



Identifying Counterfeiting and Grey Market Selling



## Counterfeits

Counterfeit goods, often of inferior quality, made or sold under another's brand name without the brand owner's authorization.

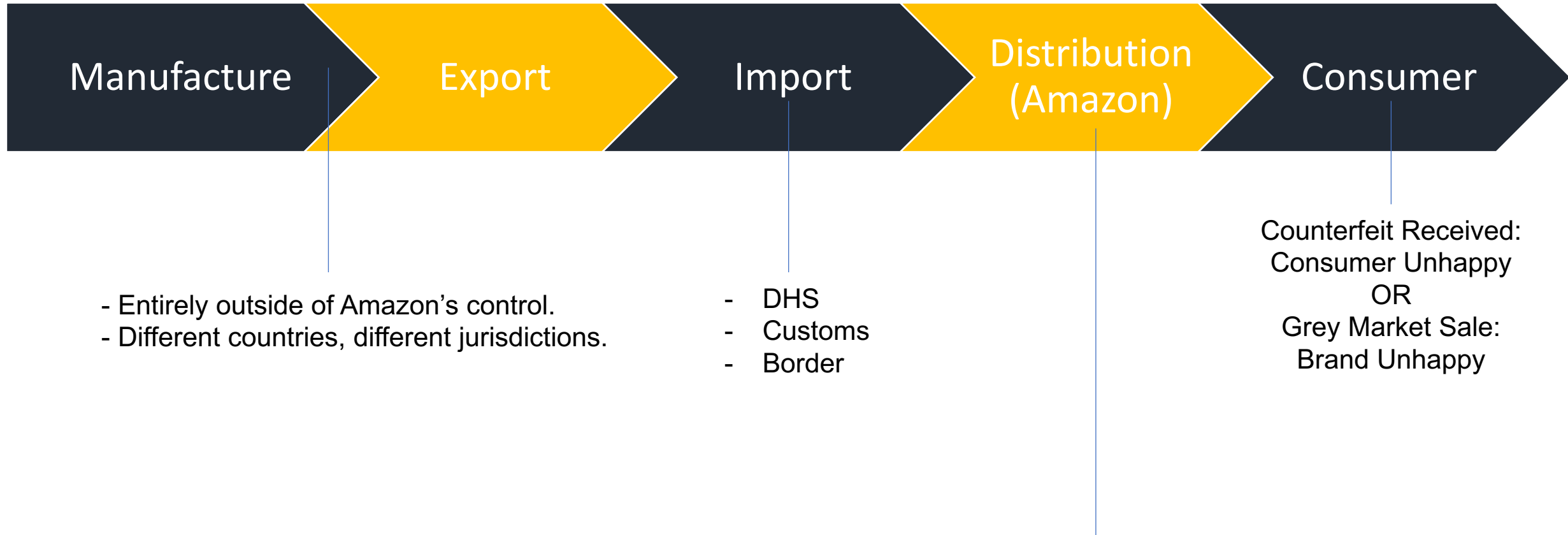
(e.g. sale of fake Nikes)

## Grey Market Selling

Grey market goods are non-counterfeit goods that are sold through channels that the trademark owner did not approve of the product, often indicating a leak within the supply chain.

(e.g. importer who buys genuine Nikes in China and ships them to the US without authorization from Nike)

# Downstream Supply Chain



## - Identify Counterfeit and Grey Market Listings Based on Past Positives

- Challenge: cannot identify an positive instance until it has already happened.

# What do Positive cases look like?

Status	Source Country	List Attributes (Pictures, Description)	List Price	Reviews & Ratings
Authentic Product	Manufacturer	Normal	Standard Price	Spectrum
Counterfeit	" "	" "	Standard Price	Poor
Counterfeit	" "	" "	Below Standard	Poor
Grey - Market	" "	" "	Standard Price	Poor
Grey– Market	" "	" "	Below Standard	Good

# Identifying instances of Grey-Selling



Bruno

## ☆☆☆☆☆ Defective item

Reviewed in the United States 🇺🇸 on August 22, 2022

Size: 12 | Color: Black/Black/Grey | [Verified Purchase](#)

So I bought the black and white ultraboost 21 right after. The black one is certainly defective as the insole slips out WHILE I am running. I tried contacting customer care and since the issue can't be seen on a picture (you have to run with it to see the insole slipping out) they provided no support. it's pretty frustrating because it's an expensive shoe and since I own the exact same shoe in other color I can compare that the black one has issues. so buy with care and if you experience any discomfort while running, send them back.

Helpful

Report abuse



LA Brown

## ☆☆☆☆☆ Flawed product

Reviewed in the United States 🇺🇸 on December 4, 2022

Size: 11.5 | Color: White/White/Grey | [Verified Purchase](#)

Loved the fit & comfort of these shoes but after a couple of months the soles started to leak a substance which caused the to become discolored. My friend likes my shoes initially, and bought a pair for himself and he is having the same issue. Very disappointed in this product given the price we paid.



One person found this helpful

Helpful

Report abuse



agora1031

## ☆☆☆☆☆ FRAUD AND TERRIBLE SERVICE

Reviewed in the United States 🇺🇸 on July 29, 2022

Size: 7.5 | Color: Core White/Core White/Green | [Verified Purchase](#)

I purchased these shoes and attempted to return them within the 30 day window because they are too big. I was unable to obtain a return label within the 30 day window and now on the 31st day the seller tells me they can't authorize a return. TOTAL FRAUD AND SCAM. No reason for not authorizing except they want to keep my money for a useless product. DO NOT PURCHASE FROM THIS SELLER. PRODUCT WAS NOT AS ADVERTISED, TERRIBLE QUALITY, AND DOES NOT FIT WHATSOEVER.

Helpful

Report abuse



Sherry

## ☆☆☆☆☆ Sold as new shoes but had clearly been worn

Reviewed in the United States 🇺🇸 on November 27, 2022

Size: 10.5 | Color: Core White/Core White/Dark Blue | [Verified Purchase](#)

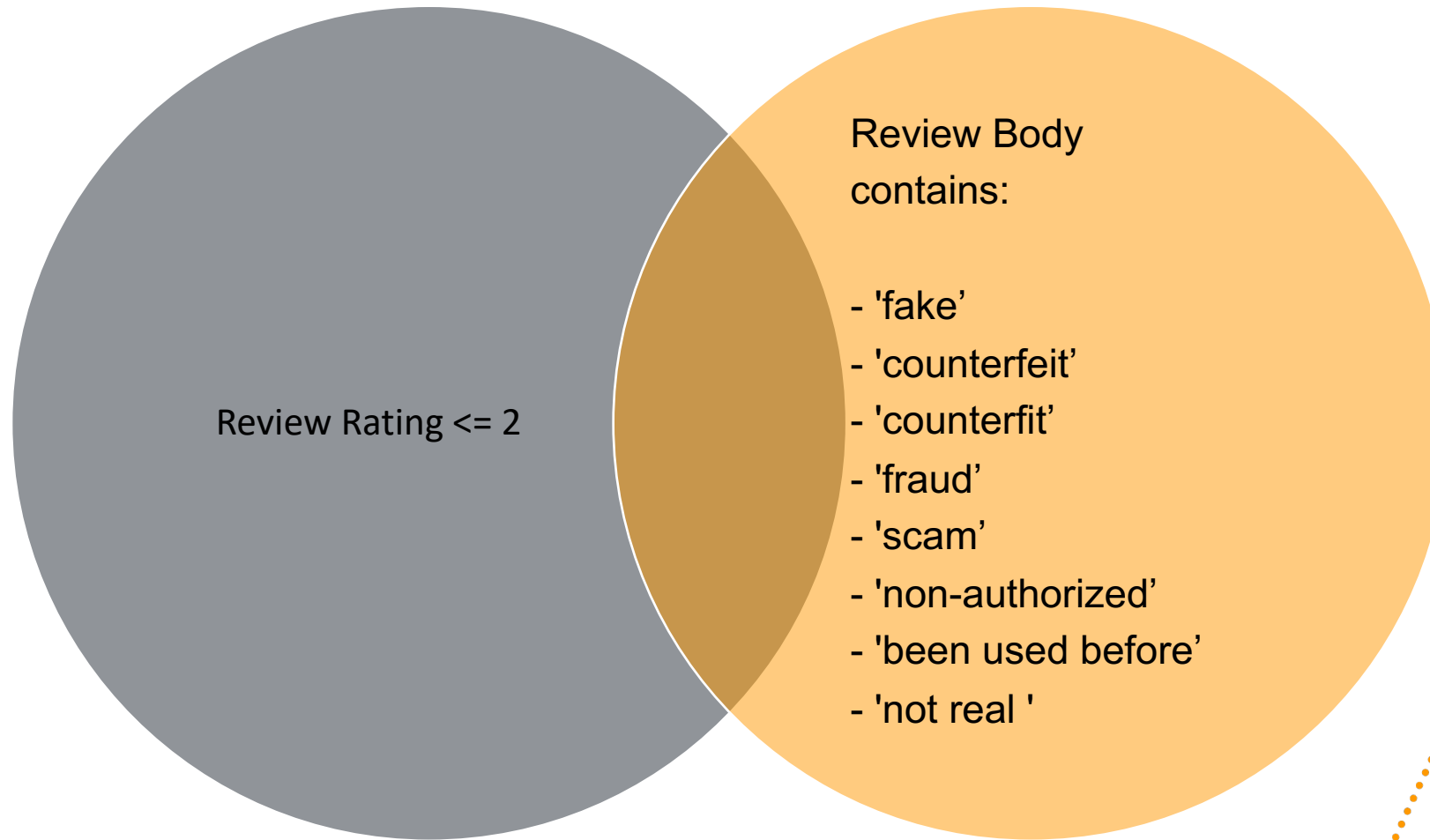
I paid \$99 for these sold as new for a Christmas present for my husband and opened them to find used shoes that had been worn and were dirty on the bottom. I can't give him dirty used shoes for Christmas. What the h.



Helpful

Report abuse

# Assigning a positive class

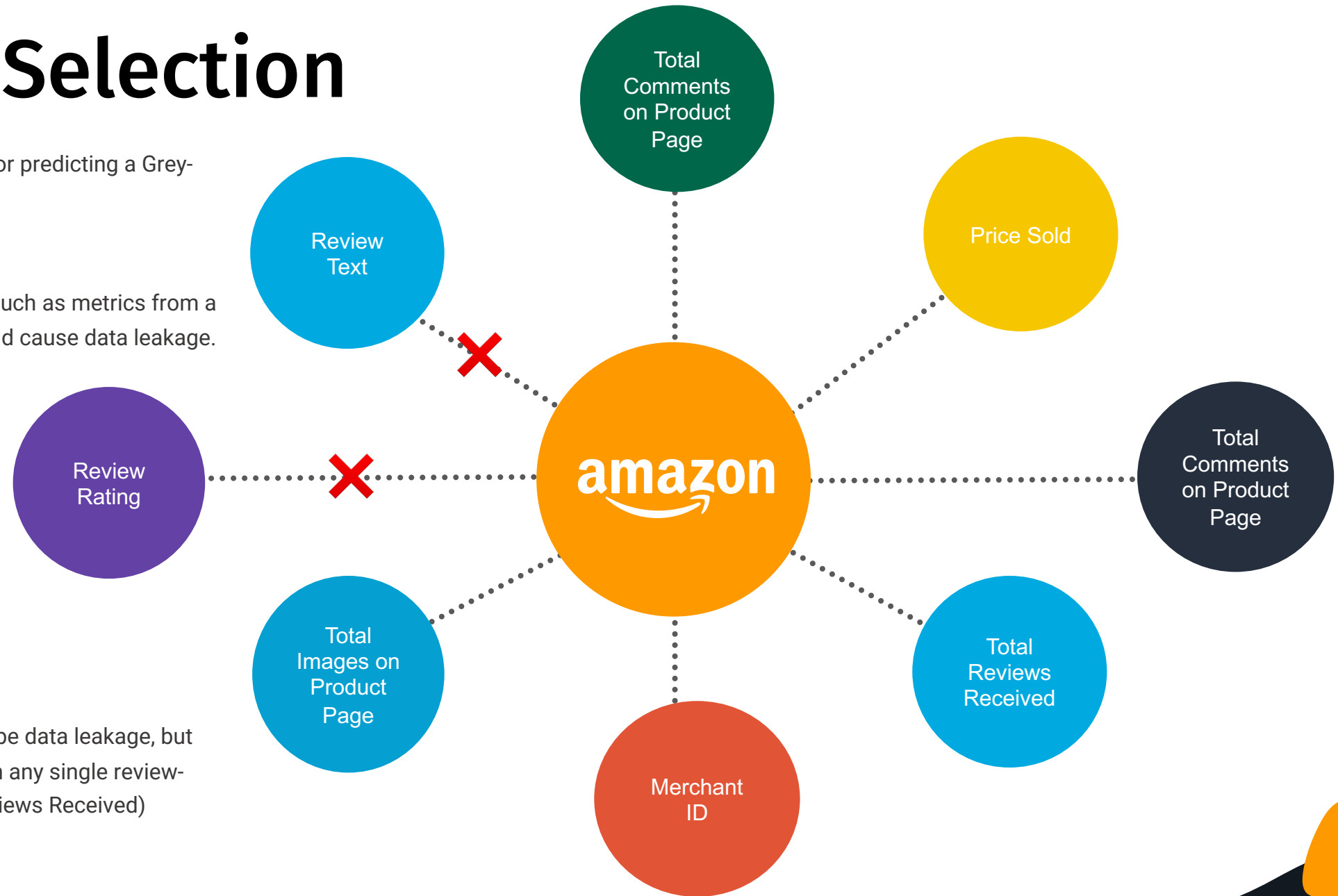


# Feature Selection

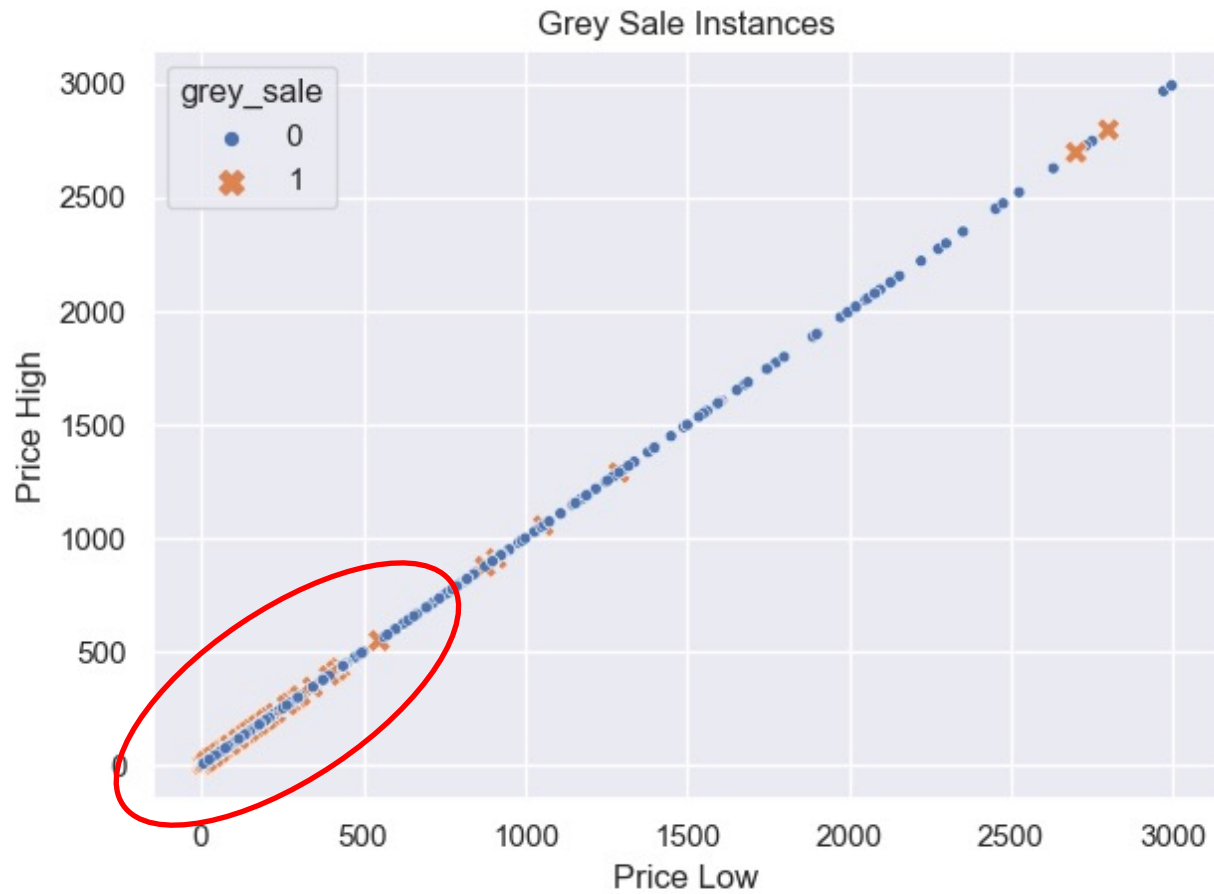
What are the best features for predicting a Grey-Sale before it happens?

Using any post-sale data, such as metrics from a specific review, would cause data leakage.

Some features may appear to be data leakage, but can be mutually exclusive from any single review-specific feature (e.g. Total Reviews Received)






























































# Feature Selection: Price





# Feature Selection: ASINs, Brands, & Categories

<div><div>Amazon's Choice</div><div></div><div><div>adidas</div><div>Men's Ultraboost-21 Running Shoes</div><div>4.6       (5,639)</div><div>\$106<sup>99</sup> List: \$180.00</div><div> FREE delivery Wed, Mar 1</div><div>Prime Try Before You Buy</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Men's Ultraboost 21 Running Shoe</div><div>4.5      (288)</div><div>\$99<sup>99</sup> List: \$179.95</div><div> FREE delivery Tue, Feb 28</div></div></div>	<div><div>Previously viewed</div><div></div><div><div>adidas</div><div>Men's Ultraboost 21 Running Shoe</div><div>4.1      (25)</div><div>Save 5%</div><div>\$147<sup>72</sup> Was: \$155.50</div><div>Lowest price in 30 days</div><div> FREE delivery Wed, Mar 1</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Ultraboost 21 Gore-TEX Running Shoes Men's</div><div>4.7      (14)</div><div>\$217<sup>99</sup></div><div>FREE delivery Mar 6 - 8</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Ultraboost 21 Shoes Men's, Black, Size 10</div><div>5.0      (2)</div><div>\$185<sup>00</sup></div><div>FREE delivery Mar 1 - 2</div></div></div>
<div><div></div><div></div><div><div>adidas</div><div>Mens Ultraboost 21 GV7726 Parley - Size 9</div><div>No reviews</div><div>\$209<sup>00</sup></div><div>FREE delivery Mar 1 - 2</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Ultraboost 21 Unisex Shoes</div><div>No reviews</div><div>\$179<sup>00</sup></div><div>FREE delivery Wed, Mar 1</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Ultraboost 21 Shoes Men's, Black, Size 11</div><div>No reviews</div><div>\$190<sup>00</sup></div><div>FREE delivery Mar 1 - 2</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Men's Ultraboost 21 Running Shoe, 9.5</div><div>4.4      (608)</div><div>\$218<sup>26</sup></div><div>FREE delivery Mar 1 - 3</div><div>Or fastest delivery Feb 28 - Mar 1</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Unisex-Child Ultraboost 21 Running Shoes</div><div>4.6      (400)</div><div>\$84<sup>95</sup> List: \$160.00</div><div>Prime</div><div>FREE delivery Fri, Mar 3</div><div>Prime Try Before You Buy</div></div></div>
<div><div></div><div></div><div><div>adidas</div><div>Mens UltraBoost 21 Workout Gym Running Shoes</div><div>No reviews</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Ultraboost 21 X Parley Mens Running Trainers Sneakers</div><div>No reviews</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Ultraboost 21 LNY Shoes Men's</div><div>5.0      (1)</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Nebraska Ultraboost 21 Shoes Men's, White, Size 11.5</div><div>No reviews</div></div></div>	<div><div></div><div></div><div><div>adidas</div><div>Nebraska Ultraboost 21 Shoes Men's, White, Size 7</div><div>No reviews</div></div></div>

# Classification Models : Test Performance

Highest Performance achieved by Random Forest Classifier using combined Continuous and Categorical features with SMOTENC to up-sample minority class.

## Random Forest Classifier with SMOTEN

Balanced Accuracy: 0.9337  
Recall: 0.9701  
Precision: 0.9043  
F1 Score: 0.9360

Continuous  
Features Only

## Logistic Regression with NO penalty for Coefficient Interpretation

Balanced Accuracy: 0.6492  
Recall: 0.5463  
Precision: 0.6879  
F1 Score: 0.6089

Data Leakage  
Identified

## Random Forest Classifier with SMOTEN

Balanced Accuracy: 0.8859  
Recall: 0.9586  
Precision: 0.8369  
F1 Score: 0.8937

Continuous  
Features Only,  
No Leakage

## Random Forest Classifier - SMOTENC

Balanced Accuracy:  
0.9079 Recall: 0.9397  
Precision: 0.8835  
F1 Score: 0.9107

Continuous AND  
Categorical  
Features

## Random Forest with SMOTENC & PCA

Balanced Accuracy: 0.9061  
Recall: 0.9377  
Precision: 0.8819  
F1 Score: 9089

PCA



**what did we learn?**



# Next Steps for Future Iterations

## Feature Selection

Based on availability

- Minimum Authorized Price
- SNS presence
- Merchant Data

## Hyperparameters

Tuning + Optimization

Due to large runtimes and limitations of the local device, we could not tune for optimal hyperparameters. This is something we would like to explore in future iterations.

## Text Mining + NLP

Target Assignment

Exploration of feature importance for unigrams, bigrams, trigrams, etc. using CountVectorizer or similar mechanism. Could develop a better system of identifying past positive cases.

## ... more Data



thanks!



Credit for this presentation's slides template goes to:



**Slide Chef**