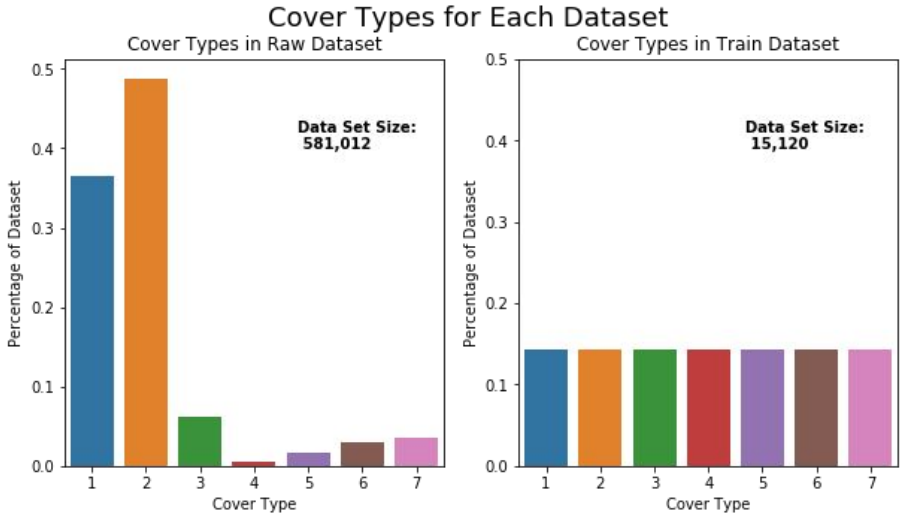
1. Elevation
2. Aspect
3. Slope
4. Horizontal distance to hydrology
5. Vertical distance to hydrology
6. Horizontal distance to roadways
7. Horizontal distance to firepoints
8. Hill shade 9am: RBG representation
9. Hill shade noon: RBG representation
10. Hill shade 3pm: RBG representation
11. Wilderness areas: 4 binary data
12. Soil type: 40 binary data

Exploratory Data Analysis

Cover Type
Key Important Feature



Cover Type
Distributions



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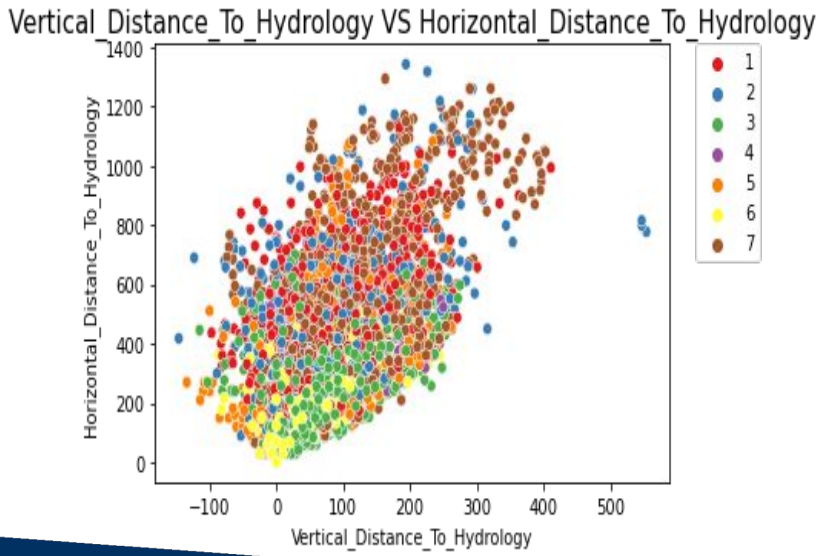
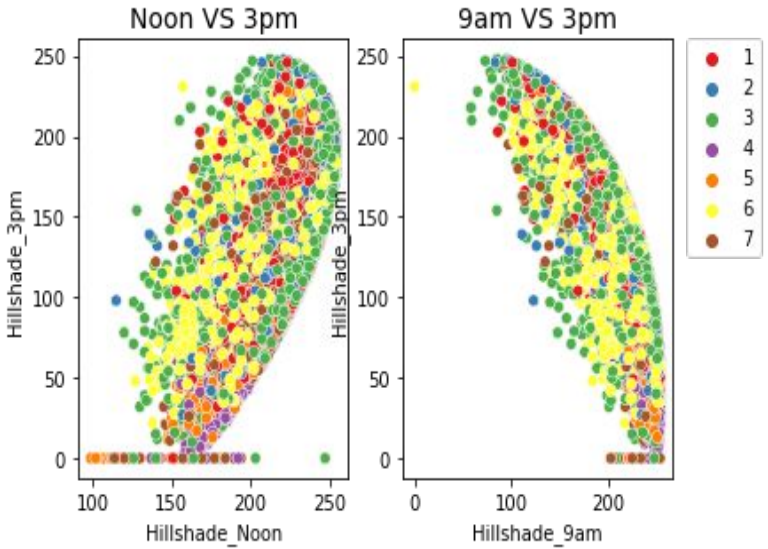
Exploratory Data Analysis

Training Data Frame



Hillshade Correlation



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Feature Engineering

Original Dataset: 54 Parameters

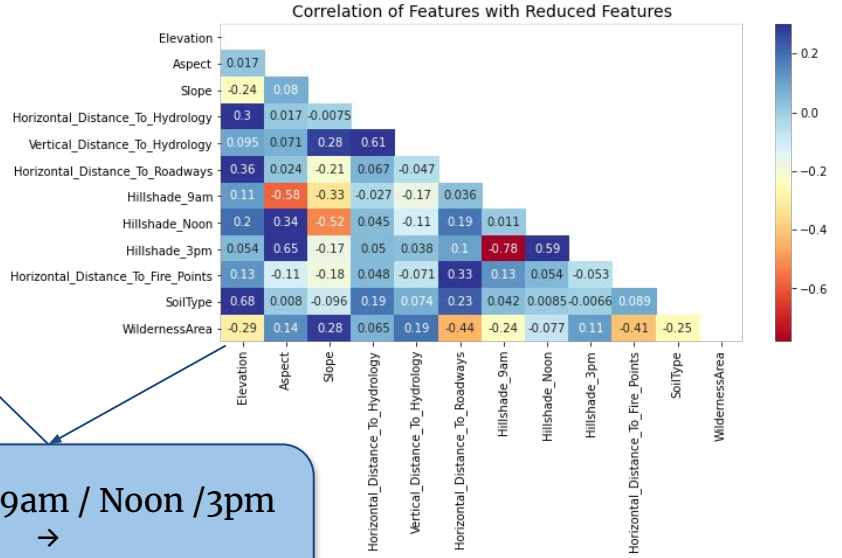
Soil Type and Wilderness Area Reduce 44 binary to 2 categorical parameters

Transformation of Aspect to Care only of N/S Facing Topos

Horizontal / Vertical Distance to Hydrology → Total Euclidean Distance

Hillshade_9am / Noon /3pm → Average_Hillshade

Normalization of all Distance values



Machine Learning Model Progression

Tuned & Featured Engineered Model Results

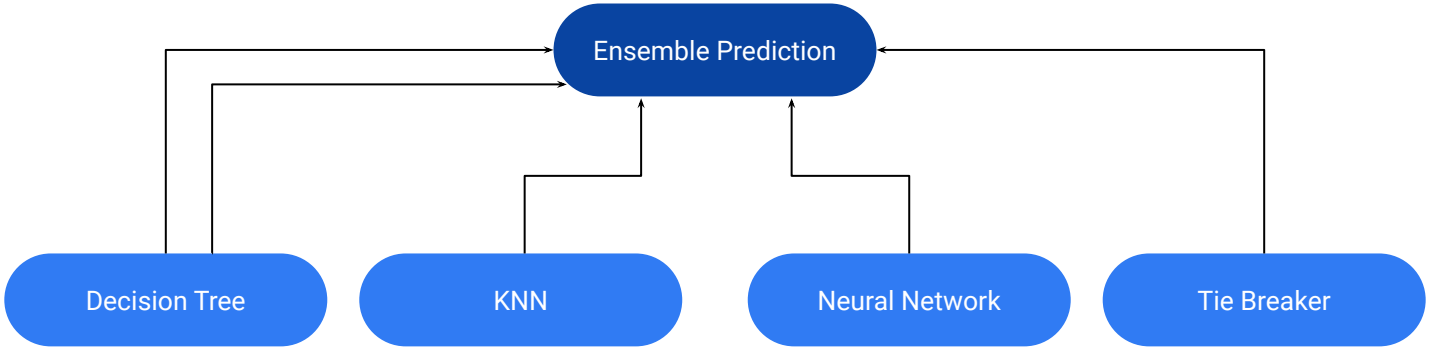
Model	Kaggle Accuracy, Before (%)	Kaggle Accuracy, After (%)
K-Nearest Neighbor	63	71
Naive Bayes	42	42
Logistic Regression	40	59
Decision Tree	66	77
Neural Network	35	72
Tie Breaker	-	72

Hyperparameter Tuning

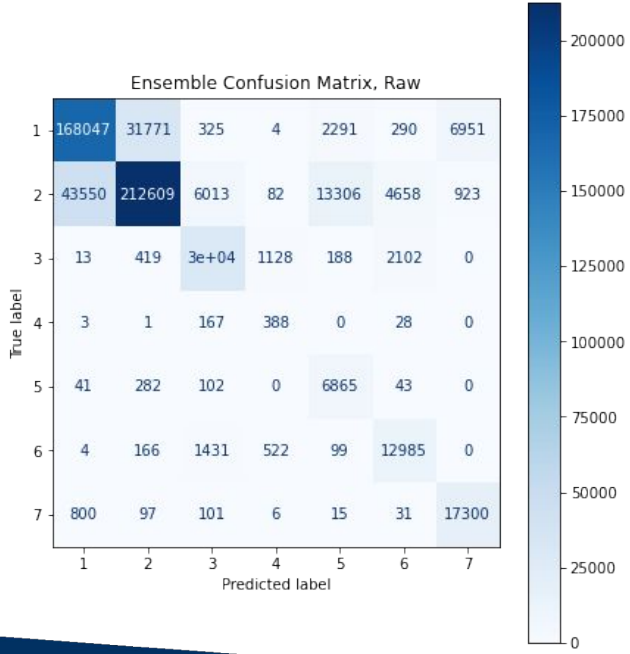
- Naive Bayes and Logistic Regression discarded due to low accuracy
- Random Forest had best individual performance
- KNN: K = 1, Euclidean distance
- NN: 9 hidden layers, 100 nodes each

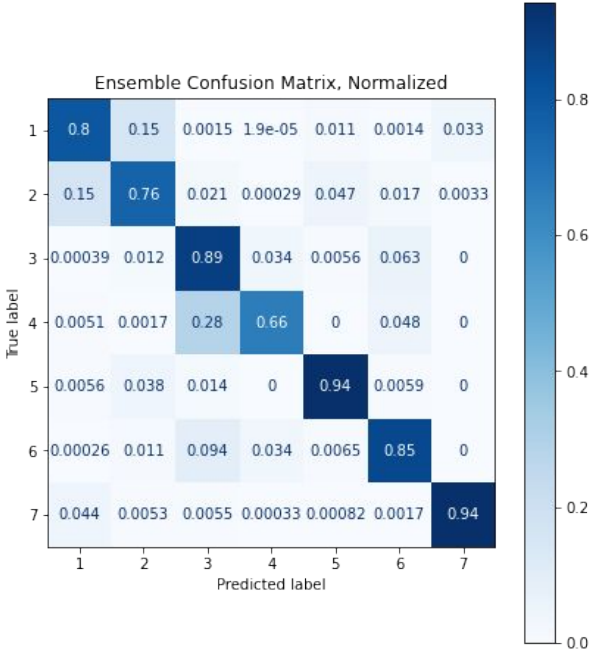
Evaluation of the Best Model

- Best accuracy: 79.579%
- Position 197 / 1693 on the Leaderboard



Interpret Model Results





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Summary & Conclusions

- **Ensemble Model Achieved Best Results**
  - Power of Group Consensus
- **Cover Type 1 and 2 Dominate in Test Data**
  - Make up 85% of Data
- **Future Use Case Challenges**
  - Specific to Wilderness areas in Colorado
  - Data Collection Method Unknown

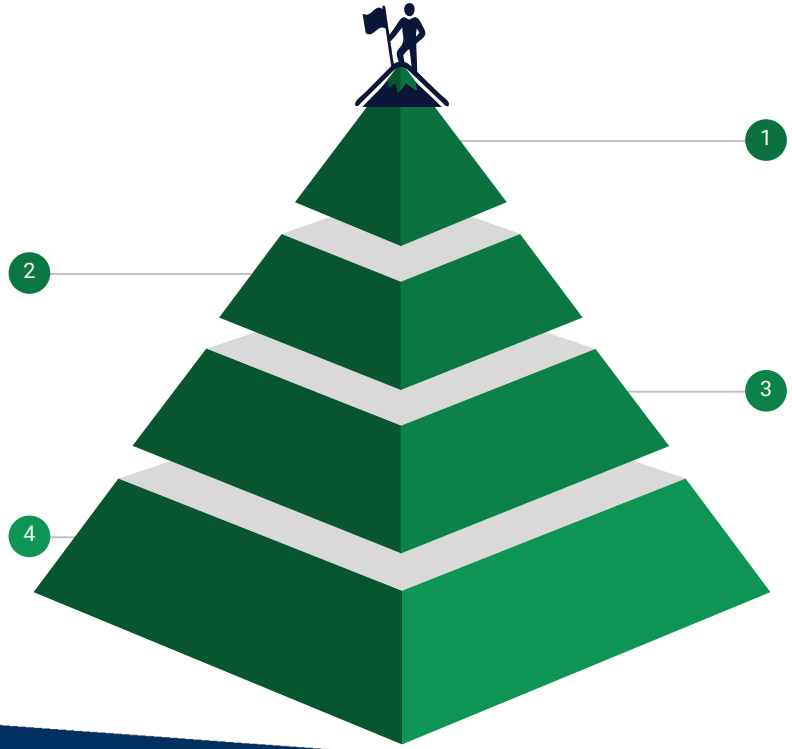
Lessons Learned

Hyperparameter Tuning is Compute Intensive

Way too much time spent waiting for models to return results

Collaboration is Key

Good Communication and task alignment is critical to timely completion



Last 10% was >90% of work

Perseverance is key, shocking how much didn't work

Feature Engineering is difficult

- Deep understanding of data
- Model Specific
- Imbalanced Dataset is a challenge



Questions?