



VALASYS MEDIA
Empowering marketers with powerful insights

TIME-SERIES ANALYSIS

**FOR B2B SEASONAL TREND
MINING & MAPPING**

**USING DIFFERENT MACHINE
LEARNING MODELS TO GENERATE
PRECOGNITIVE INSIGHTS**

ABSTRACT

When the question of analyzing the seasonal patterns pops up, one might think if seasonal trends hold any real significance in the context of B2B marketing.

Seasonality, however, is as true for the B2B ecosphere as for the B2C. B2B companies are run by humans and humans are on both the problem and solution side of the business; therefore, seasonality impacts B2B companies that are run by humans and sell to humans.

B2B businesses don't exist in oblivious vacuum spaces and are a lot dependent on the seasonal cycles.

This paper helps explore what seasonality is and how it applies to the B2B marketing and sales dominion.

Sales prediction is an integral part of modern business approaches, especially when the data to connect the dots is either missing or lacking or there's a presence of outliers. **Sales under such circumstances can be considered to be in the time series. In this research, we have compiled different time series models.**

We unveil the study of the usage of the machine-learning models for sales predictive analytics. The whitepaper takes into account multiple approaches and case studies and discloses how machine learning can be used for sales forecasting. **The machine learning generalization was employed to make sales predictions when there's a small amount of data for specific sales time series when a new product or service is launched.**

Time series analysis and forecasting help develop practical forecasts. It is a branch of applied statistics and allows marketers to bridge the gap between theory and practice by providing them with appropriate tools to analyze the time-oriented data and construct useful, short- to mid-term statistically significant forecasts.

The ARIMA model approach, used in this paper, can be employed to identify and fit these models not just for seasonal time series but also for non-seasonal ones.

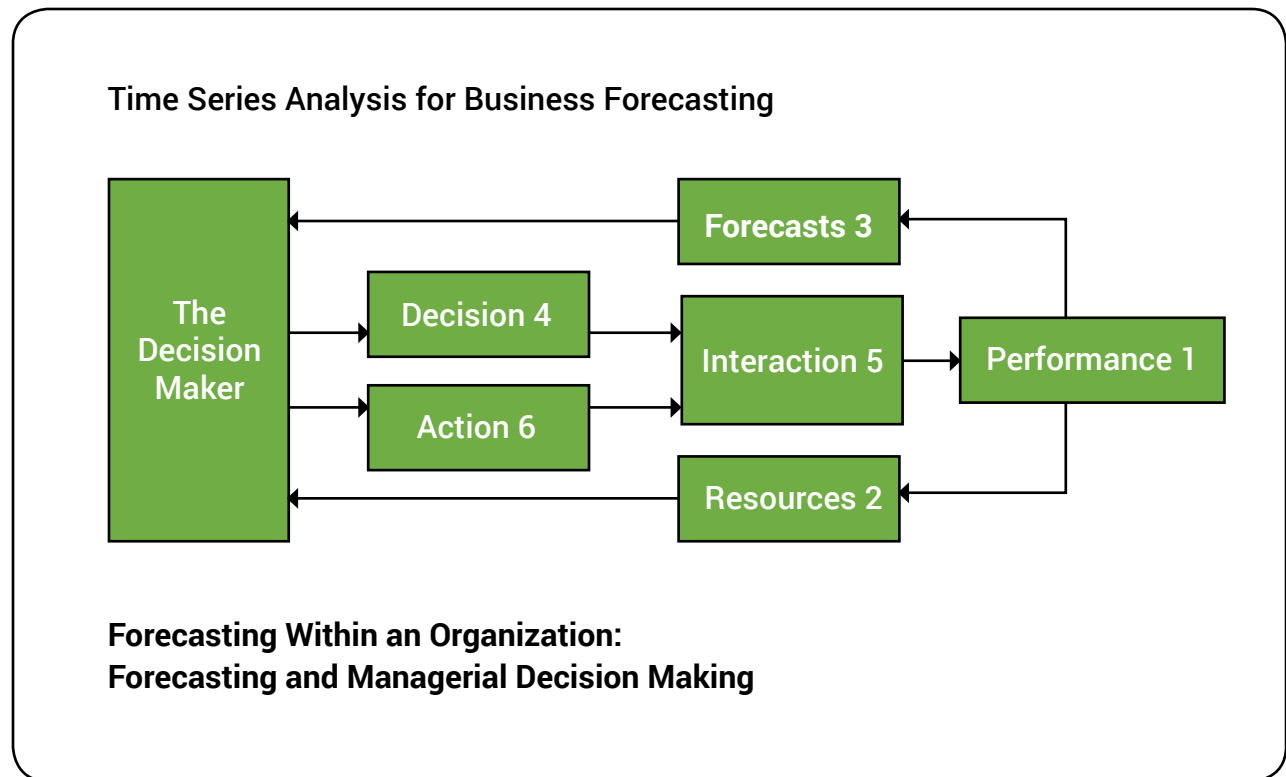
Keywords: machine learning, stacking, seasonal trend mapping, B2B marketing, forecasting, regression, sales, time series

INTRODUCTION

B2B marketing is impacted by seasonality as seasonality has a profound impact on how your customers think and reciprocate to seasonal shifts and this influences or inhibits season-based sales. **"Time is Money" in B2B business activities and influences a wide range of managerial decisions, particularly as time and money are strongly correlated. To make strategic decisions, all business leaders need to rely on forecasts. Seasonality impacts the choices of marketers as well as those of the customers and directs their**

respective choices by their anticipation of the results of their actions or inactions.

Every managerial decision would become operational and hence should be based on the forecast of the future conditions.



The decision-makers use the modeling process to investigate the impact of different courses of action retrospectively as if the decisions have already been taken under a specific course of action.

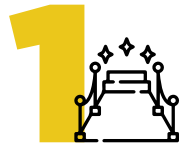
Seasonality in B2B marketing impacts organizations from Black Friday Sales to summer specials.

Modeling and forecasting seasonal and trend time series is an important research topic for B2B marketers and a burgeoning one. It gives them important insights to fuel their business activities. In this study, we forecast the seasonal and time series using traditional as well as modern approaches. We have tried to dissect time to trend and have employed the autoregressive integrated moving average (ARIMA) models.

WHAT SEASONALITY TRENDS TYPICALLY IMPACT B2B MARKETERS

The seasonal trends that impact B2B marketing strategies can be categorically broken down into the

following categories:



Business Trips & Events – Marketers need to research **when and where the big industry events are being hosted and whether their prospective leads are going to attend those events**. This will give marketers an idea of when to 'Get in Touch' to optimize their appointment setting and lead conversion instances.



Holidays – Holidays typically aren't the times when your customers would be much responsive. **Most of the customers during holidays are with their families or are taking creative breaking post the finish or start of the college sessions**. Therefore, the marketers need to track customers' behavioral patterns and exclusive the insights from emotional marketing hacks to generate the optimum conversions post the holiday seasons. **This can be done by planning and executing effective holiday marketing campaigns to remind your customers of you and your offerings**, to inspire them, to show empathy, and express gratefulness, and to keep their humor tickling.



Weather and Seasonality – When selling to businesses that are affected by weather, marketers need to ensure that they're targeting them at the right time when they really require your products or services.



Budget Cycle – All the businesses have an annual budget to adhere to. **The end of the financial year is a good time to target business prospects and most of the marketers will have budget leftovers to spend**. Also, since they're approaching a new year, they will receive a **new budget** and therefore, are **more likely to consider your offers**. Prospects, therefore, in general, are most receptive to buying at the end of a financial year.

Knowing their seasonality trends allows marketers to ramp the best of their marketing efforts to make the most of their good seasons and generate enough leads and profit in this time to make up for the impending slow seasons.

B2B MARKETING IS SEASONAL: THE TREND ANALYSIS OF THE FOUR SEASONS

B2B marketing is seasonal. Its purpose is to provide lead utilization to the dependents i.e. the sales professionals. To ensure a fresh supply of leads, B2B marketers need to plan for the year ahead. This also helps them in shaping their perennially healthy sales pipelines.

Here's the breakout of the seasonal trends and their impact:

1. Winters – In December the B2B marketers are strategically focused on **growing and nurturing their leads in-house** which can transpire into revenue opportunities in the New Year.

Honestly, the end of the year isn't an ideal time to focus on generating new leads and most of the focus of the B2B salespeople in December is to rush to meet sales targets. The practice of infusing the new leads into the pipeline can commence again in January and February.



2. Spring – April and May are eventful months in B2B marketing and **the inbound marketing inquiries of the marketers grow vigorously during this time**, primarily because of the efforts earlier in the year.

For B2B marketers spring is a good time to focus on growth and look forward to acquiring new projects. Also, the annual budgets are usually disclosed at this time and both the clients as well as the sales teams are infused with fresh energies to materialize their procurement plans.

TIME-SERIES ANALYSIS FOR B2B SEASONAL TREND MINING & MAPPING

Using Different Machine Learning Models to Generate Precognitive Insights



3. Summer – During the hot months of July and August prospects are majorly planning for holidays. The salespeople demonstrate urgency to book maximum appointments or sign off maximum customers before mid-July.

Summers are also the time when **B2B marketers procure the by-products of the sales process** – such as the client-win press releases and case studies to distribute later in the year.



4. Autumn – Database contacts created earlier in the year are drafted into leads during this time of the year. The focus is not just on accelerating the process of acquiring new leads but also on nurturing those leads.

Around mid-September, the sales teams witness accelerated sales conversions while the marketing team is

planning to execute **new and effective campaigns to generate fresh leads before the end of the year.**

The time between **mid-September and late October is the prime time for starting the last marketing campaigns of the year.** Also, this is the time when B2B marketers accelerate their event marketing & tradeshows. The companies spend their remaining **marketing budgets on advertising, PPC and last moment lead generation campaigns.**



Understanding the seasonality patterns helps marketers in ensuring a perennial supply of fresh leads as well as allows them to stockpile marketing materials and sales tools to nurture an optimum number of sales opportunities to down-the-funnel conversions.

DEPLOYING TIME SERIES FOR B2B E-COMMERCE SALES WITH THE HELP OF THE RBF-AR MODEL

A non-linear autoregressive model is written as the following equation:

$x_t = f(x_{t-1}, x_{t-2}, \dots, x_{t-p}) + e_t \dots \dots \dots (1)$, where the time series under the study is represented by $\{x_t : t=1, 2, \dots, M\}$.

(In the above equation, $f(\cdot)$ is a nonlinear map, p is a positive integer referred to as the order of the model and e_t denotes noise usually regarded as Gaussian white noise independent of previous observations.)

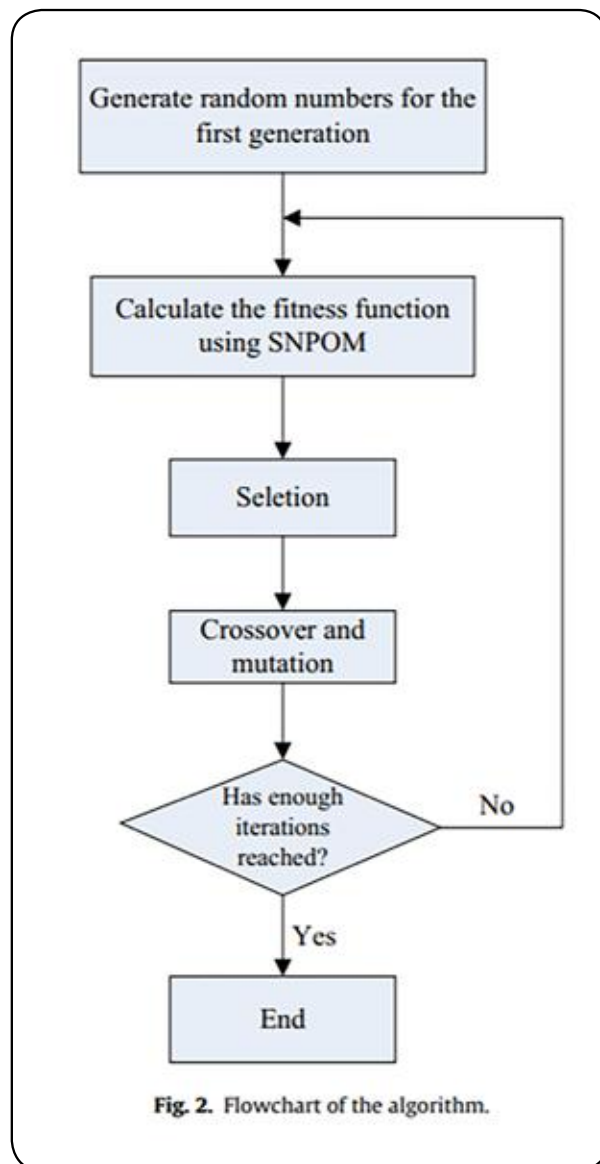
Equation (1) is too general to be useful in practice. Usually, some specific form is assumed. A flexible structure and without the lack of generality needs to be formed for a more reliable RBF-AR model.

The new RBF-AR model can be regarded as a quasi-AR model.

HOW TO LEVERAGE HYBRID ALGORITHM FOR MODEL IDENTIFICATION

The identification of the RBF-AR model involves the choice of **input variables, estimation of all the parameters including the number of hidden nodes, center vectors, widths, and the linear output weight.** Selecting proper model terms and variables to produce a parsimonious model is beneficial for improving forecasting performance.

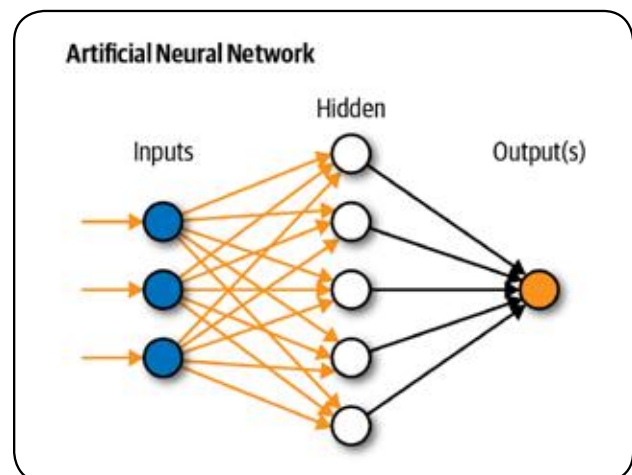
The **Neural Networks (NNs)** can be trained with the help of both **random search algorithms and gradient search algorithms.** The process of identification is summarized below:



Step 1: Initialization: An initial number of N observations are produced as per a uniform distribution ranging over problem space.

Step 2: Calculation of Fitness Functions: The larger of the root mean square error (RMSE) is used for training and validation of data sets and is regarded as the fitness function.

A Generic Representation of the Artificial Neural Network (ANN) Algorithm Applied in Time Series Analysis



A typical three-layer feedforward model (used for forecasting purposes).

DATA SETS AND RESULTS

Five real-time series for B2B eCommerce sales, when subjected to the RBF-AR model analysis the following results were observed:

Comparison of the Results of Five Real-Time monthly time series (Year over Year - YoY) Analysis

Data From Departments Facilitating B2B eCommerce Sales in an Organization	RBF-AR Model (Radial Basis Function-Based Autoregressive Model)			ANN + DSDT (Artificial Neural Networks + Deseasonalized and Detrended)			TDNN (Time Delay Neural Networks)	ARIMA (AutoRegressi ve Integrated Moving Average)	SVR (Support Vector Regression)
	RMSE of Training	RMSE of Validation	RMSE of Testing	RMSE of Training	RMSE of Validation	RMSE of Testing	RMSE of Testing	RMSE of Testing	RMSE of Testing
Marketing	423.01 (10.06)	419.20 (12.9)	411.8 0 (2.09)	382.23	228.05	975.55	628.70 (28.27)	1005.41	602.35
Sales	244.89 (0.00)	274.00 (0.00)	337.7 2 (0.01)	174.07	203.20	315.43	372.50 (50.66)	519.60	802.79
Logistics	40.31 (0.30)	42.41 (0.09)	23.53 (0.28)	26.16	20.48	49.17	372.50 (6.90)	100.71	39.47
Operations	77.85 (0.12)	75.47 (2.94)	191.5 4 (1.98)	52.35	140.93	99.45	173.10 (31.10)	124.44	266.47
Human Resources (HR)	62.63 (2.03)	65.01 (1.90)	96.8 (3.87)	37.39	39.69	88.74	91.51 (10.41)	98.17	97.98

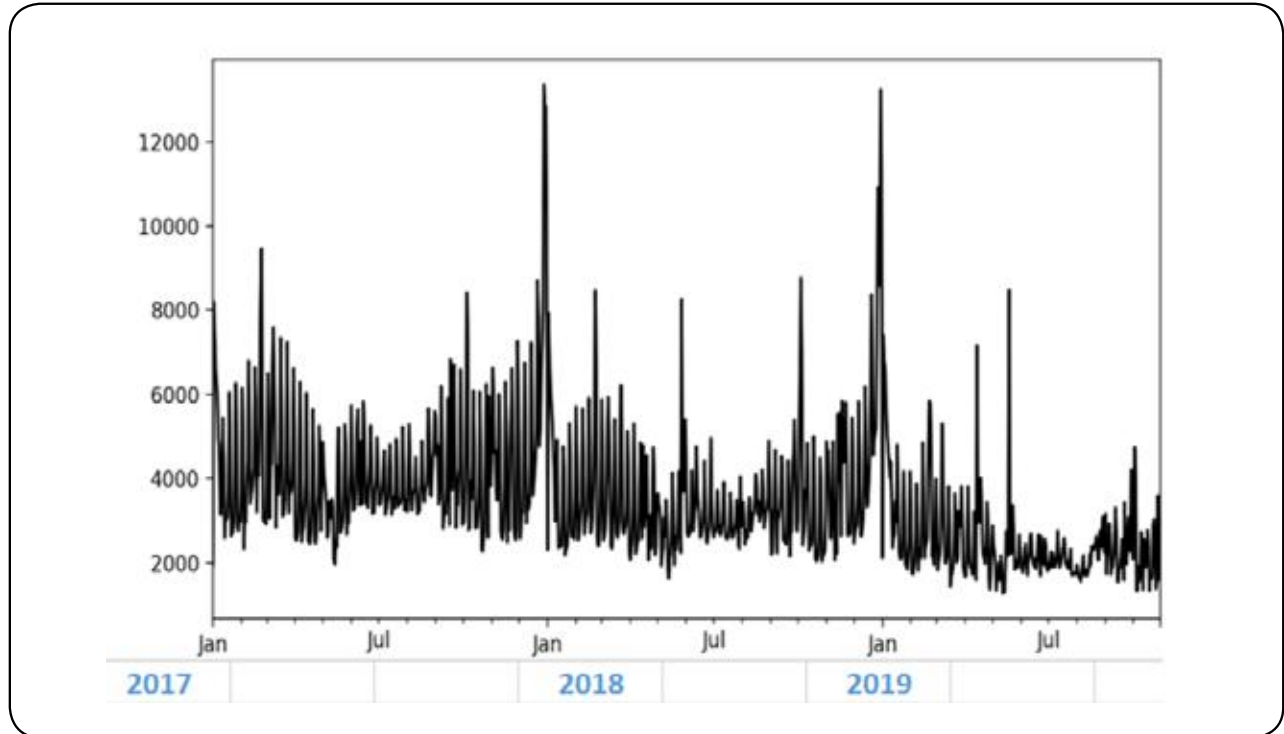
Basics to Read This Table

The mean and standard deviation of RMSE results were run for 30 minutes for training, validation, and testing samples and the volumes noted in the parenthesis denote the standard deviation (SD). The results of the SVR analysis method are compared against the RBF-AR. The Standard Deviation (SD) provided by the RBF-AR model is very small as compared to the other methods.

This testifies that the estimation algorithm performed robust and stable analysis. When compared to the ARIMA model, the TDNN and RBF-AR models perform better on 3 out of the 5 total instances in the dataset; compared with the ANN.

The time series examines ranges from 01-01-2017 to 12-31-2020 and has 1034 observations; a mean of 3528 and a standard deviation of 1585 for the RBF-AR Model.

The scatterplot below substantiates the same:



CONCLUSION

Accurate seasonal trend mining and forecasting is an important B2B business activity. The impact of **seasonality is non-linear and therefore, tracking it becomes difficult.**

In this whitepaper, we have employed a quasi-linear AR model approach to modeling & forecasting.

While analyzing the trends marketers need to study the peaks and the extremes of the curve. Marketers need to consider the 4 seasons from customers' perspective before they develop campaigns for the fiscal quarters. As the purchasing habits of the customers tend to shift based on activities that they participate in, any online B2B business needs to take this into account well ahead of time.

Indeed, time is money for those who understand how to monetize it.

How do you understand the impact of seasonality on your business? Do you want to help us optimize your business endeavors, no matter what time of the year it is?

Drop us a line for creating, shaping, and optimizing your B2B marketing campaigns at **info@valasys.com** and we would be happy to help.