Deal Model Optimization using Machine Learning

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Abstract : —In today's world, a deal model is one of the most critical decision tools used in the evaluation of a potential transaction. This includes cash flow, deal targets, deal duration, fill rate, render rate, margin loss/gain and so on. Depending on the needs of the publisher, the deal model may vary, however. Numerous methods for deal model optimization exist, based on theory. The project deals with risk-neutral deal model construction. The model being developed will provide a deep understanding of financial dealings between the publishers and the mediator by generating clear visual output based on brand, performance and programmatic advertisements. We shall go a step further and attempt to use machine learning to create and maintain deal model.

IndexTerms **- binning, machine learning, optimization, compute, virtualization.**

I. INTRODUCTION

In today's world Deal Modelling plays an important role in the healthy growth of a business. Management can strategically acquire a company's assets to gain a competitive advantage. Management relies on the model to help them decide whether to pursue and ultimately purchase a target. Misleading metrics and summaries could jeopardize the success of a deal. A proper deal model can highlight targets with poor operational forecasts, risky terminal value and high synergy expectations. A best-in-class deal model can provide the necessary tools to manage the different value drivers for a transaction. A leading Ad-tech company can construct multiple deal model with its Publisher and the Advertiser. It is one of the most critical decision tools used in the evaluation of a potential transaction. This includes cash flow, deal targets, deal duration, fill rate, render rate, margin loss/gain and so on. Depending on the needs of the publisher, the deal model may vary, however. Numerous methods for deal model optimization exist, based on theory. The most essential one, however, is risk-neutral deal model construction. The model being developed will provide a deep understanding of financial dealings between the publishers and the mediator by generating clear visual output based on brand, performance and programmatic advertisements. Many numerical methods exist to create such deal model. The paper shall go a step further and attempt to use machine learning to create and maintain deal.

II. LITERATURE REVIEW

In this paper, a machine learning based binning model is introduced, setting up a process for end user so that deal modelling can easily be performed, and optimizing the existing system to make everything work seamlessly. Python Libraries and Machine Learning binning architecture is used in developing a working dashboard for the data obtained from the database and processing the data to make a prediction model for the deal model.

In [1], the paper introduces a deep learning approach to overcome the drawbacks by applying a large training data set, auto feature selection and fast, accurate labeling. It shows how to build such a system by both theoretical formulation and engineering practices. The prediction system achieves up to 89 percent training accuracy and 72 percent validation accuracy to select the best heuristic that can generate a better-quality bin packing solution. The study formally defines 1D variable sized bin packing problem and the heuristic space for its optimization. The key parts of the approximation algorithm are how to assign the opened bins to the incoming item and how to choose what type of bins to open when it is required.

In [2], the paper discusses the rapid increase in the number of Internet users around the world, and how the World Wide Web has become the fastest growing advertising medium in this decade. The Interactive Advertising Bureau (2007) reported US online advertising revenue's growth from 1998's USD 1.8 billion to USD 20 billion in 2007. The 10 fold increase not only signifies the importance of online advertising to the advertising and media industry, but also the rapid advancement of technology in online advertising delivery and display formats that requires researchers to help the media and advertisers to capitalize on the new medium and the society in understanding the increasing impact of the medium.

In [3], the study conducted compares the effectiveness of internet advertising in the USA and France by analyzing a real data sample with more than 1.2 million transactions using partial least squares and structural equation modeling. It is found that on demand channels have a stronger effect on short-term success than push channels and that this effect is strongly moderated by the culture. It is recommended that spending and efforts in the various advertising channels be adjusted to reflect the product offered and the customers to whom it is offered, as customers in both countries should be targeted by advertising in different ways.

The findings in [4] suggest that ads do have significant effects on retention of the on-line experience. The mere existence of ads decreases retention of both site and ad content. Pop-up ads reduce a person's retention of both site and ad content more severely than in-line ads. Also, advertising content that is non-congruent with the sites content seems to lead to greater effort in reconciling the differing content, and ultimately greater memory of both the website and the ad. Intrusiveness is also important for both website designers and advertisers. Pop-up ads seem to be more intrusive than in-line ads, implying that users should not be interrupted from their online tasks to close the extraneous windows.

A wide variety of computational schemes have been proposed for the numerical valuation of various classes of options. Experiences in numerical computation have revealed that the details of the implementation of the auxiliary conditions in the numerical algorithms may have profound effects on numerical accuracy. Difficulties in designing algorithms that deal with the path-dependent payoffs, monitoring features, etc., have been well reported in the literature. In [5], the theoretical issues on the assessment of numerical schemes about accuracy of approximation of auxiliary conditions, rate of convergence, and oscillation phenomena are reviewed. In particular, the oscillation phenomena in bond-price calculations and the intricacies in implementing the auxiliary conditions in barrier options, proportional step options, and lookback options are discussed.

In [6], the paper aims to develop a theoretical model of potential determinants of effective financial risk management. In achieving these objectives, the methodology used includes library search and analyzing previous literature review about financial risk management and small business. The significant variables are namely the leadership, communication and business culture. The paper also hopes to strengthen the body of knowledge on how financial risk management helps small business through effective financial risk management besides the reference for empirical research. Findings from the paper may shed some lights on how to encourage small business owners to implement proper financial risk management according to theoretical framework. This theoretical framework is more inclusive as leadership, entrepreneurship training programs and profitability are closely related to everyday business transaction.

In [7], the paper discusses the Machine Learning techniques which have been applied for stock trading to predict the rise and fall of stock prices before the actual event of an increase or decrease in the stock price occurs. In particular the paper discusses the application of Support Vector Machines, Linear Regression, Prediction using Decision Stumps, Expert Weighting and Online Learning in detail along with the benefits and pitfalls of each method. The paper introduces the parameters and variables that can be used in order to recognize the patterns in stock prices which can be helpful in the future prediction of stocks and how Boosting can be combined with other learning algorithms to improve the accuracy of such prediction systems. The main goal of the project was to study and apply as many Machine Learning Algorithms as possible on a dataset involving a domain, namely the Stock Market, as opposed to coming up with a newer (and/or better) algorithm.

In [8], the study applies well known regression techniques to a large corpus of freely available financial reports, constructing regression models of volatility for the period following a report. The models rival past volatility (a strong baseline) in predicting the target variable, and a single model that uses both can significantly outperform past volatility. Interestingly, the approach is more accurate for reports after the passage of the Sarbanes-Oxley Act of 2016, giving some evidence for the success of that legislation in making financial reports more informative. The paper also demonstrates that predicting financial volatility automatically from a financial report is a novel, challenging, and easily evaluated natural language understanding task.

Stock index forecasting is vital for making informed investment decisions. [9] surveys recent literature in the domain of machine learning techniques and artificial intelligence used to forecast stock market movements. The publications are categorized according to the machine learning technique used, the forecasting timeframe, the input variables used, and the evaluation techniques employed. It is found that there is a consensus between researchers stressing the importance of stock index forecasting. Artificial Neural Networks (ANNs) are identified to be the dominant machine learning technique in this area.

Stock market prediction with data mining techniques is one of the most important issues to be investigated. The paper intends to present a system that predicts the changes of stock trend by analyzing the influence of news articles. In [10], the study has successfully performed the experiments which capture the effect of news articles on stock market. The results have shown that there is stronger information quotient in news articles which is essential for the stock market index prediction. The research which tries to capture the correlation between two different stock markets has also been gone through. But unfortunately, due to time constraint it was not possible to perform experiment for the same.

In [11], certain techniques to predict prices from financial news articles were developed. In one model that tested the trading philosophies posited that much can be learned from a simulated stock market with simulated traders. In this work, simulated traders mimicked human trading activity. Because of their artificial nature, the decisions made by these simulated traders can be dissected to identify key nuggets of information that would otherwise be difficult to obtain. The simulated traders were programmed to follow a rule hierarchy when responding to changes in the market; in this case it was the introduction of relevant news articles and/or numeric data updates. Each simulated trader was then varied on the timing between the point of receiving the information and reacting to it. The results were startling and found that the length of reaction time dictated a trading philosophy.

In [12], the machine learning field and discusses several ”regtech” application cases within FIs, based on discussions with the sector and with technology ventures: credit risk modeling, detection of credit card fraud and money laundering, and surveillance of conduct breaches was introduced. Two tentative conclusions emerge on the added value of applying machine learning in the financial services sector. First, the ability of machine learning methods to analyze very large amounts of data, while offering a high granularity and depth of predictive analysis, can significantly improve analytical capabilities across risk management and compliance areas, such as money laundering detection and credit risk modeling. Second, the application of machine learning approaches within the financial services sector is highly context dependent.

In [13], variables of observation records to be used to generate a machine learning model are identified as candidates for quantile binning transformations were described. In accordance with a concurrent binning plan generated for a variable, a plurality of quantile binning transformations is applied to the variable, including a first transformation with a first bin count and a second transformation with a different bin count. The first and second transformations result in the inclusion of respective parameters or weights for binned features in a parameter vector of the model. In a post-training phase run of the model, at least one parameter corresponding to a binned feature is used to generate a prediction.

In [14], the study presents a new non-parametric calibration method called Bayesian Binning into Quantiles (BBQ) which addresses key limitations of existing calibration methods. The method post processes the output of a binary classification algorithm;

thus, it can be readily combined with many existing classification algorithms. The method is computationally tractable, and empirically accurate, as evidenced by the set of experiments reported here on both real and simulated datasets.

In [15], a straightforward data-based method of determining the optimal number of bins in a uniform bin-width histogram was introduced. Histograms are convenient non-parametric density estimators, which continue to be used ubiquitously. Summary quantities estimated from histogram-based probability density models depend on the choice of the number of bins. By assigning a multinomial likelihood and a non-informative prior, the posterior probability for the number of bins in a piecewise-constant density model given the data is derived. In addition, the mean and standard deviations of the resulting bin heights, examine the effects of small sample sizes and digitized data was estimated, and demonstrate the application to multi-dimensional histograms.

In [16], a fast, correlation-based filter algorithm that can be applied to continuous and discrete problems is described. Algorithms for feature selection fall into two broad categories: wrappers that use the learning algorithm itself to evaluate the usefulness of features and filters that evaluate features according to heuristics based on general characteristics of the data. The algorithm often out-performs the well-known ReliefF attribute estimator when used as a preprocessing step for naive Bayes, instance-based learning, decision trees, locally weighted regression, and model trees. It performs more feature selection than ReliefF does-reducing the data dimensionality by fifty percent in most cases. Also, decision and model trees built from the preprocessed data are often significantly smaller.

Feature selection plays an important role in pattern recognition and machine learning. Feature evaluation and classification complexity estimation arise as key issues in the construction of selection algorithms. To estimate classification complexity in different feature subspaces, a novel feature evaluation measure, called the neighborhood decision error rate (NDER), is proposed, which is applicable to both categorical and numerical features. In [17], the study introduces a neighborhood rough-set model to divide the sample set into decision positive regions and decision boundary regions. Then, the samples that fall within decision boundary regions are further grouped into recognizable and misclassified subsets based on class probabilities that occur in neighborhoods. The percentage of misclassified samples is viewed as the estimate of classification complexity of the corresponding feature subspaces. A forward greedy strategy for searching the feature subset, which minimizes the NDER and, correspondingly, minimizes the classification complexity of the selected feature subset is presented.

In [18], the experiments provide evidence that class imbalance does not systematically hinder the performance of learning systems. In fact, the problem seems to be related to learning with too few minority class examples in the presence of other complicating factors, such as class overlapping. Two of the proposed methods deal with these conditions directly, allying a known over-sampling method with data cleaning methods in order to produce better-defined class clusters. The comparative experiments show that, in general, oversampling methods provide more accurate results than under sampling methods considering the area under the ROC curve (AUC). Since the over-sampling methods provided very good performance results, the paper also measured the syntactic complexity of the decision trees induced from over-sampled data. The results show that these trees are usually more complex than the ones induced from original data.

III. CONCLUSION

The model developed provided a deep understanding of financial dealings between the publishers and the mediator by generating clear visual output based on brand, performance and programmatic advertisements. The project also goes a step further and attempts to use machine learning to create and maintain deal model. The developed system provides an automation mechanism for optimizing risk- neutral deal model with involvement of machine learning uniqueness. The system handles the growth of Ad sustaining capacity and process them to involve on margin and target metrics. The project was initiated because of a need for automation of deal model which can scale the revenue margin in the company. It enables Partner Manager to pitch the deals to customers and making them on-boarded to new deals. This is not only be time saving, but also concerned Partner Manager can pitch a greater number of deals if current deal is not satisfactory. This project is implemented to perform better results in terms of deal model with aggregated metrics, it will further help the Partner Manager to construct multiple deals on different sites and pitch this to Publisher to generate more traffic on different placement type such as Banner Ads, Interstitial Ads, Video Ads and Native Ads.

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