

KEPLER EXOPLANETS CLASSIFIER

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BACKGROUND AND OVERVIEW

- The Kepler mission was designed to locate Earth sized planets by analyzing an object's transit data as it orbits a star
- These objects are classified as confirmed, false positive or candidate exoplanets.
- Candidate planets require additional research in order to classify. The goal of the model is to predict which candidates would likely be confirmed exoplanets so resources and focus can be directed towards them.



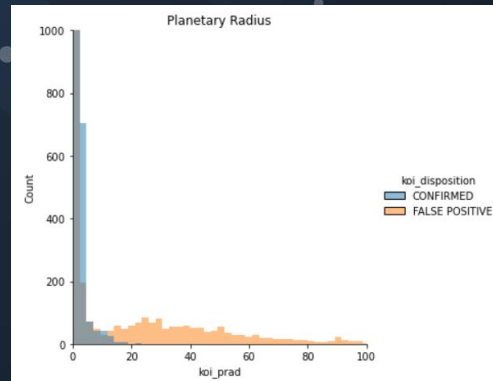
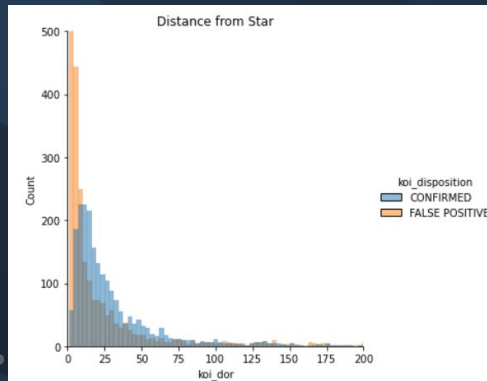
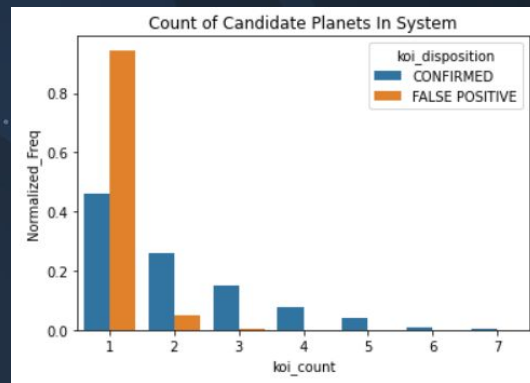
SOURCES AND DATA

- NASA Exoplanet Archive
 - Kepler Objects of Interest Database
 - User friendly
 - Lots of documentation
- Final Model Includes:
 - 33 features
 - 2900 False Positive Objects
 - 2200 Confirmed Planets
 - Random Forest Classifier

| Transit Surveys | | 107,628,888 Light Curves | | |
|---|---|---|------|-------|
|  | | The first space mission to search for Earth-sized and smaller planets in the habitable zone of other stars in our neighborhood of the galaxy. | | |
|  Search Stellar Data → |  Objects of Interest (KOI) → | | | |
|  Threshold-Crossing Events → |  Documentation → | | | |
|  Completeness and Reliability Products → |  API Queries → | | | |
| TESS | Kepler | K2 | KELT | UKIRT |

EXPLORATORY DATA ANALYSIS

- Dropped any rows with missing data
- Several features contained many outliers
 - Used Robust Scaling when modeling to counteract
- Removed multicollinear features to help speed up modeling time
- Removed confounding features used in calculating disposition
- Top Features Include:
 - Planetary Radius
 - Distance from Star
 - Count of Planets in System



MODELING - BALANCED FOR ACCURACY

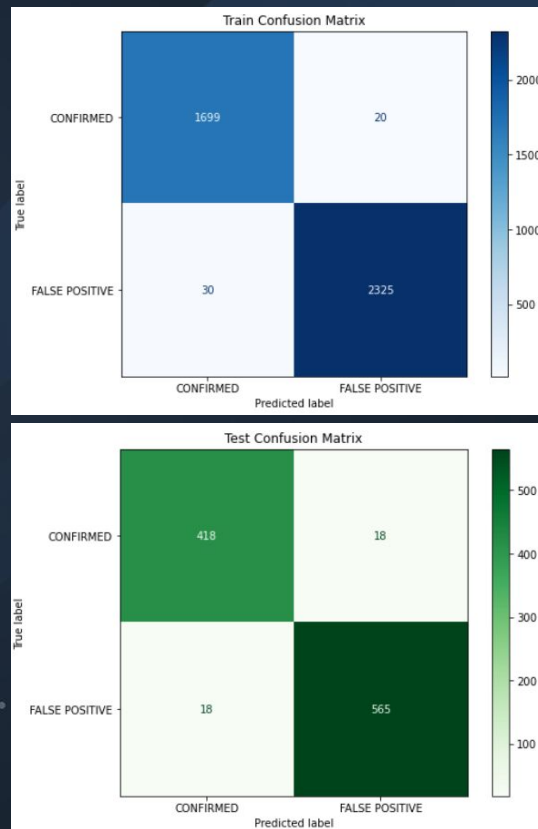
BASE MODEL

- Logistic Regression
- Train Results:
 - Accuracy = 91%
 - Precision = 91%
 - Recall = 91%
- Test Results:
 - Accuracy = 89%
 - Precision = 89%
 - Recall = 89%

- ** Accuracy chosen to balance costs and benefits of True/False Positives
- Maximizing True Positives can help locate as many viable Confirmed planets as possible
 - However, time and data collection can be very limited when observing celestial objects

FINAL MODEL

- Random Forest Classifier
- Train Results:
 - Accuracy = 99%
 - Precision = 99%
 - Recall = 99%
- Test Results:
 - Accuracy = 96%
 - Precision = 96%
 - Recall = 96%



CANDIDATE PREDICTIONS

**1600 CANDIDATE
OBJECTS**

**57%
CONFIRMED**

~ 912 POTENTIAL CONFIRMED PLANETS

**43%
FALSE
POSITIVES**

NEXT STEPS

IMPROVE DOMAIN KNOWLEDGE

Consult with subject matter experts to improve models

HABITABLE PLANETS

Help identify potentially habitable planets

OTHER MISSIONS

Apply models to other exoplanet search missions

ADAPT MODELS

Utilizing different exoplanet searching techniques



THANK YOU

<https://github.com/NelGen/NG-NASA-Exoplanet-Classifier-Project>

<https://exoplanets.nasa.gov/>