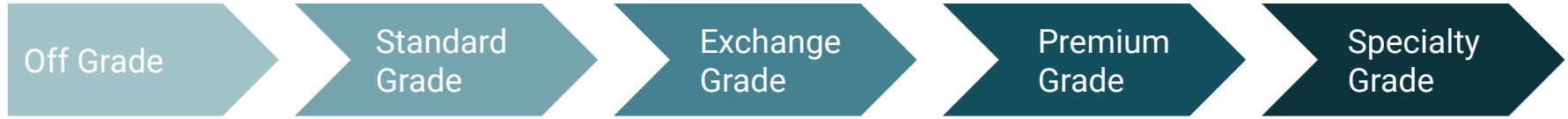




# Predicting Coffee Grade

By Matthew Roumelis

# CONTEXT AND PROBLEM STATEMENT



A model that can accurately **predict coffee grade** based on the known factors of when, where, and how the coffee was grown and processed would help businesses select better quality coffee producers and market/sell their products appropriately.



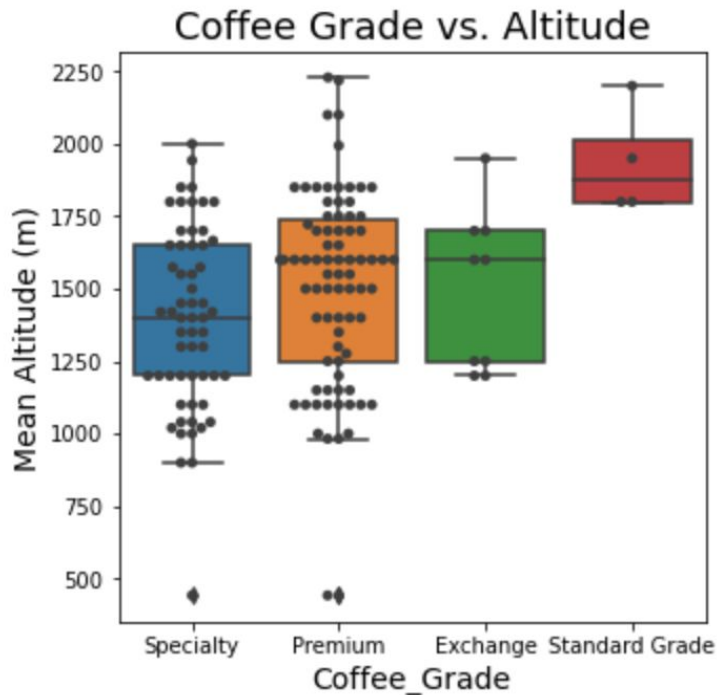
# THE DATA

**Size:** 150 coffees

**Important Features:**

- Variety of Coffee
  - Country where coffee was grown
  - Altitude at which coffee was grown
  - Harvest Year
  - Processing Method
  - Moisture
  - Number of Defects
  - Number of Quakers
  - Cupping Grades
-

# OPTIMAL ALTITUDE



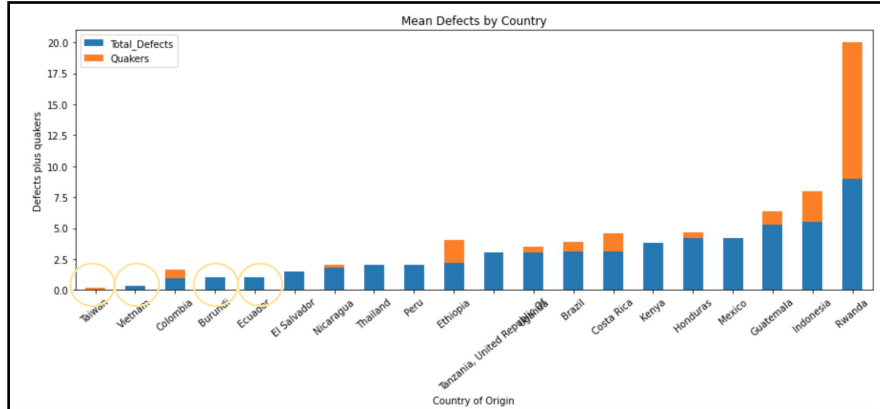
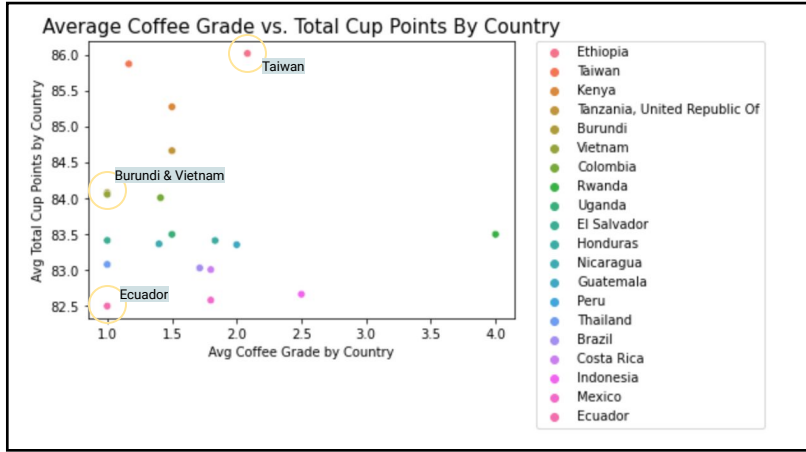
**Specialty Coffee Mean Altitude:**  
1393.43 meters

**Premium Coffee Mean Altitude:**  
1501.13 meters

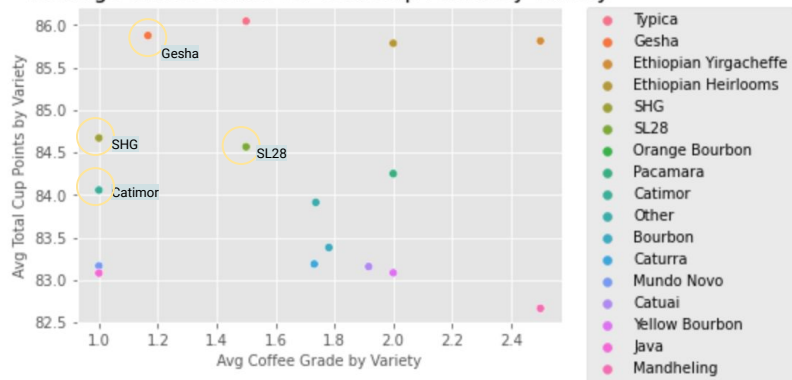
\*Statistical Difference in means ( $p=.012$ )

# BEST COUNTRIES

- Taiwan
- Burundi
- Ecuador
- Vietnam



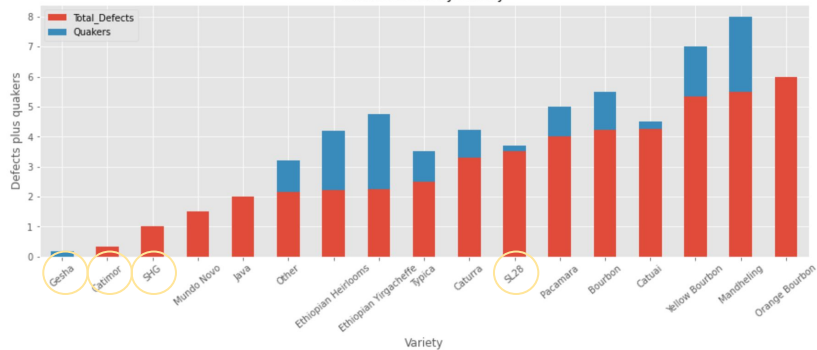
Average Coffee Grade vs. Total Cup Points By Variety



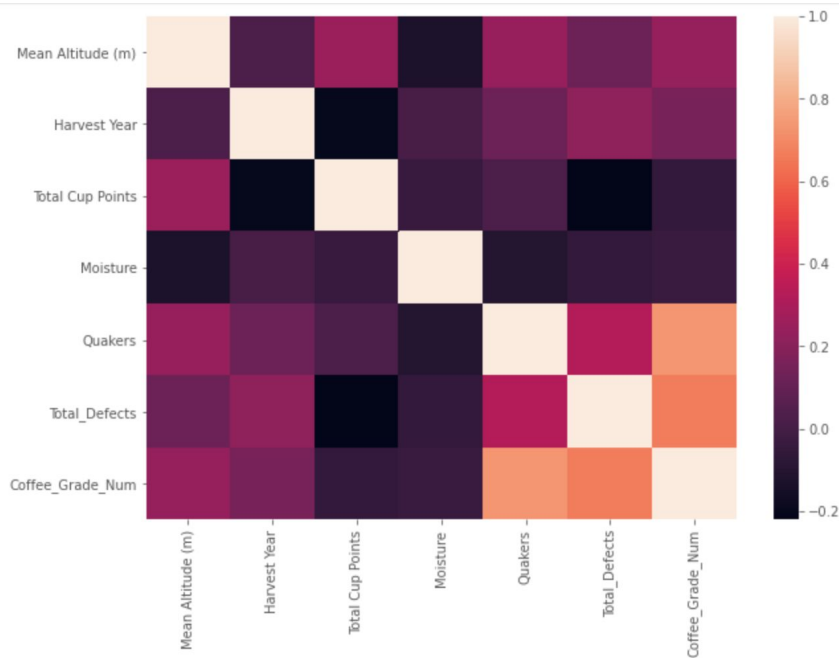
# BEST VARIETIES

- Gesha
- SHG
- SL28
- Catimor

Mean Defects by Variety



Heat Matrix



# OTHER FEATURES

**No features are  
highly correlated  
with Coffee Grade**

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\*Coffee Grade is a function of Quakers  
and Total Defects

# PREDICTION MODELS

Logistic Regression

Random Forest

Gradient Boost

CatBoost

	model	name	train_accuracy	test_accuracy	train_f1	test_f1
9	(DecisionTreeClassifier(max_features='auto', random_state=1165313289), DecisionTreeClassifier(max_features='auto', random_state=1165313289))	Random Forest Balanced Subsample	0.9911	0.8421	0.9911	0.8421
7	(DecisionTreeClassifier(max_features='auto', random_state=1165313289), DecisionTreeClassifier(max_features='auto', random_state=1165313289))	Random Forest Out of the Box	0.9911	0.8421	0.9911	0.8421
8	(DecisionTreeClassifier(max_features='auto', random_state=1165313289), DecisionTreeClassifier(max_features='auto', random_state=1165313289))	Random Forest Balanced	0.9911	0.8421	0.9911	0.8421
22	RandomizedSearchCV(cv=3, estimator=<catboost.core.CatBoostClassifier object at 0x7f85d85b5e0>, param_grid={'max_depth': [100, 10, 1, 0], 'min_child_weight': [1, 5, 10, 50, 100, 200, 500, 1000], 'subsample': [0.5, 0.7, 0.9, 1.0], 'learning_rate': [0.01, 0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0], 'colsample_bytree': [0.5, 0.7, 0.9, 1.0], 'colsample_bynode': [0.5, 0.7, 0.9, 1.0], 'reg_lambda': [0.01, 0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0], 'min_data_in_leaf': [1, 5, 10, 20, 50, 100, 200, 500, 1000], 'max_leaves': [100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000, 100000], 'max_features': ['sqrt', 'log', 'best', 'auto'], 'max_cat_features': [1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1048576, 2097152, 4194304, 8388608, 16777216, 33554432, 67108864, 134217728, 268435456, 536870912, 1073741824, 2147483648, 4294967296, 8589934592, 17179869184, 34359738368, 68719476736, 137438953472, 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# COMPARING TOP RANDOM FOREST MODELS

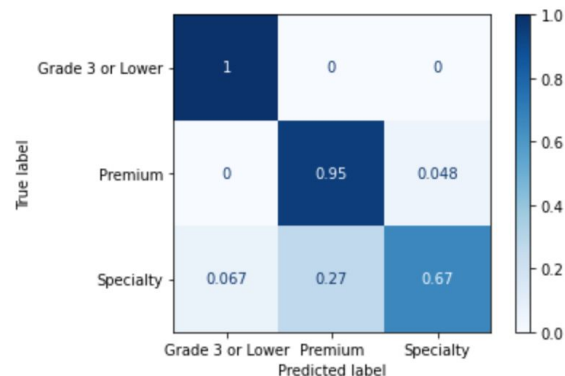
Out-Of-The-Box



Balanced Subsample



Balanced



Lower "Grade 3 or Lower" F1 Scores

Best Model

# CONCLUSION & RECOMMENDATIONS

## BEST MODEL TO PREDICT COFFEE GRADE:

Random Forest Balanced

## INVEST IN COFFEE THAT IS:

- **TYPE:** Gesha, SHG, SL28, and Catimor
  - **FROM:** Taiwan, Burundi, Ecuador, and Vietnam
  - **GROWN AT:** altitudes ranging from 1250-1600m
-