

PROPENSITY MODELLING- AN EFFICIENT PREDICTIVE TOOL USING MACHINE LEARNING

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ABSTRACT

Data gains its real importance when used to predict the future rather than just analyzing the past. Propensity modelling looks at the past behavior and uses that information to make predictions of tomorrow and provides a foresight.

Uncertainty has always been an elemental aspect of any business. In almost most of the businesses success or failure depends on human behavior. Through such behavior we can derive patterns which help us to come to various conclusions. Propensity modelling is a technique used to derive patterns and predict such behavior. Propensity modelling predicts what a customer is likely to do with the help of machine learning algorithms which explore patterns in human behavior.

This paper aims to explore the various areas where propensity modelling has been used. It also aims to suggest ways of evaluating the performance of the propensity model.

Keywords: Propensity Modelling, Machine Learning.

Introduction

Propensity modelling is something that was known since 1983 but it's only in recent times that machine learning has gained its true value.

Propensity modelling predicts what a customer is likely to do with the help of machine learning algorithms which explore patterns in human behavior. These models are used for a wide variety of tasks related to prediction in various areas. After building a model it is very important that we evaluate the performance of the model and understand which model is best suited for your organization or business. Various studies provide solutions for businesses to target the right customer and maximize their profit. But very few have been able to predict customers with accuracy.

Organizations are striving hard to reach out to the right customers at the right time. They are in search of models which measure up to one-size-fits-all and bring pieces together to create an effective model that can accurately give targeted solutions.

A model which can evolve with trends, adapts to a large data set, processes real time data and delivers predictions accurately.

Propensity Modelling is one such solution in an age of hyper personalization.

Objectives

- 1) To understand the importance of Propensity Modelling in Businesses.
- 2) To explore the different areas where propensity modelling is used.
- 3) To explore the different challenges involved in implementing propensity models.

Review of Literature

Clarke (2017) a propensity model, monitoring user actions in order to create content as per the propensity of the user. (Tasdighi, Arabi, Harmel, & Line, 2018) in the paper explores the effect of conditioning previous wave data on predictive and discriminative ability of Response propensity Models.

Campisi, Torrisi, Ignaccolo, Inturri, & Tesoriere (2020) the implementation of car sharing service among university students. A propensity model was applied to check the difference between expected and observed frequencies for several combinations of the analysed attributes.

Kozić, Mikulić, & Krešić (2016) a micro level empirical analysis of the determinants of propensity to travel. (Li, W., Sun, K., Schaub, F., & Brooks, C., 2021) have investigated students' propensity to consent to opt out of having their data collected and used for learning analytics. Study also suggests that there are various factors such as demographics, personality etc which motivate students to express their consent (Rentsch, A., Schaffner, B. F., & Gross, J. H., 2019) in their study reveals that there are many demographic variables that are taken into account to predict the turnouts and overreporting in voters.

Zhang (2021), provides solutions for the company's more precise marketing and the discovery of potential customers. Machine learning techniques like Logistic regression and random forest have been used to solve the problem, and compare the prediction effects of the two models. Few studies (Theofilatos, Yannis, Antoniou, Chaziris, & Sermpis, 2017) have contributed to the existing knowledge by utilizing machine learning techniques for predicting accident risk. Findings suggested that accident risk and type depend more on less on the prevailing traffic conditions (i.e) real time traffic. (Barga, Fontama, & Tok, 2015) focusses on buyer propensity models to business processes. Their study applies the key concepts and explores the capabilities of utilizing machine learning for predictive analytics.

Verenich, Kikas, Dumas, & Melnikov (2015) in their research adopts a combination of propensity and influence to provide a solution to targeting users on social media. The study highlights the problem of selecting users on online social networks.

Characteristics of Propensity Models

In order to prevent huge revenue losses and build more safer and targeted marketing campaigns, propensity models need to possess the following characteristics

- 1.1 Dynamic: Models should be built in such a way that they should adapt to changing trends and should be able to learn and derive from new data as and when it is available.
- 1.2 Scalable: Models should be created such that they can be used in scenarios which produce a wider area of predictions rather than a single scenario.
- 1.3 Adaptive: Models should be able to adapt to changes in terms of data validation and deployment.

Types of Propensity Models

1. Propensity to purchase or convert
2. Predicted customer lifetime value
3. Propensity to churn
4. Propensity to engage

Different types of data sources are taken into consideration

1. Information that tells us "Who" the person is.
2. Sources that give us information about "What" a person has purchased in the past.
3. Information about "Why" a person has purchased things.

Steps to implement a propensity model

- Develop a Strategy
- Collect Relevant Data
- Prepare data for modelling
- Create and Test Model
- Deploy a Model

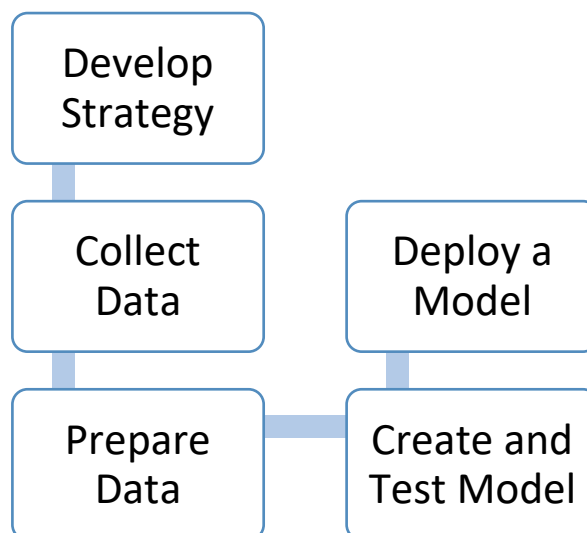


Fig 1: Steps to Implement Propensity Model

Develop a Strategy

It is important to plan out a strategy before you move ahead to implement a model else you would end up investing on resources. The first step is to define the objectives and take a decision as to what conclusions you need to derive out of it.

Collect Relevant Data

Choosing your data depends on the predictions you would make. Data can be derived from first party sources like websites, mobile applications etc or could be from third parties.

Prepare Data

In order to ensure that the data you select is consistent, accurate and complete, the right choice of variables have to be made.

Create and Test Model

After the data is prepared, it has to be trained using different approaches like logistic regression, neural network and other machine learning techniques.

Deploy a Model

The last step is to deploy the model and maintain the model so that results can be improve over time.

Areas where propensity models can be used.

Areas including Insurance, Mortgage, Re-Financing, Credit Cards, Loans, Investments, Satellite TV, Cable, Netflix, Online Banking, Online money management, Voting and Disease are some of the cases where propensity models can be implemented.

Propensity modelling in Travel industry-

Even in the Travel Industry, propensity models can be used to generate meaningful insight from the passenger's behaviour.

A traveller is more likely to go for travel insurance if they are more prone to risk or have purchased insurance in the past.

Likelihood to travel or also termed as propensity to travel depends on the willingness of the person to be a tourist. There are three factors which greatly impact someone's propensity to travel: namely age, education and income (Kožić, Mikulić, & Krešić, 2016).

Propensity models in election campaigns

Propensity models have been used in election campaigns to predict which voters could be encouraged to vote and what campaigning techniques such as flyer, call, door to door campaigning would be best suitable for each voter.

Through various studies (Rentsch, Schaffner, & Gross, 2019), voter models are built that take into account different variables that help to predict the turnout or overreporting during elections and would make it easy to implement in future elections.

Banking

Key Customers were identified with the help of propensity modelling and thereby helped in designing promotions for the right customers which led to increased productivity.

Banking industry ("How Banks use Product Propensity to Increase Customer Delight and Profitability?," 2018) have benefitted from this modelling with respect to debt collection efforts: propensity to pay. When it comes to collecting debt they do not possess the required expertise which help them to decide which processes should be applied to customers.

In order to reap the maximum benefits of retaining maximum customers at low costs banks use propensity models complemented by customer segmentation and predictive modelling.

Customer Lifetime Value (CLV) is an important dimension that directs banks to generate maximum revenue. More features like customer preferences and usefulness of the product are instilled in order to make sure that the right customers are benefitted with the right products.

Healthcare

Propensity in healthcare ("Five best practices in healthcare propensity modeling," 2021) indicates the probability of a patient who is likely to take a particular treatment based on certain characteristics or behaviour.

You are in a better position to manage disease and costs when you are able to identify patients who have a higher likelihood of a particular disease. Preemptive action can be taken to treat a patient and seek better care.

With the help of models which use demographic and other data sources to identify and target those populations which are at higher risks.

Healthcare marketers use a set of features like diagnostics, visit history, socio demographics, socioeconomic, lifestyle for predicting the likelihood of a patient [8].

TV Data company

In order to utilize its maximum potential, marketers should use propensity modelling and use machine learning technologies.

A US based company could manage its spending on advertisements appropriately with the use of AI in propensity modelling and were able to target the right customers. The result was remarkable and the predictions made were accurate to 80% percent.

Airlines

Scandinavian Airlines have made use of machine learning and predictive analytics in propensity modelling. With this they were able to predict the changes of a customer to book a ticket. They were able to target the customers and provide timely offers to frequently bought tickets which led to flights taking off without empty seats.

Mobile Operators

With accurate propensity models' marketers were able to achieve their targets and reduce the customer churn. They could form segments of customers and were able to determine which products were perfectly matched. This resulted in a 30% reduction in customer churn and 2% increase in revenue.

Media and Entertainment Companies:

Advancements and innovations in technology have had a great impact on media and entertainment.

For almost 2 decades, changes in these companies have been tremendous, resulting in higher customer churn and dissatisfied customers.

Propensity modelling ("Can propensity modeling & customer segmentation help media and entertainment companies predict their customer's next move? | Head to Quantzig's article to find out," 2020) has definitely

proven to tackle the challenges through targeted campaigns which resulted in retaining customers year after year.

Real time cases where Propensity Modelling have been effective

1. In 2012, during Barack Obama’s re-election campaign, propensity models were built by a team of data scientists. The use of this analytics helped in winning Obama’s re-election.
2. The Bouqs. Co, a US based floral delivery company, invested in developing propensity models to identify most valued customers and provided them with offers.
3. Vodafone, one of the leading mobile operators in Ukraine built a propensity model in order to make better decisions and reduce customer churn which resulted in 30% reduction in customer churn and 2% increase in revenue.

Ways to evaluate a Propensity Model

Propensity models which are effective will provide accurate predictions. In order to evaluate the different types of propensity models we need to divide the data into

- Training Data- which will assist in finding the best model
- Testing Data- which will assist in evaluating the performance of the model which is best suited.

There are three ways for evaluating the quality of the propensity model

Model Training Performance-In this evaluation method, it is assumed that the prediction is most successful when we choose the training data from the same time period as that of the testing data, i.e., training set and testing set are from the same time frame.

Future Model performance- In this method, data upto a certain specific day is considered and then the model is tested using data that appears after the date. Actual activities are tracked in order to see how accurate the predictions are.

Historical Future Model performance- In this evaluation, the model is trained using data up to a specific date and data is tested after that date. Future performance is analyzed and predictions made using past data. In this way, you no longer need to wait for future data.

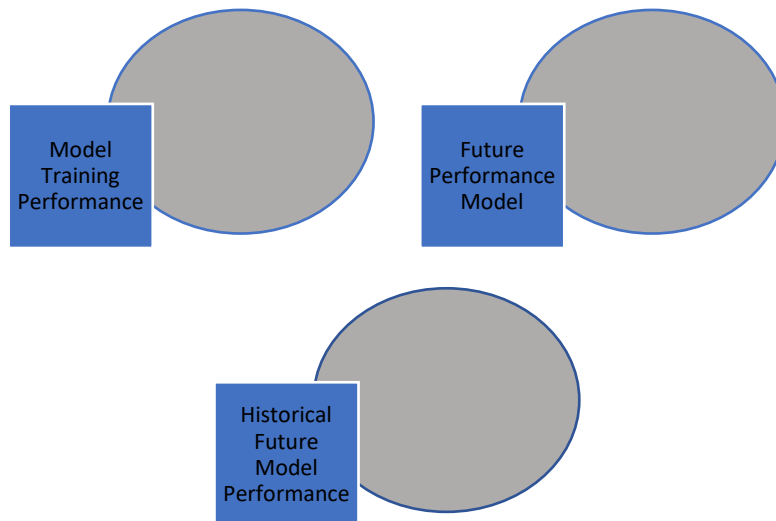


Fig 2: Ways for evaluating the quality of the propensity model

Conclusion

When implementing a certain model for an organization, there are various factors that need to be taken into consideration.

All models will not be actually useful or will not be able to produce the desired benefits.

The intended use of the model needs to be brought into consideration for the expected business impact. In worst scenarios, propensity models developed inappropriately may lead to a negative impact on businesses and marketing tactics. A detailed study of the problems associated or challenges faced have to be undertaken in order to implement the best suited model for an organisation.

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