Vol. 02, No. 3 ,(2018), 086–094 , **ISSN:2581-3242**

IJMLNCE JOURNAL

International Journal of Machine Learning and Networked Collaborative Engineering

Journal Homepage: http://www.mlnce.net/home/index.html

DOI : https://doi.org/10.30991/IJMLNCE.2018v02i03.001

Smart Advisor: An Intelligent Inventory Prediction Based On Regression Model

[a]Ömer Küçük[*], [b]Farzad Kiani

[a,b]*Department of Computer Engineering, Engineering and Natural Sciences Faculty, Istanbul SabahattinZaim University, 340303, Kucukcekmece, Istanbul/Turkey*

[a] *omerkucuk2000@hotmail.com, https://orcid.org/0000-0003-3180-5250*

[b]*farzad.kiani@izu.edu.tr, https://orcid.org/0000-0002-0354-9344*

Abstract

Today one of the biggest expense items of the enterprises is raw material and stock amounts. Therefore, proper inventory management is very important for the profitability of the enterprises. Products that are not purchased on time cause interruptions in production and products left over because the expiration date has passed will also cause losses for businesses. Therefore, proper inventory management is critical for profit / loss situations of businesses. In this paper we presented a model to predict the demand of certain stock items by using a regression model. Our model can analysis and computer the prediction results on given dataset. We evaluate our model on sample dataset and provide the analysis as well calculations over the existing inventory. Accurate analysis of stock consumption enables accurate estimation of the amount of stock to be consumed in the future. Accurate forecasting of stock consumption helps to take corrective steps in decision making. That is, it only allows you to buy in sufficient quantity when necessary. These stages are critical for economic stock management. For this reason, robust and adaptable approaches that can provide models ensure that stock consumption can be managed properly. It is difficult to find previously written sources on estimating the direction of stock movements. One of the most important reasons for this is the lack of incentive to make such studies in the academic literature. As a result, articles written about the subject and the work done have been limited, the results have not reached the reproducible level.

Keywords

Machine Learning,
Linear Regression,
Inventory Prediction,
Smart System.

1. Introduction

Machine Learning is a subordinate of Artificial Intelligence. The basic logic is to conduct a self-learning activity by analyzing data. Artificial Intelligence is the ability of computers to use intelligent methods to accomplish certain goals, and is broader in the context of machine learning. Machine Learning is

[*] Corresponding author

Ömer Küçük

Email: omerkucuk2000@hotmail.com

the realization of artificial intelligence by learning only the data obtained without the programming of computers.The machine learning and artificial intelligence, which are increasing in importance in recent years, are being implemented in many areas.With the emergence of new concepts such as smart systems, distributed systems, big data analysis, their working and application areas are increasing. Smart cities [1], IoT [2] and mixed of them [3, 4], big data [5] can be pointed from these application fields.Therefore, the importance of machine learning is increasing day by day and the workings in this area continue with the latest speed.So machine-learning methods are described in this section.Machine learning algorithms are generally classified into three groups [6].

1.1. Supervised Learning

In this method called controlled learning, an objective function is learned to obtain the desired output set Y from the input set X. There is an artificial education for supervised learning. Inputs and outputs for each sample are included in the training data. It is assumed that there is also a connection between this input and output. We have a good understanding of how supervised learning should be in the dataset. In supervised learning, collected observations related to the concept to be learned are entered into the system as a training set. In the training set, the desired output values are also given for each sample. Using this information, a relationship is established between input and output. Using the generated relation, the Y values corresponding to the future X inputs can be estimated. Supervised learning problems are divided into regression and classification. In regression problems, it is tried to map the input values to some continuous functions. Classes are separate in classification. It is tried to map input values to different categories. Each observation is assigned a class.

1.2. Unsupervised Learning

It discovers the indirect relationship between unattended learning data chunks and improves rules that define behavioral changes in variables with the greatest causal effect on other variables. The Y output values are observed as well as the X input values observed in supervised learning. For unattended learning only focus on the X input values. Since there is no set of Y values associated with X, the Y output values are not predictable. It provides the opportunity to have an idea about the structure of the problems that have no knowledge about the results of unattended learning. The goal is to discover information about the measurements available. For example, the possibility of dividing the observations into subgroups is investigated, or the data are examined in an informative manner. The relationship between X data is exploited to reveal this in problems.

1.3. Reinforcement Learning

Reinforced learning demonstrates how a system that can perceive itself and make decisions on its own can learn to make the right decisions to reach its goal. Reinforced learning methods can be applied in dynamic or uncertain environments where they cannot know about. This method is often used in areas such as robotics, game programming, and disease diagnosis and factory automation.

There is an instructor in the reinforced learning, but it cannot give or give much detail to the system like supervised learning. Instead, the learning system rewards the system for making a decision when it is correct and punishing for mistakes. Reinforced learning methods increase their experience by interacting with their environment. The aim is to check whether the probable situation of the learning system is the target and to remember all the right or wrong cases tried.

If the decisions are remembered in the form of consecutive sequences, then each decision in the sequence of consecutive situations that is remembered depends on the success of the situation. It tries to maximize its success by choosing movements that receive continuous prizes.

There is usually a function (V) that determines a prize or a penalty. With the behavioral policy (π), optimum can be selected from the actions that can be made in . Reinforced learning prefers a behavioral policy with the greatest payoff generated by the value function. The preference policy of optimum behavior is expressed as equation 1.

$$\Pi = \operatorname{argmax}\left(V(\right. \qquad (1)$$

In our work, we will use the Linear Regression technique from Machine Learning techniques to construct a prediction model of stock consumption. We will perform prediction on stock infrastructure by using an application developed by us names Smart Advisor. Smart Advisor analyses the inputs and checks coefficient of system characteristics and tries to predict outputs.

Rest of the research paper is organized as follows. Related work and limitations of existing systems are discussed in Section 2. In Section 3, the proposed architecture and its implementation are discussed. In Section 4, we explain our experimental setup and results with discussion. Finally conclusions and finding are discussed in Section 5.

2. Related Work

As mentioned the machine learning methods are categorized in three general groups. There are many studies in the literature in these group studies. In this paper, we were benefited in some general and new approaches [7-9] so we could inspired from some of them to work on our own. One of the earliest works in Artificial Intelligence is the checkers game developed by Arthur Samuel [10]. Arthur Samuel defines machine learning as a computer's ability to learn a job without being explicitly programmed. Arthur Samuel developed a checkers game in 1950s. The feature that made this game different from the others was that it was one of the first examples of machine learning. The program, which analyzes good and bad positions by analyzing and comparing the data in the games played, eventually became a better player than Arthur Samuel.

One of the paper on stock estimation using machine learning is “iJADE Stock Advisor” [11] which published by RayJam S. T. Lee in 2014. Lee has developed a “smart” agent based stock advisor application names “iJADE stock advisor” for intelligent web mining and other intelligent e-commerce applications for this paper. A hybrid RBF repetitive neural network was previously developed for stock estimation. The study is an extension of the traditional RBF network and adds two main features: First, a 'forgetting factor' emerges in the back propagation algorithm. Second, there is”decay" in the repetitive time-difference mechanism. Both additions effectively increase the importance of newer observations. Another study is related to the Stock Estimate published by Pyo [12] in 2017. He offers a simple Artificial Neural Networks based stock estimation solution, based on an introductory literature review. Concepts of basic and technical analysis and efficient market hypothesis are examined and the near-time populations of Artificial Neural Networks on the basis of traditional time series estimation and stock movement estimation using linear models are discussed. Michael David Rechenth is researching forward predictability in the thesis study of machine learning classification techniques for inventory analysis and estimation. The framework adapts to changes by using the stochastic subgroups of past data and by creating thousands of traditional base classifiers (SVM, Decision Tree and Neural Network) that cover similar inventories and optimally combine the best of these base classifiers. It also deals with stock data flows, especially class imbalance, quality creation, size reduction [13].

Chatsiz [8] proposed another study in forecasting stock markets. This will contribute to the ongoing debate on the nature and characteristics of the spreading channels for international accident events. In particular, we examine the transfer mechanisms of stock markets, together with the effects of bonds and currencies. Our approach involves a comprehensive forecasting mechanism for the probability of a stock market crash that occurs at different times. The development approach is a combination of daily stock information from 39 countries covering a wide range of economies, different machine learning algorithms presented with monetary and monetary units. In particular, a number of technical linguistic and deep neural networks such as classification trees, support vector machines, random forests, neural networks, extreme gradients are strengthened. For further information, it is believed that in-depth learning and development approaches in the literature are the tools for predicting stock market crises for the first time. In our data, arguments that contain information about link of channels that can be triggered by financial risks: returns and fluctuations.

N. Zadehhas developed a prediction approach for drug sales [14]. The intent of their work is to suggest a new method for estimating PDC sales. The presented method is a combination of network analysis tools and time series estimation methods. Due to the lack of sufficient past sales records for each drug, a research-based network-based analysis is used to find clique sets and group members and use stakeholder sales data for sales forecasting. Later, time series sales forecasting models are created with three different approaches such as ARIMA methodology, neural network and advanced hybrid neural network approach.

The hybrid method of applying each drug and its recorders to historical records makes it easy to accurately capture linear and non-linear sales models. The performance of the proposed method was evaluated by a real data set provided by one of the leading PDCs in Iran. The results showed that while the proposed method accurately predicted drug sales, the number of past records might be low. Here, unlike our work, we carried out a study to estimate the sales of the stock from the stock.

Jui-Chang Hun et al. were proposed an improvement model in inventory model with a company example [15]. This study aims to help companies improve inventory control. In their work, they tried to manage inventory entry by production rather than stock consumption as a different way. First, the products presented in the portfolio are divided into groups, with the help of the R programming language, to promote and forecast future sales of different products. Simulation and forecasting of future sales based on categorization results and classification techniques for the creation of different formulations and control techniques based on simulations and estimations are used to manage stock levels according to the results of the estimations. The results can be used to improve inventory control and inventory management.

Cardenas et al. proposed a multi-product inventory model in Columbia example [16]. In this study, we present a comparison of the demand model estimates for multiple products, choosing the best among the following: autoregressive integrated moving average (ARIMA), exponential smoothing (ES), a Bayesian regression model (BRM) and a Bayesian dynamic linear model (BDLM). For this purpose, the cases in which the time series are normally distributed are first simulated. Secondly, sales forecasts for three products of a gas service station are estimated using four models and BRM is the best model. Then multi-product stock model is optimized. Bayesian search elements that combine a Tabu search item to develop a solution are used to define policies for order, stock, costs, and profits. This stock model optimization process is then applied to a petrol service station in Colombia. In these last two studies, we are forecasting sales values instead of inventory outputs.

3. Smart Advisor Architecture

Our calculation flow chart is at the following diagram figure 1. A test dataset for calculations is created. First sample quantities of material and drugs were defined for using in calculations then, purchased from these materials at different quantities on different dates. And at different dates, some of these materials were consumed. Finally monitored and analyzed the results of Smart Advisor and discussed prediction rates.

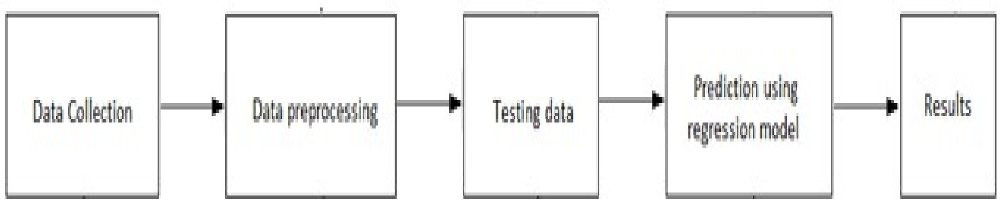

Figure 1. Flow Chart of proposed Smart Advisor System

Now let’s analysis inputs and outputs of Smart Advisor infrastructure.

3.1. Material Expiration Date

Expiration date information of the material is one of the important points at the system. Because the materials that are closest to the expiration date are used first. And system will decide and calculate consumption, considering expiration date of the material.

3.2. What is minimum level?

The duration of time from material is ordered to material is delivered. The amount of material consumed during the period of deliver is the minimum level for that material. That is, when material is ordered, the minimum level of material must be enough until received. The main purpose here is to order material without reach to the minimum level so that the material in the stock is never reset. The minimum level depends on the material, so it is kept on a material basis.

3.3. Consumption Speed

Stock Consumption Speed is the rate at which materials are used in unit time. The period between the date when the material was first used and the date when it was last used is calculated by proportioning to the amount of total material used (output) in that interval. In this study we will calculate at daily.

3.4. Prediction

For the most efficient inventory management at the lowest cost, we estimate when how much to buy from which materials.

The stock outputs in the system are the input (X) values for the prediction part. The prediction part analyzes material stocks, monitors instant stocks, calculates stock consumption speed, and calculates when minimum values will arrive according to minimum level values.

The inputs and outputs of the prediction section are shown in figure 2.

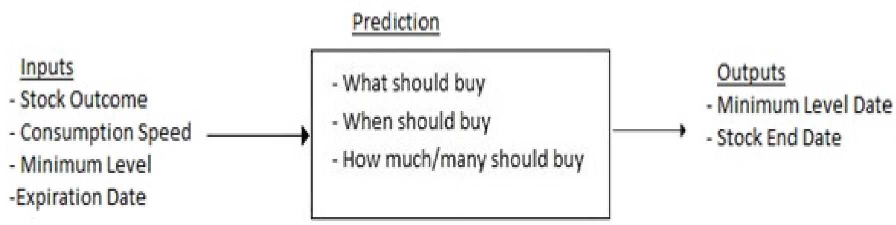

Figure 2. Prediction Process

Daily consumption speed is calculated with considering the outputs of the materials in the system. This information is the average rate of consumption of that material in unit time. The extreme over and extreme under of this speed are the noisy records for the prediction part. There is a filter part to exclude these noisy records from the prediction part. How much below or above records will be filtered, we determine the level by considering the outputs.

3.5. Smart Advisor

The steps we have discussed in this study are realized with our application called Smart Advisor, which we have developed in Java. In this stock management application, we made predictions based on the stock data of the classical system as well as the input and output transactions.

4. Results

The result of the proposed system is presented in two parts as they are described in this section of the paper.

4.1. Stock Status Report

In figure 3, we see the material code, name, and name of the species as well as the minimum level of information in the stock. We can also see the stock consumption rate that the system calculated for materials and used in forecasting. If the material goes below the minimum level, we can see the state "Under the Minimum Level" and the stock is exhausted, but in the field "No Stock". And at the far right we see the information generated by the forecasting structure. There is information about how many days the material is left to go down to minimum level, how many days are left for the stock depletion, at which minimum date will be reached and the date of the stock will be consumed. Notice that the number of days that the minimum falls to the minimum level is negative. The figure 3 is a snapshot of the software product we have developed.

STOCK STATUS

CODE	NAME	TYPE	MIN LEVEL	COUNT	CONSUMPTION SPEED	STATUS	DAYS TO MIN LEVEL	DAYS TO STOCK END	MIN LEVEL DATE	STOCK END DATE
21	PANTOPRAZOL	DRUG	53	19	0.45	Under Min Level	-77	43	30/05/2018	27/09/2018
15	EPOETIN BETA	DRUG	55	33	0.37	Under Min Level	-61	91	15/06/2018	14/11/2018
2	KATATER	MEDICAL MATERIAL	15	0	0.41	Zero	-37	0	09/07/2018	15/08/2018
28	ZIPRASIDON	DRUG	48	7	1.28	Under Min Level	-32	5	14/07/2018	20/08/2018
19	NAPROKSEN	DRUG	51	34	0.67	Under Min Level	-26	51	20/07/2018	05/10/2018
1	ASPİRİN	DRUG	10	0	0.45	Zero	-23	0	23/07/2018	15/08/2018
8	DRENS	MEDICAL MATERIAL	31	25	0.60	Under Min Level	-10	42	05/08/2018	26/09/2018
9	GLOVES	MEDICAL MATERIAL	35	33	0.60	Under Min Level	-3	55	11/08/2018	09/10/2018
3	KAĞIT HAVLU	MATERIAL	20	20	0.41	Available	0	50	15/08/2018	03/10/2018
22	PROPOFOL	DRUG	38	39	0.47	Available	2	84	17/08/2018	06/11/2018
23	SODYUM FOSFAT	DRUG	39	46	0.89	Available	8	52	23/08/2018	06/10/2018
27	X PHE KID SE MAMA	DRUG	47	58	1.30	Available	8	45	23/08/2018	29/09/2018
16	LENALIDOMIT	DRUG	66	76	0.86	Available	12	89	27/08/2018	12/11/2018
5	KAN SETİ	MEDICAL MATERIAL	24	31	0.45	Available	16	70	31/08/2018	24/10/2018
18	MENOTROPIN	DRUG	41	52	0.61	Available	18	86	02/09/2018	09/11/2018
4	SONDA	MEDICAL MATERIAL	14	22	0.45	Available	18	49	02/09/2018	03/10/2018
20	OKTREOTID	DRUG	42	64	1.08	Available	21	60	04/09/2018	14/10/2018
6	DİYALİZ MALZEMESİ	MEDICAL MATERIAL	27	36	0.45	Available	20	82	04/09/2018	04/11/2018
14	DEKSTROZ (GLUKOZ)+SODYUM KLORUR	DRUG	44	66	0.89	Available	25	75	09/09/2018	29/10/2018
24	TEMOZOLOMID	DRUG	40	57	0.68	Available	25	85	09/09/2018	08/11/2018
29	ÇARŞAF	MATERIAL	46	99	1.96	Available	27	51	11/09/2018	04/10/2018
12	BUDEZONID	DRUG	28	50	0.77	Available	29	65	13/09/2018	19/10/2018
13	CADI FINDIGI DISTILATI	DRUG	33	56	0.63	Available	37	90	21/09/2018	12/11/2018
30	PERDE	MATERIAL	11	69	1.58	Available	37	44	21/09/2018	27/09/2018
26	VALSARTAN	DRUG	32	63	0.77	Available	41	82	24/09/2018	05/11/2018
25	UROKINAZ	DRUG	34	75	1.01	Available	41	75	24/09/2018	28/10/2018
17	MANNITOL	DRUG	13	66	0.98	Available	54	68	08/10/2018	22/10/2018
11	ASETAZOLAMID	DRUG	19	49	0.56	Available	54	88	08/10/2018	11/11/2018
10	ALBUMIN	DRUG	27	50	0.42	Available	55	120	09/10/2018	13/12/2018
7	IV KANUL	MEDICAL MATERIAL	16	41	0.40	Available	63	103	17/10/2018	26/11/2018

Figure 3. Stock Status Report

4.2. Linear Regression Schema

It's the report showing the system's characteristics. Each output in the system appears in graphical form with information on the daily consumption speed and how many outputs are made. The ratio of these two values gives the knowledge that the output of the material is above or below the average output value. The average of these ratios of materials gives us the general characteristic of the system. The function of this characteristic is mentioned in equation 2.

$$h\theta(x)=\theta 0+\theta 1x \quad (2)$$

Calculation of these equations coefficients is performed by the application. The coefficients of the function which shows the characteristic of the system are calculated according to the dataset which consists of daily consumption speed and output quantity of material outputs. Here θ0 corresponds to intercept and θ1 corresponds to slope information. In this case it is calculated by equation 3.

$$Y=slope*X +intercept \quad (3)$$

The function obtained with the calculated coefficients is shown under the Linear Regression Graph in figure 4. The line of this function is shown in red color in the graph. This red line is the general characteristic of the system, which is the average of the ratios of the materials we mentioned above. That is, the average of the ratios of the values of the material outputs in the system to the daily consumption rate of that material gives the slope of this linear regression line.

In this case, outputs equal to the daily consumption rate appear directly above this line. Outputs below or above the daily consumption speed appear above or below this line.

The records extreme below or extreme above this line are noise records for the system. In order to eliminate these noise records, the application also has a filter part. This filter will work to calculate records below or above a certain percentage of the linear regression line and to exclude records outside those. We declare this ratio as a percentage. For example, for an 85% ratio, the Linear Regression graph will look like figure 5.

Note that for every change in the rate of filtration, the coefficients of the Linear Regression function change as well and the values in the Inventory Report change. That is why these values are only calculated from the output values included in the calculation.

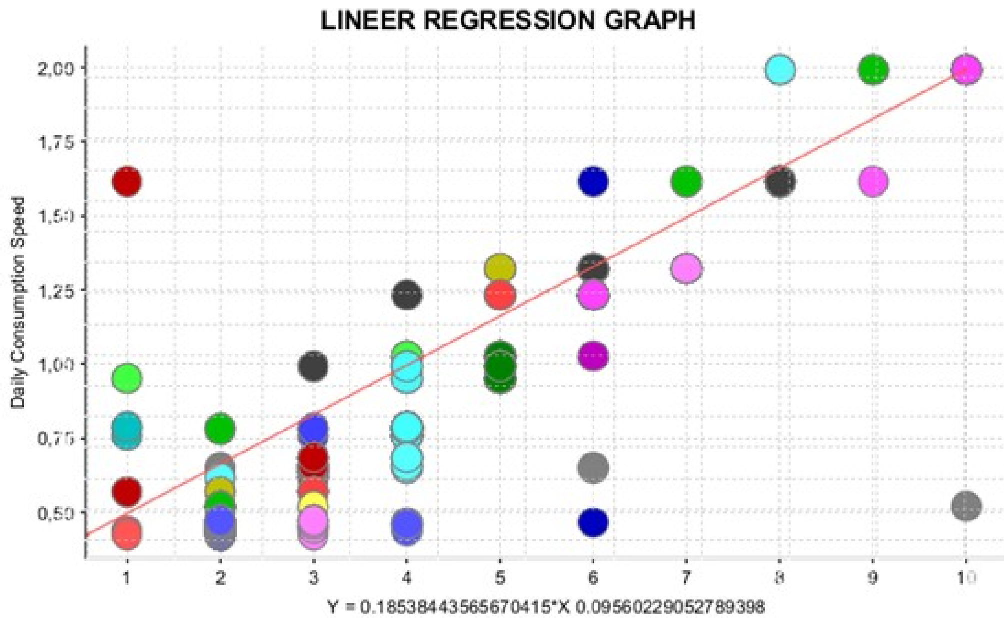

Figure 4. Linear Regression Graph

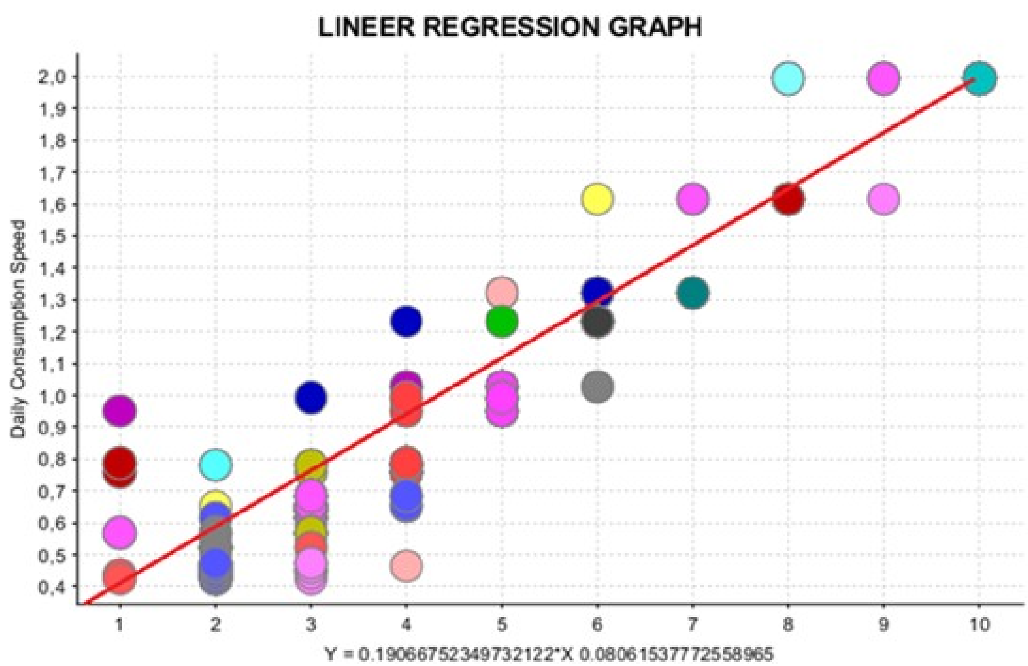

Figure 5. Linear Regression Graph with %85 Ratios

5. Conclusion and Future Works

In this work, we tried to predict outputs for each material will be possible in the future by analyzing the current outputs. We analyzed current output values (X) and the required output values (Y) to derive the characteristic of the system and the linear regression equation (the relation between X and Y). We tried to get a more stable estimation by filtering the system's exceptional behavior (noise). We observed how the estimated values produced by the system change as the current output values. There are studies in the literature about forecasting different stages from stock output, product development to product sales. Which method should be selected here depends on the type of product. For example, if direct selling products are kept in stock, estimates for product sales may be needed more. In our work, we used inventory data to estimate the inventory output as the material received was not directly sold.

In our work, we analyze the inventory outputs of the system in order to make more efficient inventory tracking with minimum inventory levels at lower cost, calculate the stock consumption rate and make forecasts of future stock outputs. Our Smart Advisor, developed for this purpose, reads the stock outputs of the application and finds out what material the system consumes in what time and consumes it and calculates which materials will be consumed. This work can provide efficient results in systems that produce new products/services using existing stocks. For example, it can be used in hospitals in the healthcare sector. This work could produce the next step, cost-tracking, or data needed for budgeting and provide resources for work to be done in these areas.

References

[1] Kadam, V., Tamane, Sh., and Solanki, V. (2018), "Smart and Connected Cities through Technologies", IGI-Global, 1-24. https://www.igi-global.com/chapter/smart-and-connected-cities-through-technologies/211738

[2] Kiani, F. (2018), A Survey on Management Frameworks and Open Challenges in IoT, Wireless Communications and Mobile Computing, Hindawi & Wiley, 1-33. https://www.hindawi.com/journals/wcmc/2018/9857026/

[3] Sanju, D.D., Subramani, A. and Kumar Solanki, V. (2017), "Smart City: IoT Based Prototype For Parking Monitoring & Parking Management System Commanded By Mobile App", Second International Conference on Research in Intelligent and Computing in Engineering, ACSIS, 10, 341–343. https://annals-csis.org/proceedings/rice2017/drp/23.html

[4] Dhall, R., and Solanki, V. K. (2017), "An IoT Based Predictive Connected Car Maintenance Approach", International Journal of Interactive Multimedia and Artificial Intelligence, 4(3), 16-22. http://www.ijimai.org/journal/node/1335

[5] Dutt, V. (2017), "Emerging Trends on Big Data & Cloud Computing", International Journal of Machine Learning and Networked Collaborative Engineering (IJMLNCE), 1(1), 23-32.http://mlnce.net/index.php/Home/article/view/22/11

[6] Buskirk, T.D., Kirchner, Eck, A., and Signorino, C. S. (2018), "An Introduction to Machine Learning Methods for Survey Researchers", Survey Practice, 11(1), 1-11. http://www.surveypractice.org/article/2718-an-introduction-to-machine-learning-methods-for-survey-researchers

[7] Yu Fu, X., Du, J.H., Guo, Y., Liu, M.W., Dong, T., and Duan, X.W., (2018), "A Machine Learning Framework for Stock Selection", Portfolio Management, arXiv:1806.01743v2, 1-6. https://arxiv.org/pdf/1806.01743.pdf

[8] Chatzis, S.P. et al. (2018), "Forecasting stock market crisis events using deep and statistical machine learning techniques", Expert Systems with Applications, 112, 353-371. https://www.sciencedirect.com/science/article/pii/S0957417418303798

[9] Kiani, F. (2018), "Improvement of Automated Learning Methods based on Linear Learning Algorithms", International Journal of Machine Learning and Networked Collaborative Engineering (IJMLNCE), 2(2), 67-74. http://www.mlnce.net/index.php/Home/article/view/31/23

[10] Samuel, A. L., (1959), "Some Studies in Machine Learning Using the Game of Checkers", IBM Journal of Research and Development, 3(3), 210-229. https://ieeexplore.ieee.org/document/5392560

[11] Lee, R.S.T., (2014), "iJADE Stock Advisor: An Intelligent Agent Based Stock Prediction System", IEEE Transactions on Systems, Man, and Cybernetics-Part A: Systems and Humans, 34(3), 421-428. https://ieeexplore.ieee.org/document/1288353/

[12] Pyo, S., Lee, J., Cha, M. and Jang, H. (2017), Predictability of machine learning techniques to forecast the trends of market index prices: Hypothesis testing for the Korean stock markets, PLoS ONE 12(11): e0188107, 1-17. http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0188107&type=printable

[13] Rechenthin, M. D. (2014), "Machine-Learning Classification Techniques for The Analysis And Prediction Of High-Frequency Stock Direction" PhD thesis, University of Iowa, 1-260, https://ir.uiowa.edu/cgi/viewcontent.cgi?article=5248&context=etd

[14] Khalilzadeh, N., Sepehri, M.M., Farvaresh, H. (2014), "Intelligent Sales Prediction for Pharmaceutical Distribution Companies: A Data, Mining Based Approach", Mathematical Problems in Engineering, 1-15..https://www.hindawi.com/journals/mpe/2014/420310/

[15] Huang, J. Ch., Wu, T.J., Ch. Y. Chiu, and Lu, Ch., (2017), "Improvement of Inventory Control and Forecast According to Activity-Based Classifications: T Company as an Example", AIP Conference Proceedings 1836, 020014, 2-15. https://aip.scitation.org/doi/pdf/10.1063/1.4981954

[16] Cárdenas, M., Javier, F., and Carlos, J. (2016), "Multi-product inventory modeling with demand forecasting and Bayesian optimization", DYNA, 83 (198), 235-243.http://www.scielo.org.co/pdf/dyna/v83n198/v83n198a29.pdf

Author's Biography

FarzadKiani has PhD degree and he is Assistant Prof. in computer engineering dept. at Istanbul SabahattinZaim University (IZU) from 2014 to now. In addition, he is deputy head of computer engineering and head of wireless sensor networks and IoT Labs at IZU from 2016 and 2017 to now, respectively. His current research interests include wireless sensor networks, Vehicle Ad-hoc networks, flying Ad-hoc networks, machine learning, game theory and IoT. He is also working on optimization algorithms and security.

ÖmerKüçük is master student in computer engineering and sciences in Istanbul SabahattinZaim University from 2016 to now. He is in thesis stage and his work title is this paper title. His research area is ad-hoc networks, machine learning and big data.

How to Cite

Küçük, Ömer, & Kiani, F. (2018). Smart Advisor: An Intelligent Inventory Prediction Based On Regression Model. *International Journal of Machine Learning and Networked Collaborative Engineering*, *2*(03) pp 86-94. https://doi.org/10.30991/IJMLNCE.2018v02i03.001