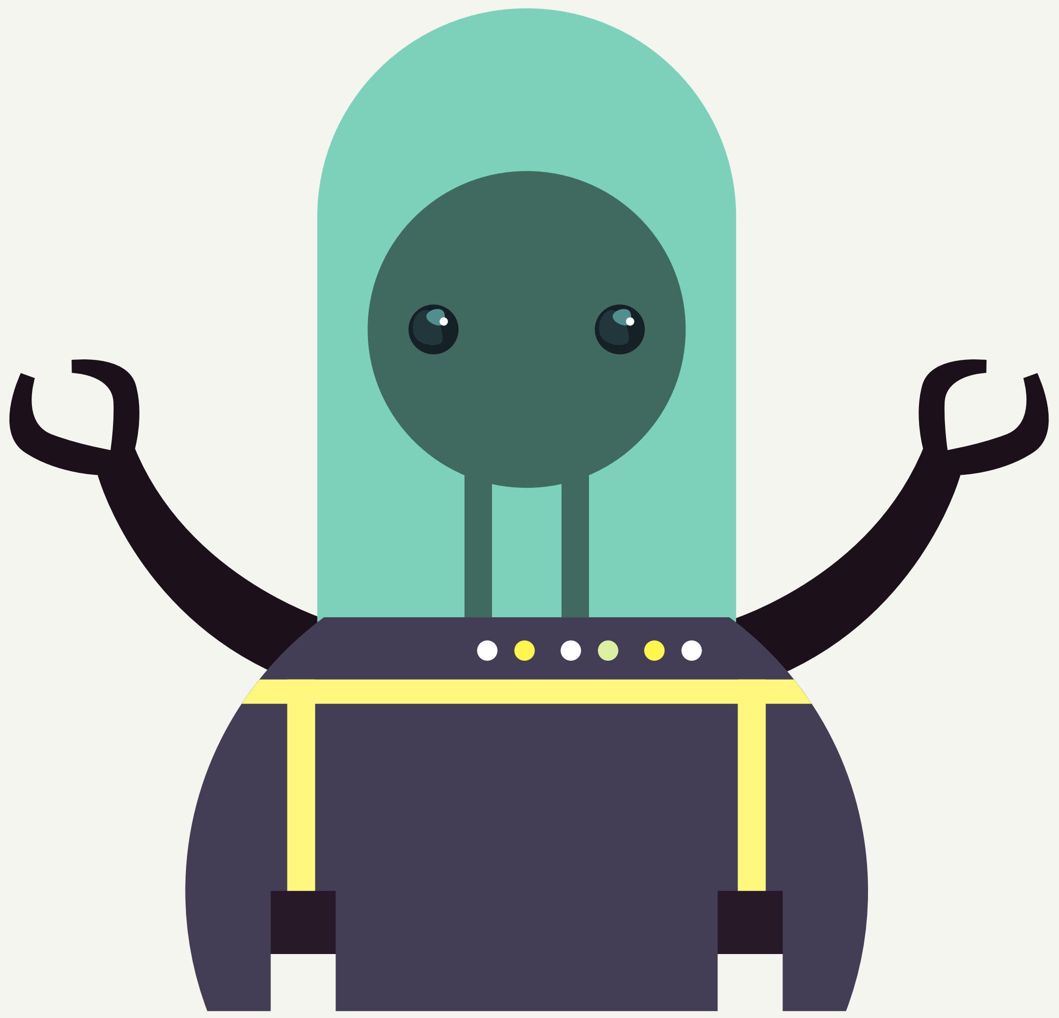
Auction Fraud Detection

"Human or Robot"

Springboard School of Data

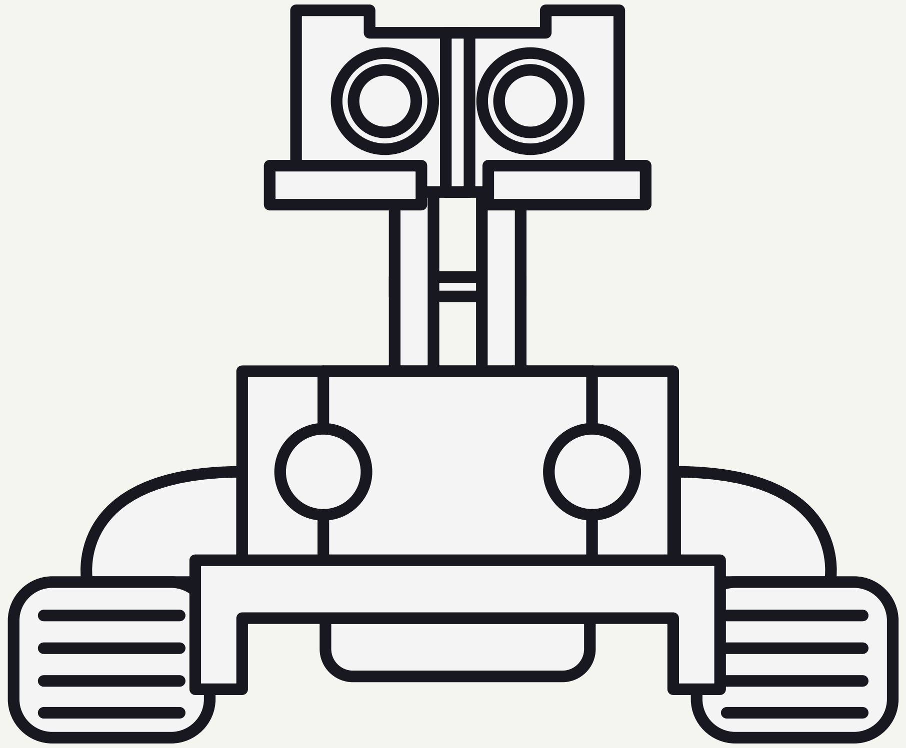
by Gabrielle Wald



Background

Overview of the project

- Auction website
- Frustrated human bidders
- Inability to win auctions vs. their software-controlled accounts
- Customer base is plummeting
- Rebuild customer happiness by eliminating computer generated bidding from their auctions.



The Problem

- We want to prevent customer churn and improve satisfaction.
- We assume the problem can be improved by eliminating robots from the website.

Goal

Identify users that are "robots", so they can be removed from the auction site.

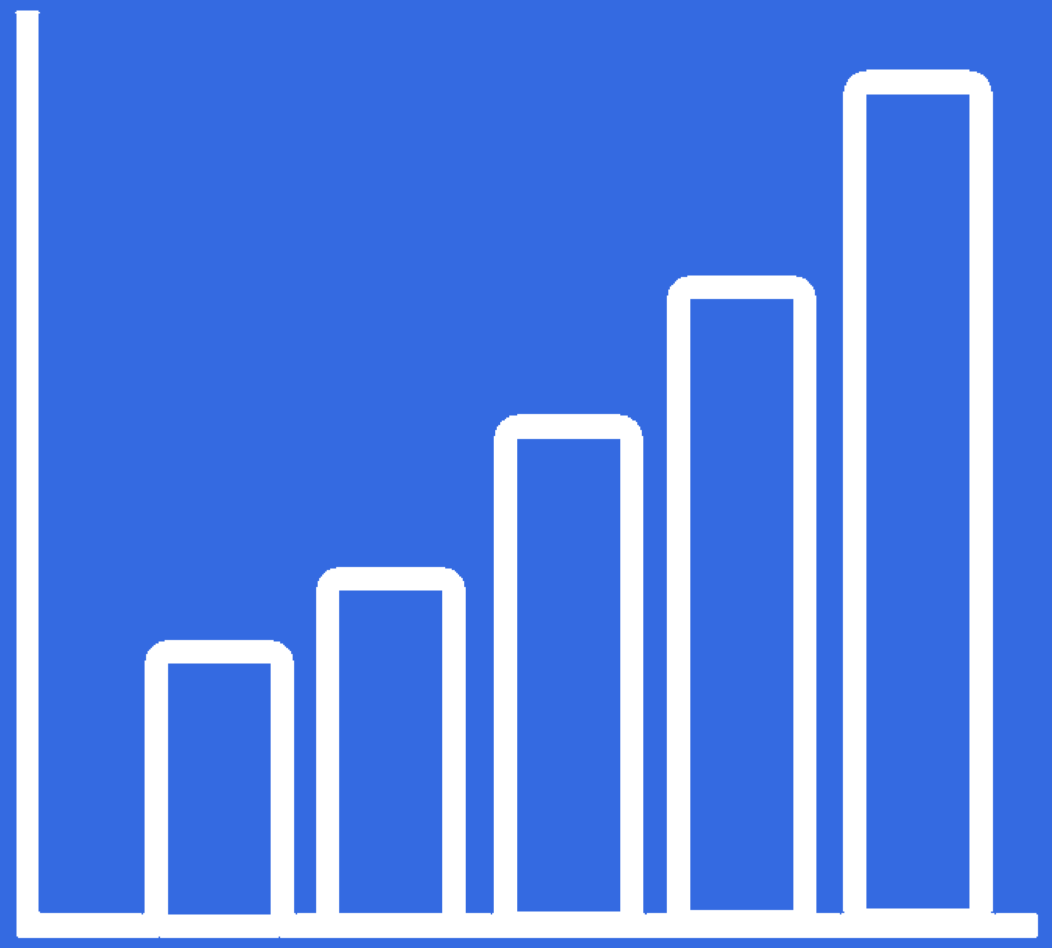
Importance

customers

- Improve customer satisfaction and experience.

website owners

- Decrease customer churn and improves profitability



Data Source

This project is part of an Engineering competition created by Facebook and Kaggle in 2015.

1. The data was retrieved from the Kaggle website in csv format.
2. One of the richest data of its kind.
3. Great potential for feature engineering.

About the Data

Two datasets:
- bidder (train and test) and bid datasets
- Over 7 million bids (data points)
- 1984 unique bidders

Challenge

- Obfuscated fields for privacy
- Unique identifiers

Data Wrangling

- Merge on bidder_id
- Performed EDA to identify patterns and inform feature engineering.

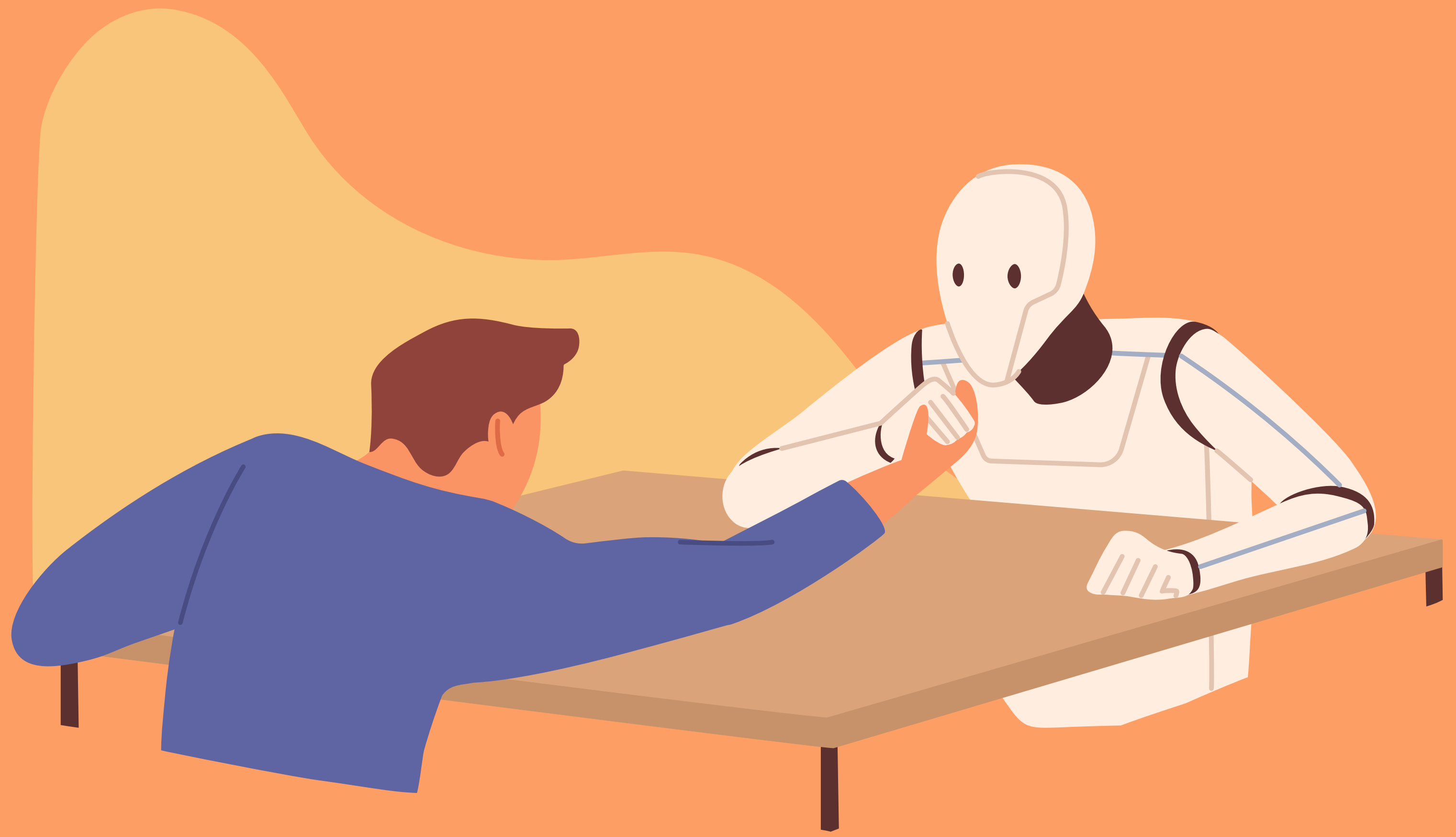
Data Cleaning

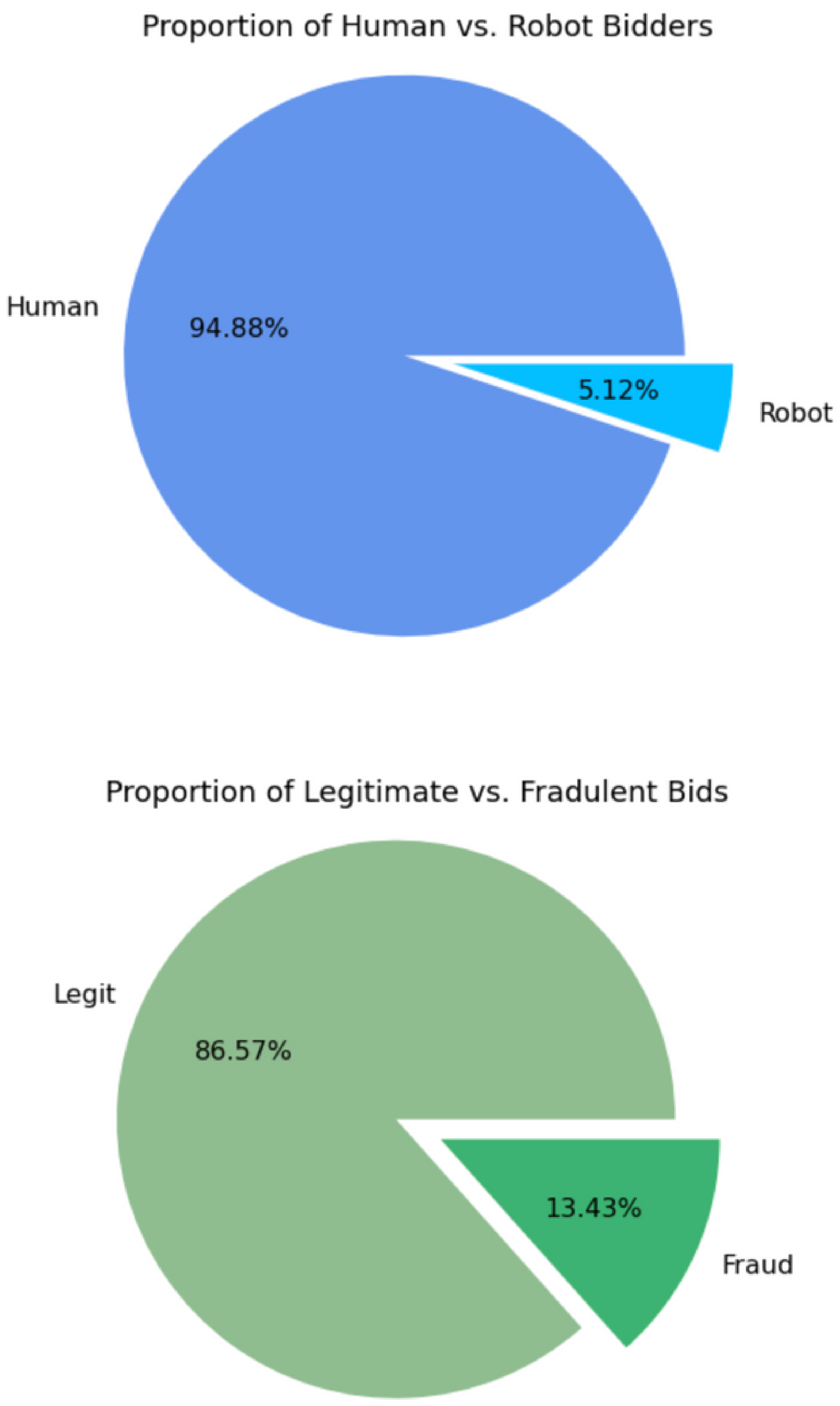
- 29 missing data points were dropped (mapped to human data).

Exploratory Data Analysis

Initial Assumptions

1. Total number of bids
2. Number of bids per auction
3. Number of distinct IP addresses
4. Merchandise category
5. Number of devices



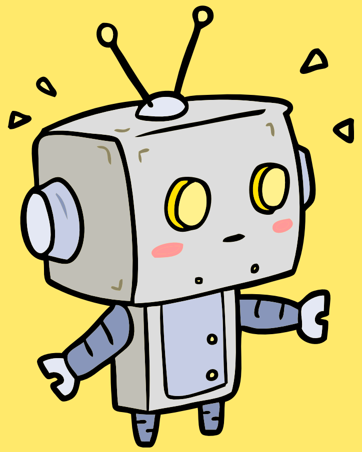


The data is highly unbalanced

at the bidder and bid levels

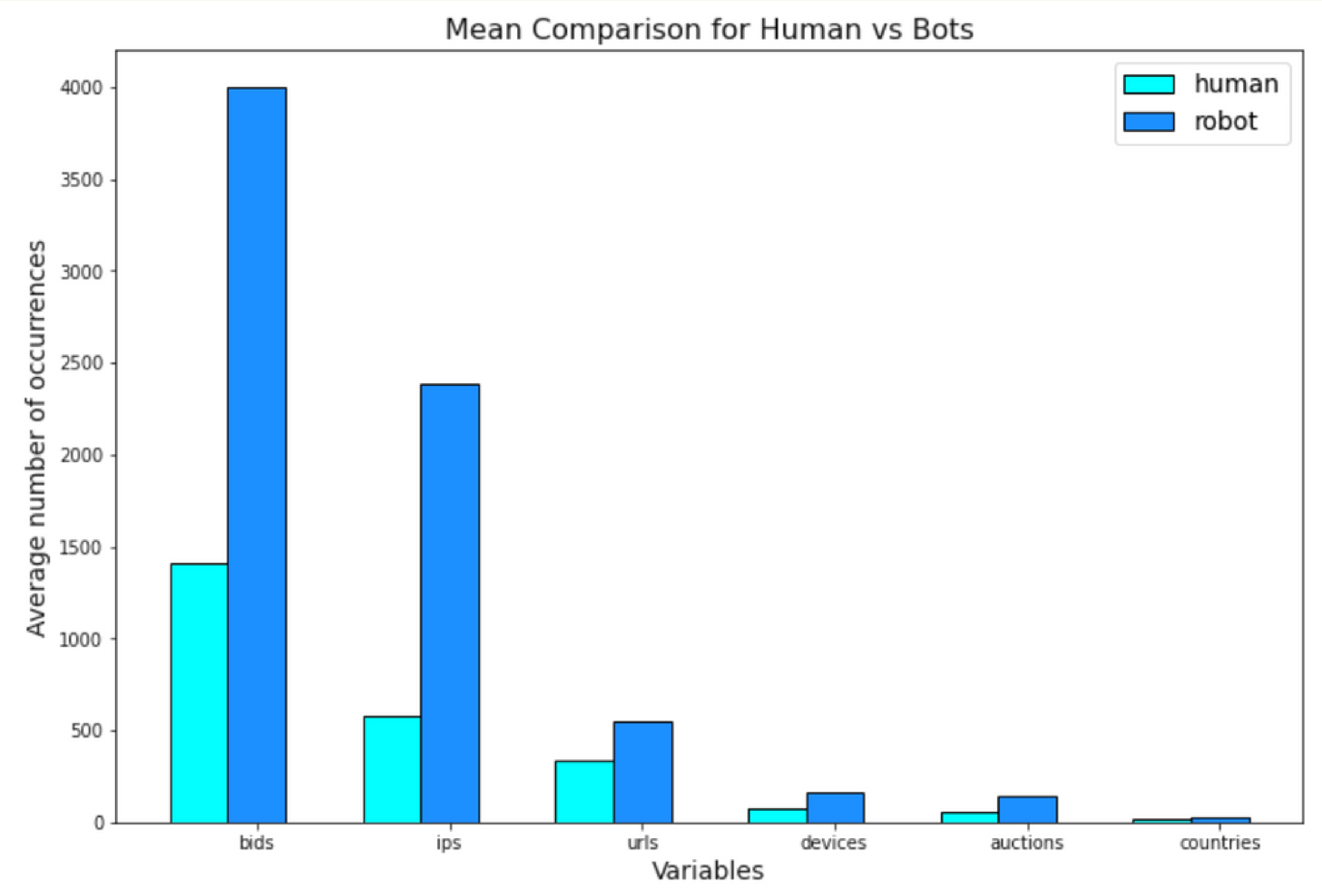
EDA FINDINGS

Robots vs. Humans

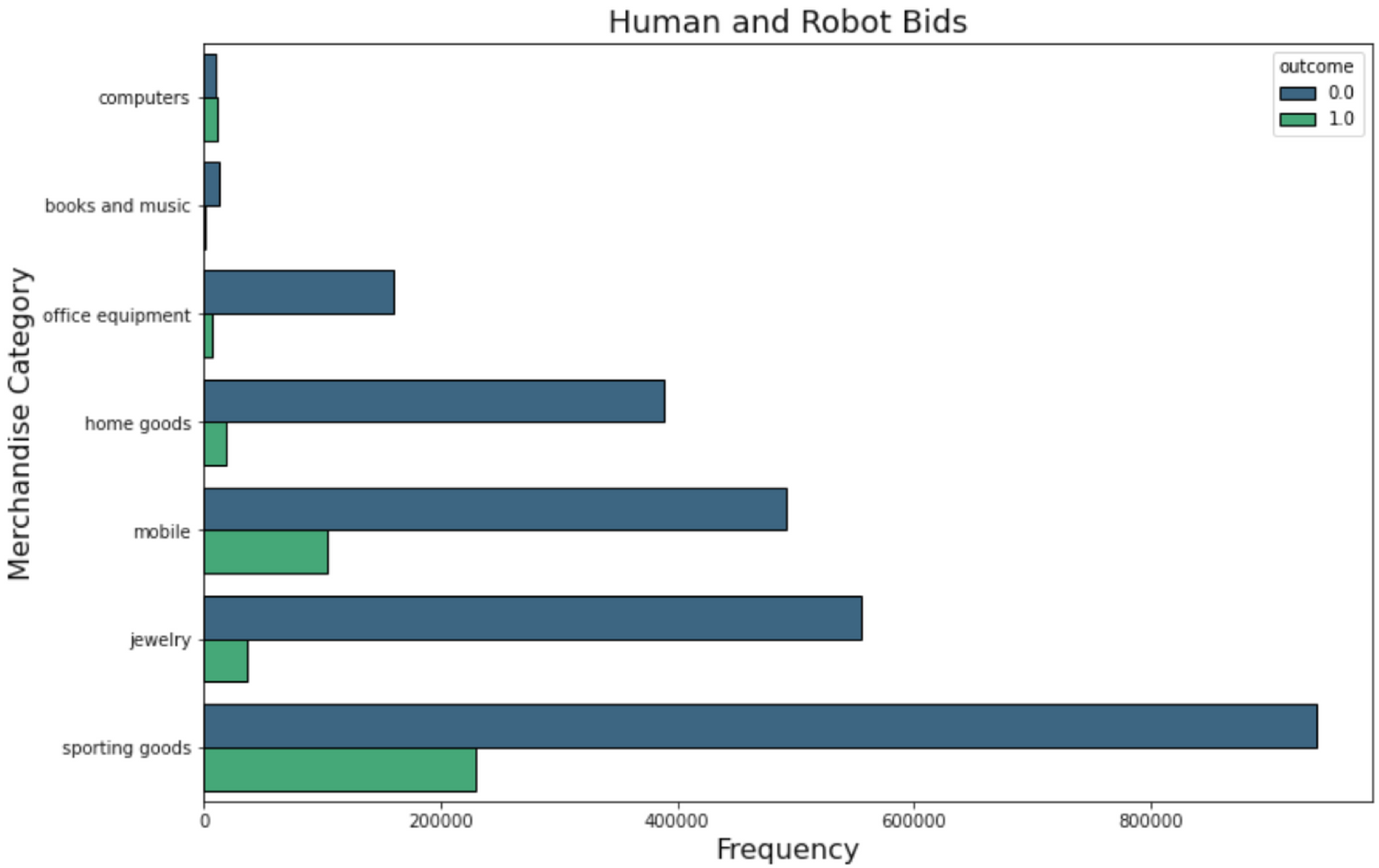


Initial assumptions held true.

The mean and median number of occurrences between human and robots differ significantly for several variables.



Merchandise Category Distribution Differs for Humans and Robots

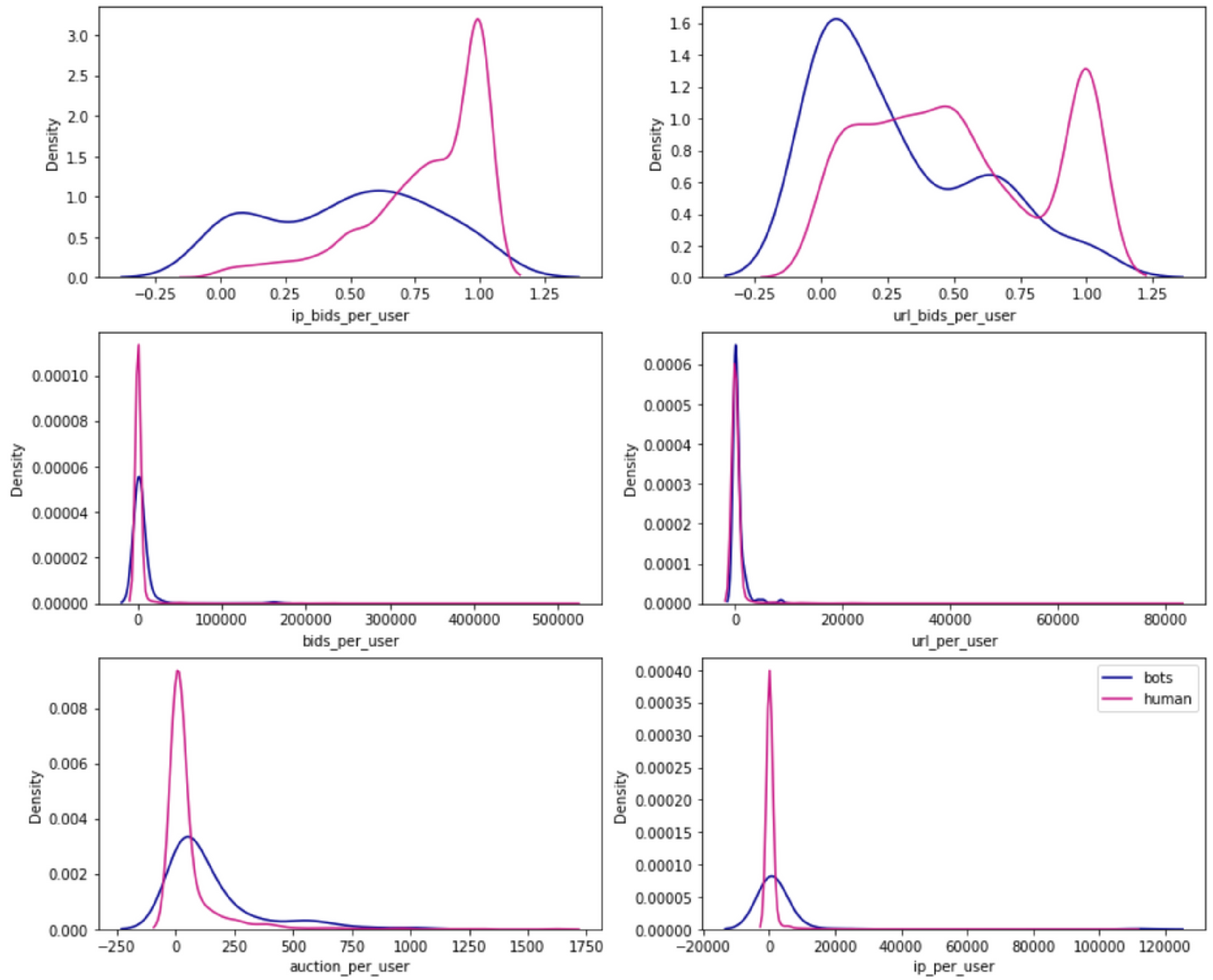


16 Features Created

Some of the Features:

- Mean/median number of bids per auction per user
- Number of unique auctions per user
- Proportion of unique ip addresses to bids per user
- Mean number of auctions for each country per user
- Mean/median number of IP addresses per auction per user

Features distribution for human vs. bots



Binary Classification

Predicting a class: "human" or "robot"

Evaluation Metrics

- Recall
- AUC

Models applied

- Logistic Regression
- Random Forest Classifier
- Decision Tree Classifier

Models Summary

Accuracy is 0.94;

- True Negatives: 372
- False Positives: 2
- False Negatives: 22
- True Positives: 1

LOGISTIC REGRESSION

Accuracy is 0.95;

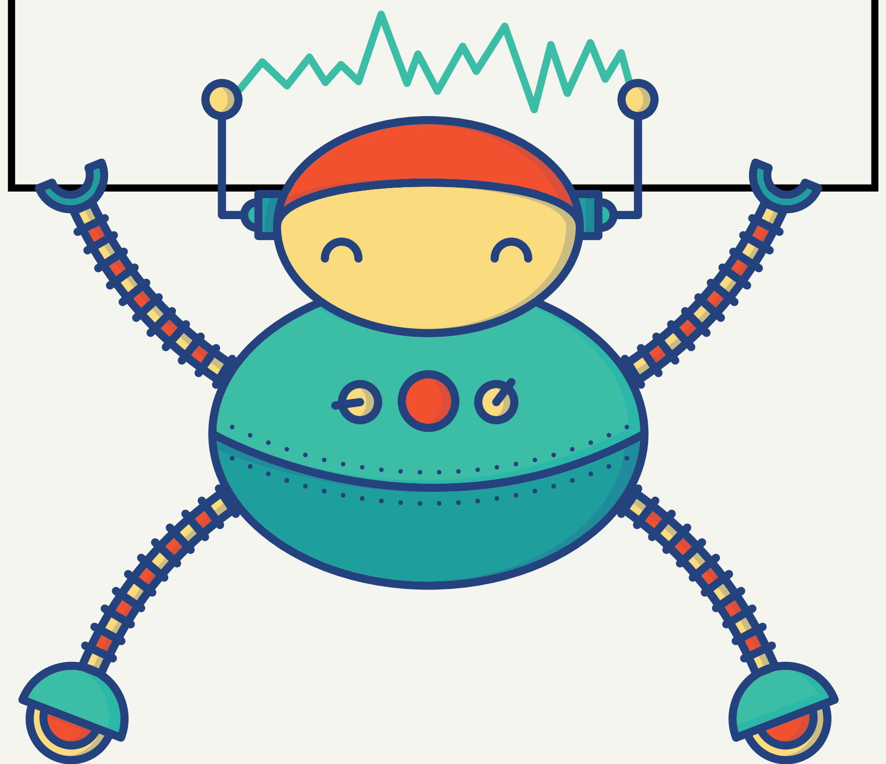
- True Negatives: 374
- False Positives: 0
- False Negatives: 19
- True Positives: 4

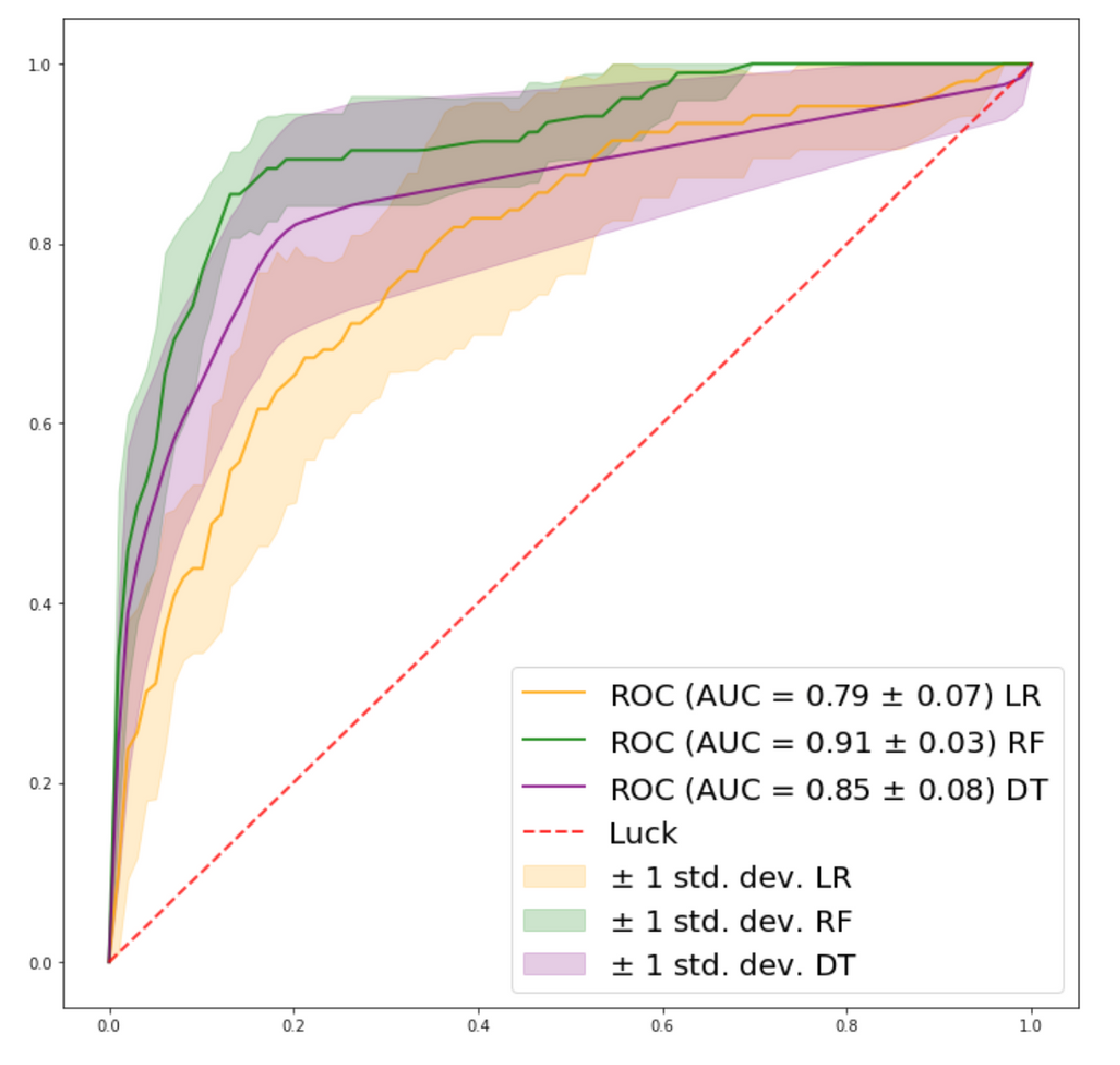
RANDOM FOREST CLASSIFIER

Accuracy is 0.94;

- True Negatives: 366
- False Positives: 8
- False Negatives: 15
- True Positives: 8

DECISION TREE CLASSIFIER



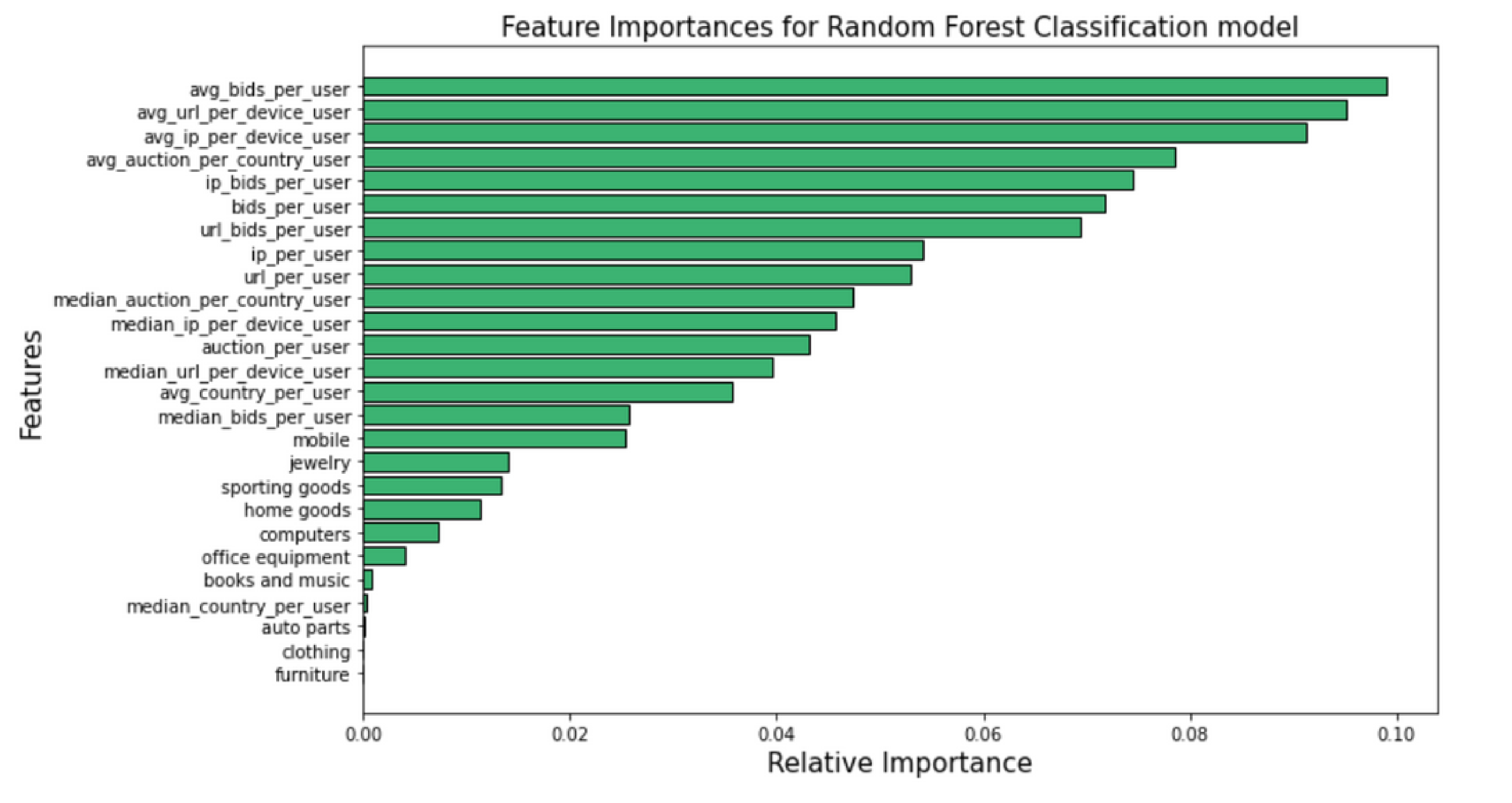


Evaluation

ROC - AUC Curve

- Random Forest has the highest AUC value: 0.91 +/- 0.03

Features Distinguishing human from robots behavior



1. Average bids per user
2. Url per device for each user
3. Average ip address per device for each user

Misclassification

Type I error - False Positive (Human classified as robot) is better than type II error - False Negative (Robot classified as human).

Possible Solution

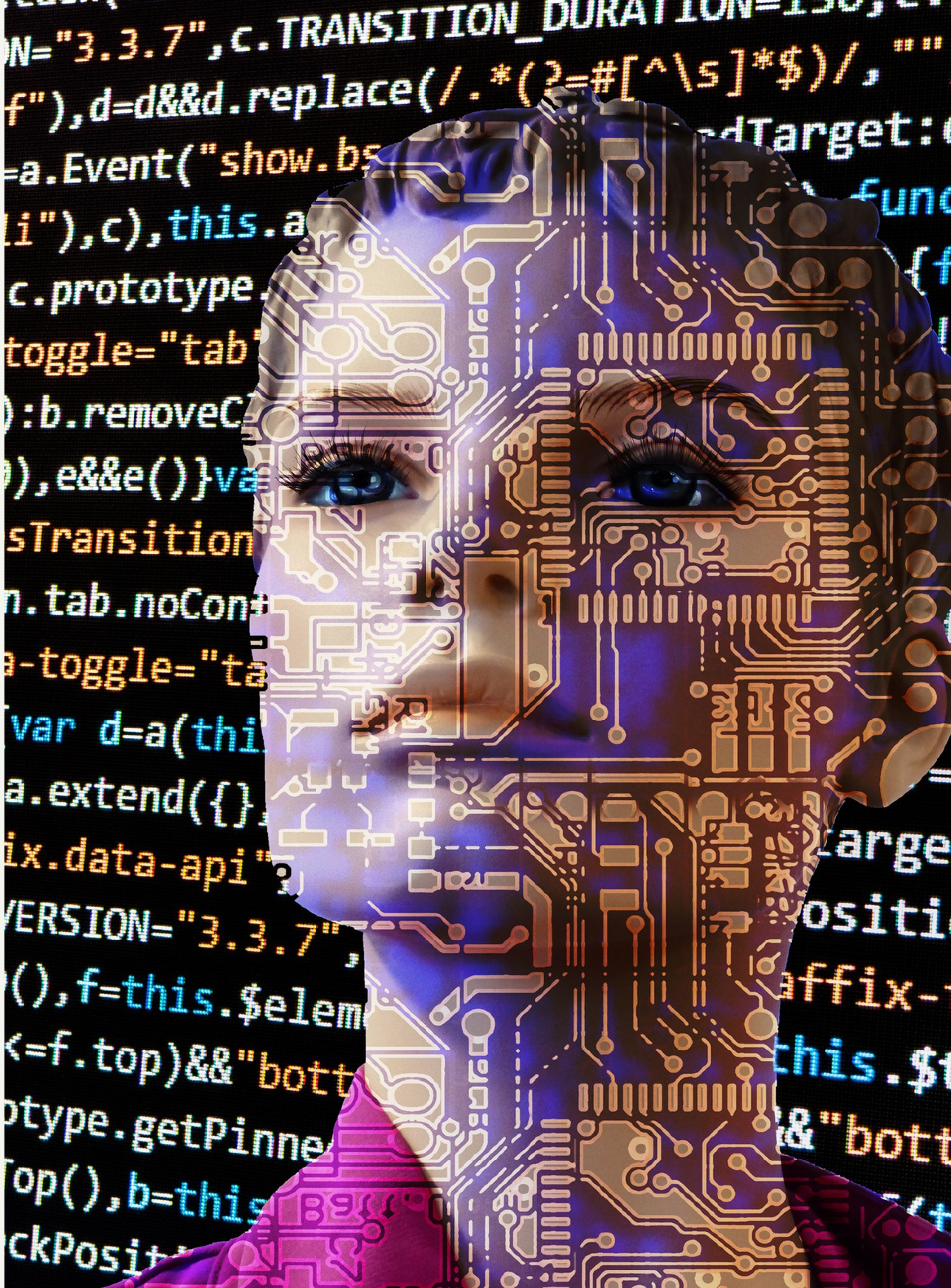
CAPTCHA is one approach to manage type I error.

Conclusion

1. Decision Tree classifier has the highest recall.
2. Random Forest classifier has the highest AUC.
3. Neither has a high success rate identifying robots.
4. Models are not ready to go into production.
5. Small sample size (Test set has 397 users, 23 labeled robots).

Next Steps

1. Create new features from the time column like:
    a. Maximum number of bids made within a 20 minute span;
    b. Median time between a user's bid and that user's previous bid;
    c. Number of simultaneous bids
2. Try XGBoost, Support Vector Machine and Naive Bayes.
3. Require more data.



Questions?

Thank you!