

# Auto Insurance Cross-Sell

A Presentation by Samuel Middleton

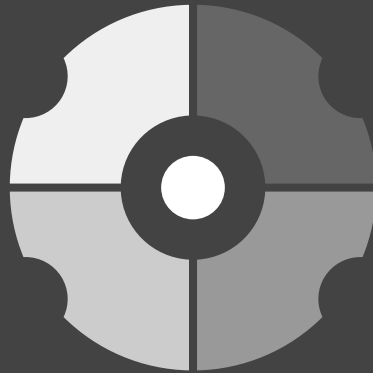
## Business Case

Can you use analytics data derived from customers who have a health insurance policy to target those most likely interested in an auto insurance policy?

The auto insurance industry is expected to make \$308.8bn this year.

# Our Data

This dataset was sourced from Kaggle. The data is very clean and provides some very interesting insights into customer analytics data. Ultimately, we want to predict if the customer is 'Interested' as opposed to 'Not Interested' in a cross-sell.



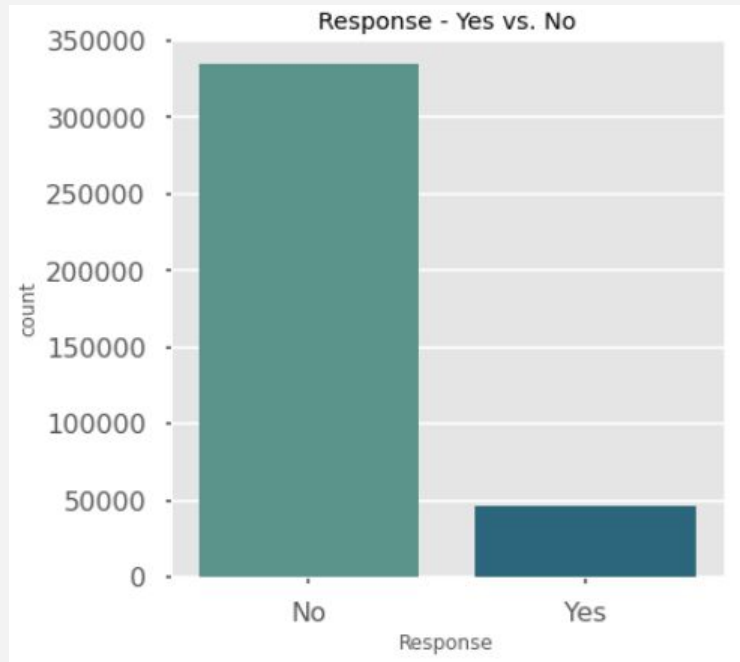
# Data Definitions

In order to better understand the data.

Variable	Definition
id	Unique ID for the customer
Gender	Gender of the customer
Age	Age of the customer
Driving_License	0 : Customer does not have DL, 1 : Customer already has DL
Region_Code	Unique code for the region of the customer
Previously_Insured	1 : Customer already has Vehicle Insurance, 0 : Customer doesn't have Vehicle Insurance
Vehicle_Age	Age of the Vehicle
Vehicle_Damage	1 : Customer got his/her vehicle damaged in the past. 0 : Customer didn't get his/her vehicle damaged in the past.
Annual_Premium	The amount customer needs to pay as premium in the year
PolicySalesChannel	Anonymized Code for the channel of outreaching to the customer ie. Different Agents, Over Mail, Over Phone, In Person, etc.
Vintage	Number of Days, Customer has been associated with the company
Response	1 : Customer is interested, 0 : Customer is not interested

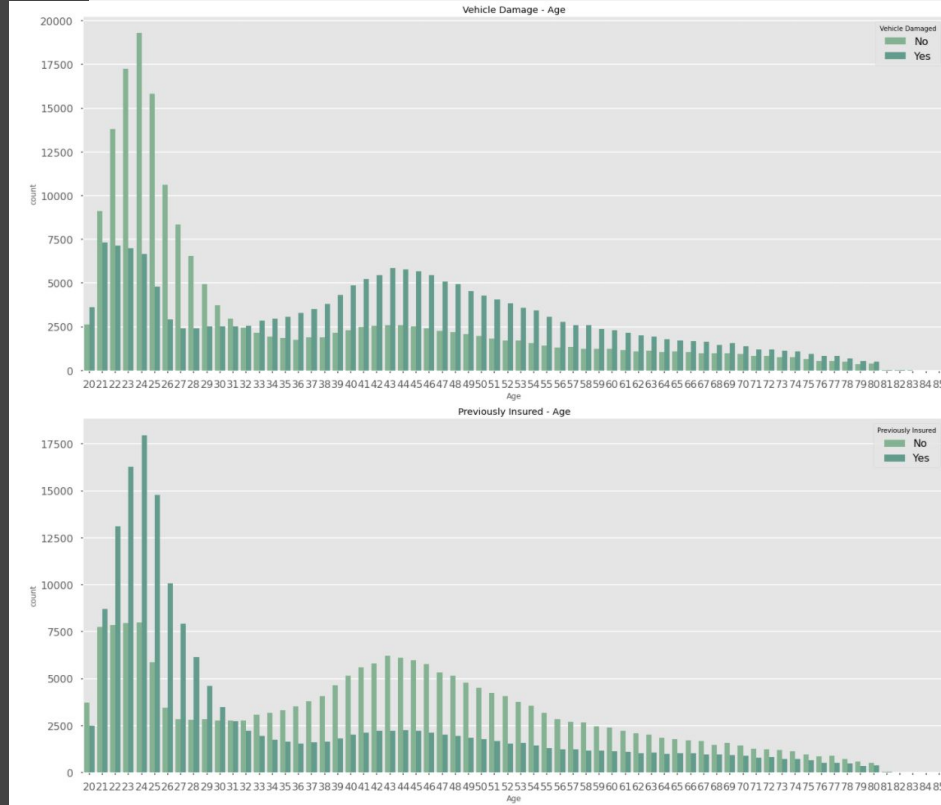
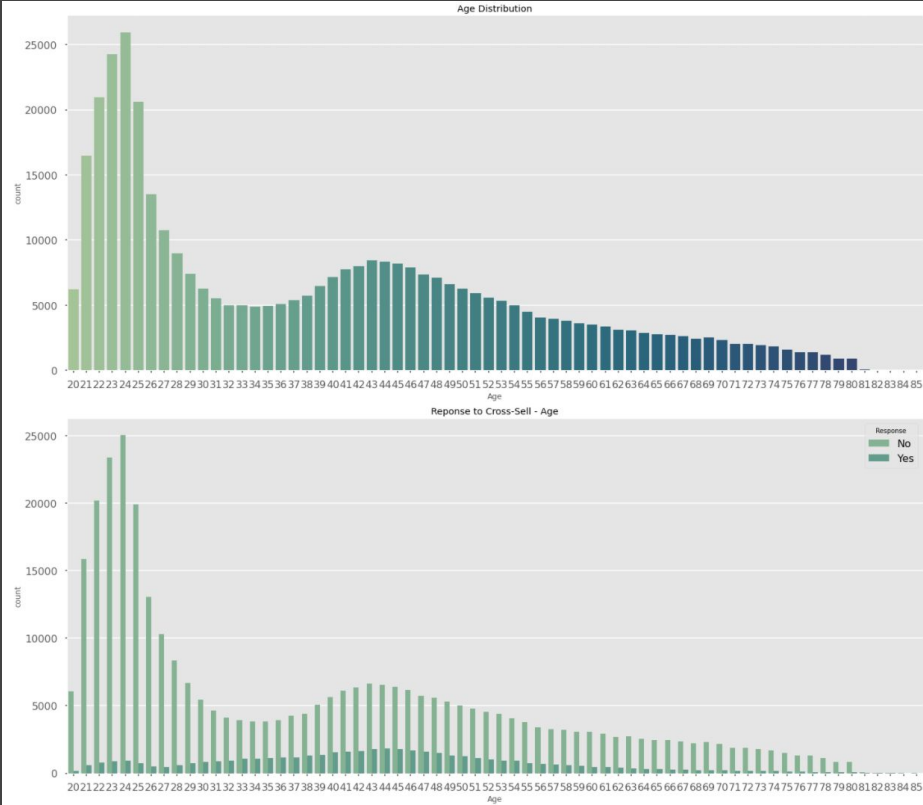
# Exploring Data - Target

The imbalance in our target is the most important discovery in our data exploration.



# Exploring Data - Age

Age data is very important as it is one of our most important data features, as you'll see later. Here we see distributions of age with our other 2 most important data features - Previously Insured and Previous Damage.





# How do we do it?

Machine Learning!

Machine Learning is the process of deriving relationships between data using mathematics!



## The Models used:

There are numerous Machine Learning models that can be used, we applied:

- Decision Trees
- Random Forest
- K-Nearest Neighbors
- XGBoost
- CatBoost



# Model Details

It sounds complicated but there are only 2 things you really need to know:



## Trees and Forests

Decision trees ask simple 'Yes' or 'No' questions in order to follow a path to an answer.

Forests are just a group of trees where the best tree gets chosen.

## Nearest Neighbors

Nearest neighbors classifies data based on the majority of points around it.



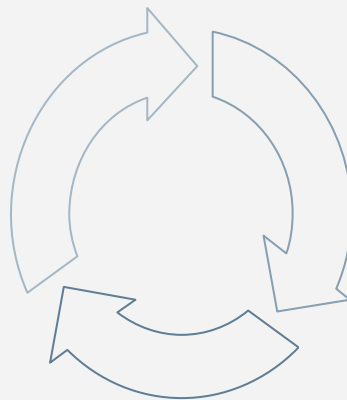
Training

Tuning

Prediction

# The Modeling Process:

An iterative Journey



# Recall Metric

We used the recall metric to score our modeling. This lets some false positives fall through the crack, but captures the most true positives.

**Recall** — Also called Sensitivity, Probability of Detection, True Positive Rate

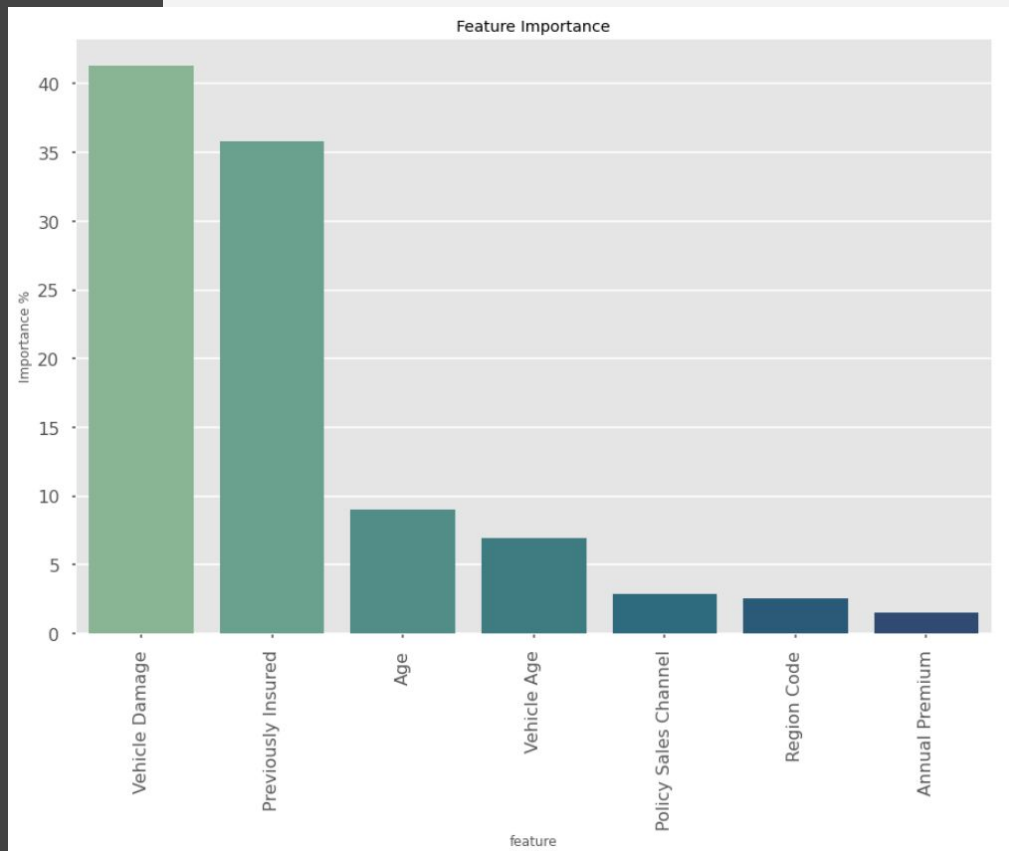
The ratio of correct positive predictions to the total positives examples.

$$R = \frac{TP}{TP + FN}$$

# CatBoost Wins!

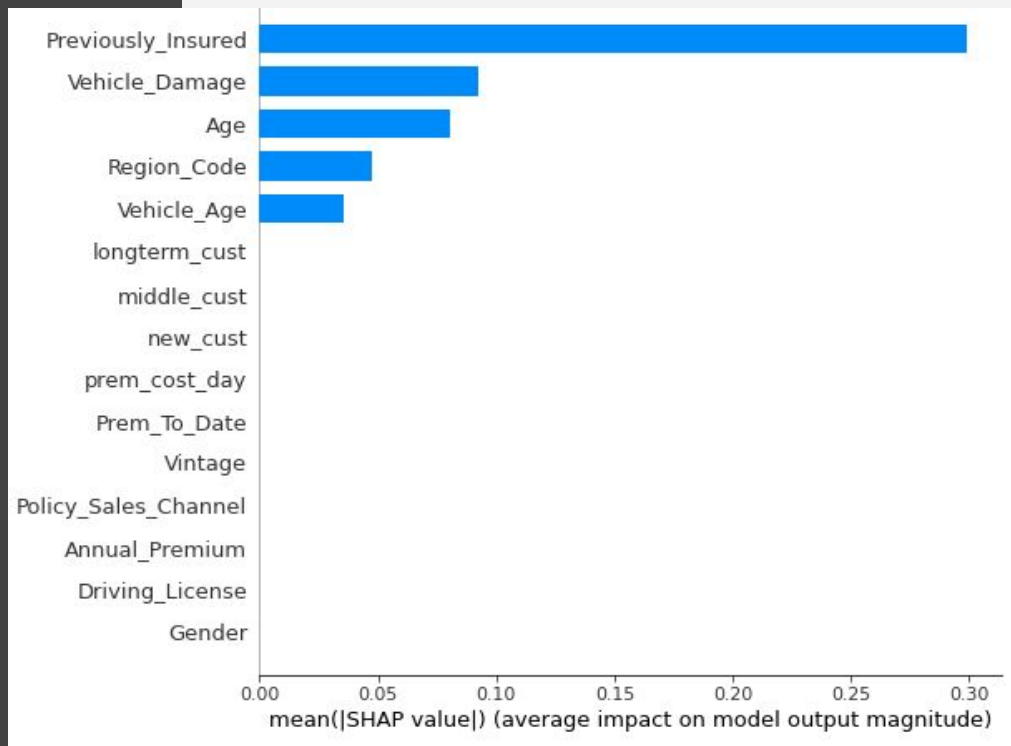
Our CatBoost model was the most accurate with ~87% to predict a 'Yes' response.

It also gave us insight on important data features.



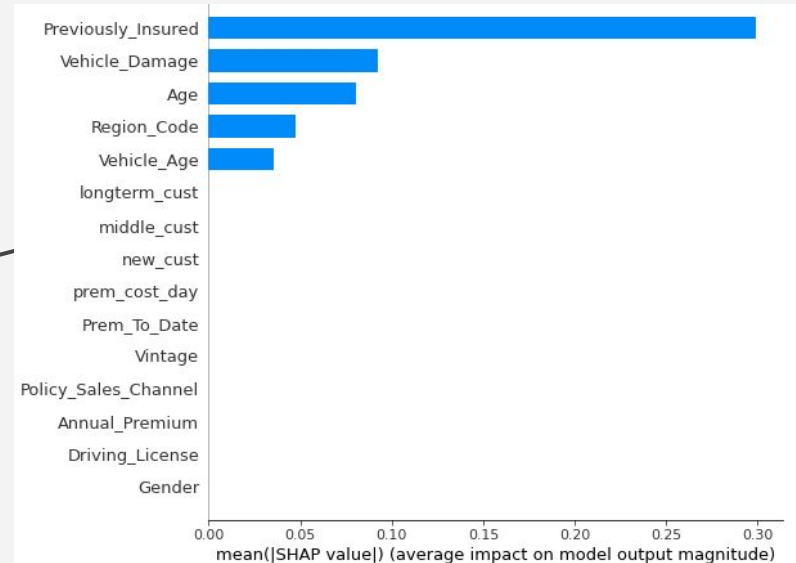
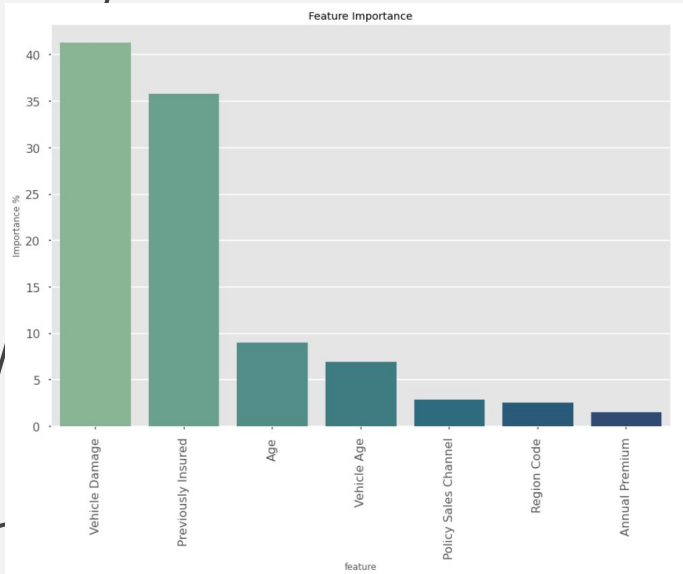
# Feature Influence

We use a mathematical method known as Shapely Values that allow us to determine what impact these features have on our model's ability.

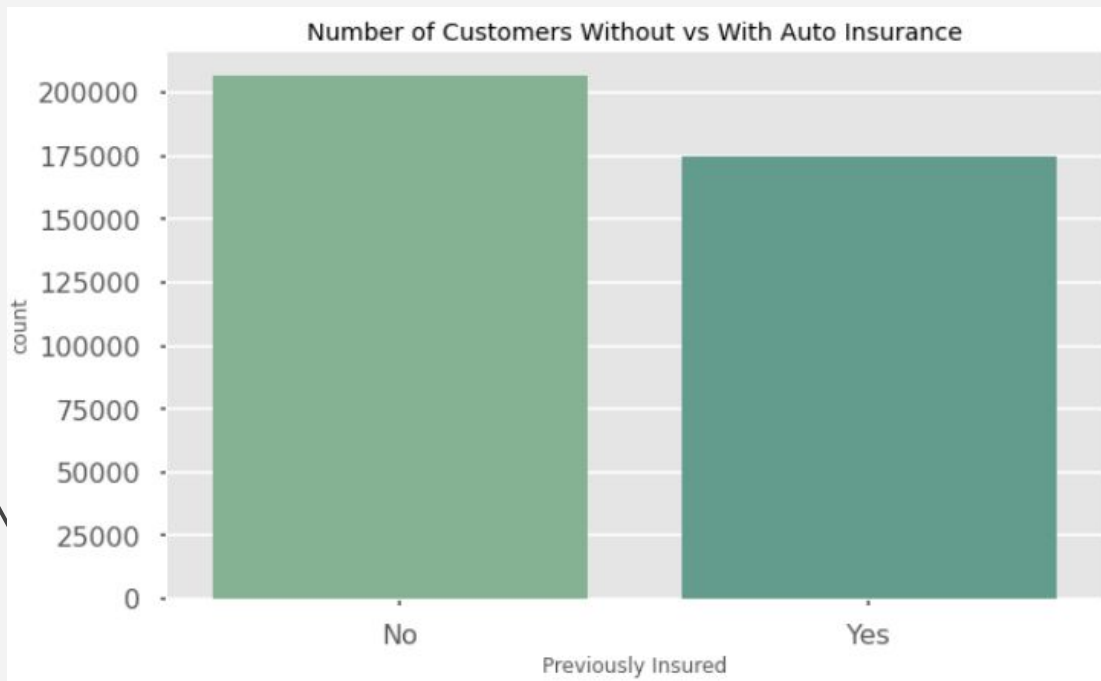


# What Do They Mean

- Previously Insured is the largest single influencing factor on if people are interested in auto insurance.
- Previous vehicle damage is the second most influential factor.
- Age is third most important.

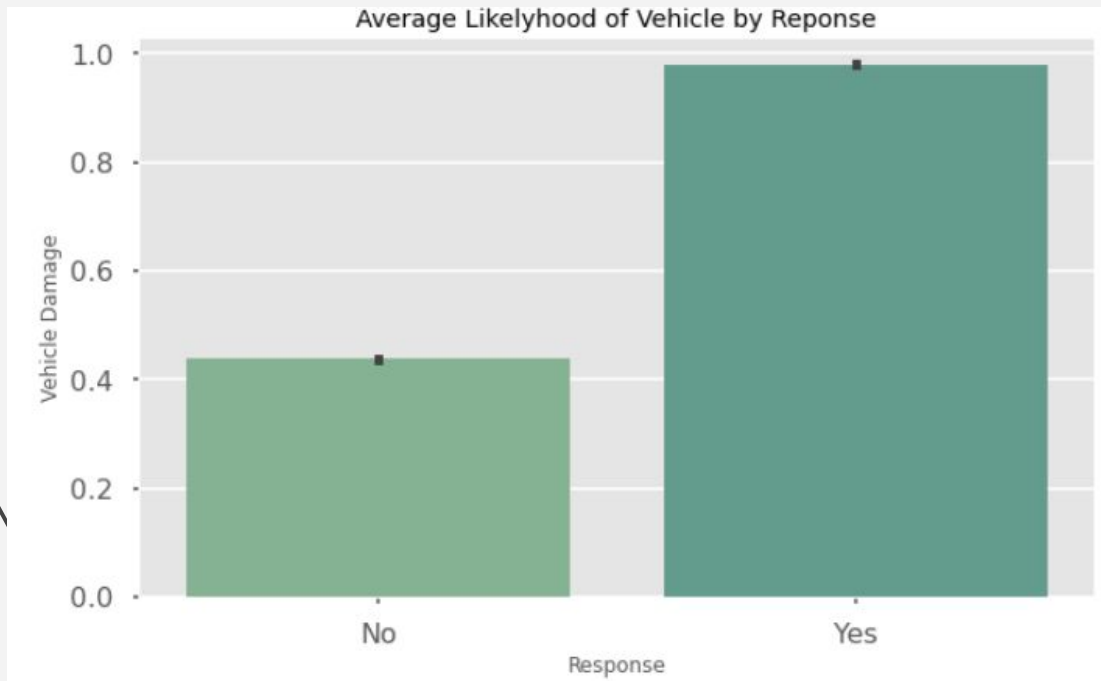


# Previously Insured



**Previously Insured** individuals are the minority, therefore it is a great demographic to target since it is also the most important feature of our model.

# Vehicle Damage

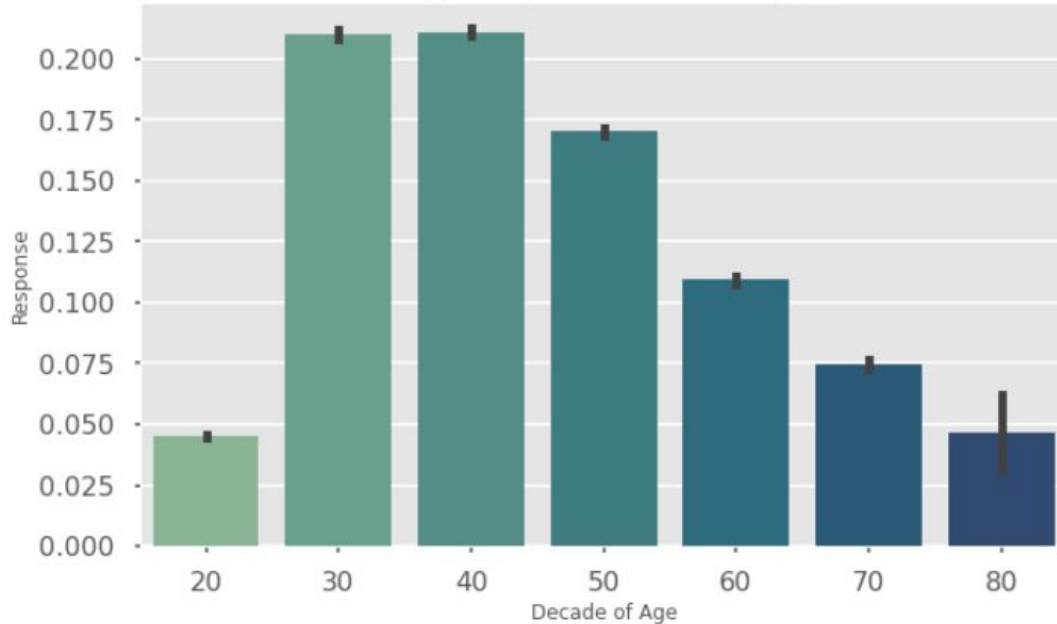


**Vehicle Damage** we can see with this chart influences the interest response in individuals we approach with the cross-sell.



# Age


Average Likelihood of Cross-Sale by Age



**Age** is an influencing factor on if an individual is interested in the cross sell or not. The very young and the elderly are generally not interested in the cross-sell.

# Recommendations

- Leverage those individuals that lack auto insurance to drive cross-sells.
- Take a risk, insure those with previous vehicle damage.
- Target the middle aged, as the young and the elderly are less interested in a cross-sell.



Work with further models and tuning to  
boost the performance.

Derive more powerful features.

Try new methods of Machine Learning to  
get a market segmentation.

## Future Work:



# Thank You

For further questions contact me at:

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Github:

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