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The significant impact of automation performance on logistics companies dealing with perishable goods

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Abstract

In this research study the researcher proposed a predictive model for Automation Performance on Logistics Companies Performance with Perishable Goods. In this context pick and pack including delivery at doorstep is one the challenging issues in the real words. The automation technologies have a potential role to automate the business process and provide secure and transparent way perishable goods and services. In current business industries the companies looking for fact and secure automation system to operate the

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business process in logistics industries. To identify the automation performance of logistics system the researcher used the 395000 datasets with different supervised machine learning algorithms to automate the logistics process During the research study the researcher found that Logistics Classifiers training accuracy 87.97% and testing accuracy 87.62%, Random Forest Classifiers training accuracy 98.59% and testing accuracy 9.29%, Support Vector Machine (SVM) training accuracy 97.48% and testing accuracy 97.85%, KNN Classifiers training accuracy 53.37%and testing accuracy 43.51%, Decision Tree classifiers training accuracy 98.68%and testing accuracy 98.36%, ADA Booster training accuracy 74.3% and testing accuracy 75.02%, XGB Booster training accuracy98.62%and testing accuracy 98.90%. Finally the researcher concluded that decision tree classifier and XGB Booster predictive model are having the 98% accuracy level and that predictive model would be suitable to measure the automation performance on logistics companies.

Subject Classification: *90B06, 90B06 Transportation, logistics: AMS_90Bxx:1.*

Keywords: *Logistics companies, Automation, Perishable goods, Predictive models.*

I. Introduction

Automated picking and packing systems: These systems can pick items from a warehouse and pack them for shipment without human intervention. Automated Guided Vehicles (AGV): are self-driving vehicles that can transport goods within a warehouse or distribution center based on first in first out (FIFO) and first expired and first out, in case of perishable good two common factors are playing one of the significant roles to control the business process.

Gattorna, Day, and Hargreaves [1] stated the significant issues of logistics management to automate the business process with speed up way to transferring from one place to another play without any delay due to perishable food and services. The researcher implemented the machine learning and business intelligent system to automate the business process and reengineering concepts. Kong et al., [2] researcher found that the current business process. The logistics solution in business industries needs special attention for supply foods and services such as vaccines, medicines, seafood's, frozen juices, vegetables, meat, fresh milk, processed foods, fruits and many more are needed. Sandilands [3] stated on strategic logistics management which are more efficient to control perishable goods and its efficient process.

Akkerman et al., [4] discussed the cross – docking which are used in supply chain management and logistics strategy for which less than truck loads, shipments, goods store capacity in efficient and proper way. The

researcher emphasized that perishable foods and services are more important and time constraints for the transforming location from one place to other places. The researcher stated the cross-docking system with reference to perishable foods and services. Alpan [5] identifies the research gap in between past decade to current system of supply chain management system and logistics management. The researcher reviewed the cross–docking research and tried to fill the gap between current and future research.

The researcher emphasized that the growing consumers demand and growing markets have forced the business to decide how to take advantages of new technology innovations to develop their capabilities and meet consumers demand in fast and safer ways. In this process the supply chain management system is giving the speed up the business process and commodities.

II. Literature Review

Kong et al., [6] proposed the robot assisted fulfillment system for auction logistics of perishable goods and services. The research emphasized the robotics system to control the logistics business process control and enhance the services in caser perishable goods. Tiwari [7] focused on the industrial revolutions are driven by the data which are collected by the different robotic system in real time mode to map the performance of supply chain management system and logistics management. Rizzi and Zamboni [8] addressed the issue associate to industries and enterprise who are using ERP system to manage their data and services to improving the efficiency of their business process rather than manual intervention for logistics and supply chain management system.

The researcher observed that the integration of warehouse management information does not actually guarantee the optimization of logistics. In order to achieve an effective synergic effect to increase the efficiency of the system. Kayikci et al., [9] explored the potential usage of block chain technology to support operational excellence in the perishable foods supply chain (PFSC). The researcher identifies the current research issues and gives optimal usage to block chain management to automate the business process.

Lam and Tang [10] described the digital transformation for cold management to manage the logistics management using automation

worth latest software technologies. Globerson and Wolbrum [11] emphasized the new of logistics management and supply chain process to management the goods and services. Akkermans et al., [12] stated that impact of ERP on supply chain management system and reverse logistics case in business Industries. The researcher identifies the current research issues and its significant impact on business Industries.

Thomas and Amit [13] modernized the supply chain management system by immense complexity, and dynamics ambiguity. The supply chain management system typically spans and involve communities, traditions, religion and other very important occasions which are important for the human being in the real world. Rejeb et al. [14] highlighted the value of digitization in procurement management to handle virtual collections and knowledge in internal logistics management within the framework of the particular organizations and enterprises to supply goods and services.

Cavus and Alpan [15] proposed a E-business technology on supply chain management to control the logistics process with more efficient and fast way.

Chou et al., [16] suggested that web technology will be a play a significant role in business Industries with respect to logistics and reverse logistics. Collins et al., [17] proposed a knowledge management – supply chain process to control the business process and its efficient approach. The researcher found the key factors which are significant in reverse logistics and supply chain management process to control the multiple process.

Cooper et al., [18] emphasized the supply chain management is more efficient to control the logistics process in current business Industries. The researcher found that IoT technology playing a very significant role to develop a smart transportation to manage the logistics process more efficient ways. Corbato et al., [19] stated the different level of automation to control the business process suing robotics and machine learning models. The development approach was more efficient and powerful to control the logistics process in real time mode.

Custodio and Machado [20] proposed an automated warehouse framework to control the logistics management process and the researcher found that the developed model is more efficient. Lal et al., [21] developed a model based on monitoring and sensing of real time data to monitor and control the logistics management process in business Industries. Deng et al., [22] stated that the automated warehouse management system is more efficient to control the business process using machine learning and IoT

based systems. Forslund [23] proposed an ERP system for supply chain management system to control the logistics management in real time cases in business Industries.

III. Research design and methodlogy

This researcher study is based on secondary data which are taken from kaggle.com and worldwide accepted platform for the research points of view. For data analysis and interpretation the researcher used the ensemble approach of supervised machine learning.

3.1 *Logistic regression*

This research study is based on logistic regression to classify the data in two different categories. For this the researcher used sigmoid function and creates a threshold value to categories that process is valuable or not to automate the perishable goods and services.

$$\text{Sigmoid Function} = \frac{1}{(1 + e - \text{value})} \tag{1}$$

3.2 *Randon forest classifiers*

Step 1: Select a random variable from given data sets.

Step 2: Build the decision tree for each model and then take predictions from each decision tree.

Step 3: All the predictions will be voted on.

Step-4: Finally, select the guess with the most votes as the final guess.

3.3. Support vector machine (SVM)

Step-1: Define the training and testing datasets based on 70:30

Step-2: Calculate the margin value between two classifier

Step-3: Analysis the vector points

Step-4: Predict the results and accuracy level

3.4 *KNN Classifiers*

Step-1: Define the distance based approach to classify the data

Step-2: Define training and testing datasets ration 70: 30

Step-3: Calculate the distance between two closets points in data segments

Step-4: Based on similarity predict the classification of data

3.5 Decision tree classifiers

Step-1: Define the information gain and entropy

Step-2: Define training and testing datasets ration 70: 30

Step-3: Define the decision tree based model

Step-4: Based on similarity predict the classification of data

Apart from the above algorithms the researcher used the two more algorithms to handle the imbalance datasets and improve the efficiency and performance or algorithms level such as Ada Booster and XGB Booster.

VI. Results and discussion

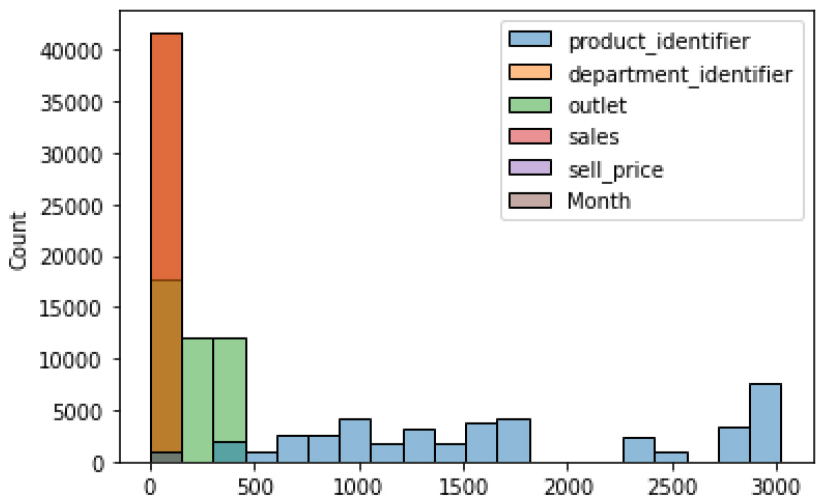


Figure 1

Statistics of Features Description of Logistics Company

Data analysis

The above data analysis report of showing the different features of datasets with specific logistics companies, the researcher used the 395000 datasets. The result statistics is showing that department identifiers are playing one of the significant role for sailing the products with months wise (Fig. 1).

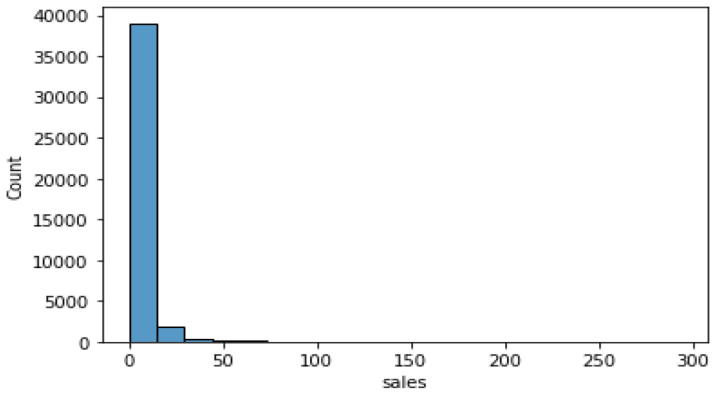


Figure 2

Statistics of Sales growth of Logistics Company

Data analysis

The above data analysis report is compiled by the Jupiter Note book using Python programming language. The statistical report is showing that sales growth of logistics companies. In this growth rate the technology automation and performance how is playing a significant role for logistics companies. (Fig. 2). During the secondary study the researcher found that technology automation performance playing a significant role of any company's sales growth rate.

Predictive models : Results analysis

S. No	Predictive Models	Training Accuracy	Testing Accuracy
1	Logistics Classifiers	87.97%	87.62%
2	Random Forest Classifiers	98.59%	9.29%
3	Support Vector Machine (SVM)	97.48%	97.85%
4	KNN Classifiers	53.37%	43.51%
5	Decision Tree classifiers	98.68%	98.36%
6	Ada Booster	74.3%	75.02%
7	XGB Booster	98.62%	98.90%

Data analysis

The researcher used the seven different predictive models such as Logistics Classifiers training accuracy 87.97% and testing accuracy 87.62%, Random Forest Classifiers training accuracy 98.59% and testing accuracy

9.29%, Support Vector Machine (SVM) training accuracy 97.48% and testing accuracy 97.85%, KNN Classifiers training accuracy 53.37% and testing accuracy 43.51%, Decision Tree classifiers training accuracy 98.68% and testing accuracy 98.36%, Ada Booster training accuracy 74.3% and testing accuracy 75.02%, XGB Booster training accuracy 98.62% and testing accuracy 98.90%. These all predictive model passed through the training and testing data sets with ratio of 80:20.

In this research study the researcher focused on "Automation Performance on Logistics Companies Dealing with Perishable Goods" using different supervised machine learning algorithms based predictive model such as logistics , random forest, support vector machine(SVM), KNN classifiers, ADA boost and XGB Booster algorithms. The results of predictive statistics show that random forest and XGB Booster having higher accuracy level of predictive model with respect to training and testing cases (Fig. 3).

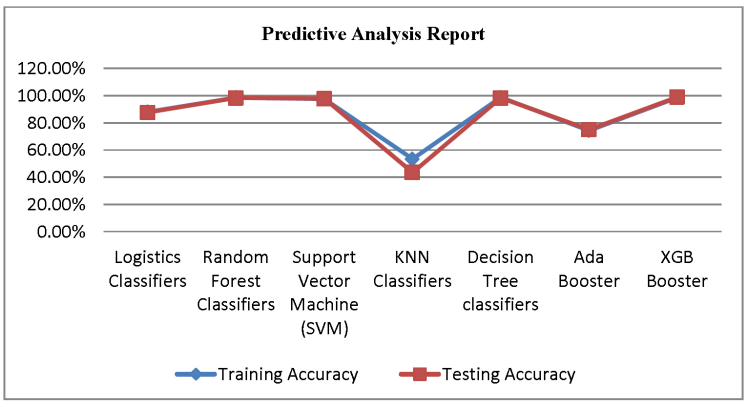


Figure 3

Predictive Analysis Report on Logistics Company

IV. Conclusion and summary

Finally the researcher concluded on "Automation Performance on Logistics Companies Dealing with Perishable Goods" to identify the best approach to automate the business process in context of perishable foods and services . The researcher reviewed the currency research on Logistics Companies Dealing with Perishable Goods and current business model to operate the supply chain management system to handle logistics in speed up and fastest way. The predictive performance of process automation the

researcher used the different machine learning algorithms to find out the performance of predictive models such as Logistics Classifiers training accuracy 87.97% and testing accuracy 87.62%, Random Forest Classifiers training accuracy 98.59% and testing accuracy 92.90%, Support Vector Machine (SVM) training accuracy 97.48% and testing accuracy 97.85%, KNN Classifiers training accuracy 53.37% and testing accuracy 43.51%, Decision Tree classifiers training accuracy 98.68% and testing accuracy 98.36%, Ada Booster training accuracy 74.3% and testing accuracy 75.02%, XGB Booster training accuracy 98.62% and testing accuracy 98.90%. During the researcher study the researcher found that random forest and XGB Booster are having most significant predictive model to automate the logistics process with Perishable Goods on timely delivery.

The researcher emphasized those Businesses that store their perishable foods in higher capacity freeze to increase inflow and outflows. The logistics industries searching the best option to optimize the business process to store their perishable foods for a long time and steady way to deliver their customers. In this context the supply chain management system and logistics management playing a significant role to deliver fastest way with minimum intervention by the human being. Technology involvement can lead to automate the logistics companies' process for fast pick and drop at doorsteps. In this context this predictive analysis would be more efficient to identify the logistics processes which are more capable to deliver in rapid ways.

References

[1] J. Gattorna, A. Day, and J. Hargreaves, "Effective Logistics Management," *Logistics Information Management*, vol. 4, no. 2, pp. 2–86 (1991). [Online]. Available: https://doi.org/10.1108/09576059110143603.

[2] X. Kong, G. Q. Huang, H. Luo, and B. P. C. Yen, "Physical internet auction logistics in perishable supply chain trading: State of the art and research opportunities," *Industrial Management & Data Systems,* vol. 118, no. 8, pp. 1671–1694 (2018). [Online]. Available: https://doi.org/10.1108/IMDS-10-2017-0486.

[3] E. Sandilands, "Strategic Logistics Management," *Logistics Information Management*, vol. 7, no. 3, pp. 1–48 (1994). [Online]. Available: https://doi.org/10.1108/09576053199400001.

[4] F. Akkerman, E. Lalla-Ruiz, M. Mes, and T. Spitters, "Cross-Docking: Current research versus industrial practice and adoption of Indus-

try 4.0," in Smart Industry – Better Management (Advanced Series in Management, Vol. 28), T. Bondarouk and M. R. Olivas-Luján, Eds., Bingley: Emerald Publishing Limited, pp. 69–104 (2022). [Online]. Available: https://doi.org/10.1108/S1877-636120220000028007.

[5] K. Alpan, "Cross-docking operations: Current research versus industry practice," *Omega*, vol. 62(C), pp. 145–162 (2016). [Online]. Available: https://doi.org/10.1016/j.omega.2015.09.006.

[6] X. T. R. Kong, R. Y. Zhong, G. Xu, and G. Q. Huang, "Robot-assisted fulfillment system for auction logistics of perishable goods," *Industrial Management & Data Systems*, vol. 117, no. 9, pp. 1954–1971 (2017). [Online]. Available: https://doi.org/10.1108/IMDS-03-2016-0114.

[7] S. Tiwari, "Supply chain integration and Industry 4.0: a systematic literature review," *Benchmarking: An International Journal*, vol. 28, no. 3, pp. 990–1030 (2021). [Online]. Available: https://doi.org/10.1108/BIJ-08-2020-0428.

[8] A. Rizzi and R. Zamboni, "Increasing efficiency in manual warehouses through ERP system implementation and logistics process redesign," *Logistics Information Management*, vol. 12, no. 5, pp. 367–377 (1999). [Online]. Available: https://doi.org/10.1108/09576059910295805.

[9] Y. Kayikci, D. Durak Usar, and B. L. Aylak, "Using blockchain technology to support operational excellence in perishable food supply chains during epidemics," *The International Journal of Logistics Management*, vol. 33, no. 3, pp. 836–876 (2022). [Online]. Available: https://doi.org/10.1108/IJLM-01-2021-0027.

[10] H. Lam and V. Tang, "Digital transformation for cold chain management in the freight forwarding industry," *International Journal of Engineering Business Management* (2023). [Online]. Available: https://doi.org/10.1177/18479790231160857.

[11] S. Globerson and G. Wolbrum, "Logistics Management and Supply Chain Management: A Critical Appraisal," *International Journal of Business and Economics Research*, vol. 3, no. 2, pp. 82 (2014).

[12] H. A. Akkermans, P. Bogerd, E. Yücesan, and L. N. Van Wassenhove, "The Impact of ERP on Supply Chain Management: Exploratory Findings from a European Delphi Study," *European Journal of Operations Research*, vol. 146, no. 2, pp. 284–301 (2003).

[13] A. Thomas and A. T. Firoz, "The Impact of E-business Technologies on Supply Chain Operations: A Macroeconomics Perspective," *Federal Reserve Bank of Dallas, Research Department*, pp. 4–8 (2014).

[14] A. Rejeb, E. Süle, and J. G. Keogh, "Exploring new technologies in procurement," *Transport & Logistic – The International Journal*, vol. 18, issue 45 (Dec. 2018).

[15] N. Cavus and K. Alpan, "Which Search Engine Is The Most Used One Among University Students," *The Online Journal of Science and Technology* (TOJSAT), vol. 1, no. 1, pp. 31–35 (July 2016).

[16] D. C. Chou, X. Tan, and D. C. Yen, "Web technology and supply chain management," *Information Management and Computer Security,* vol. 12, no. 4, pp. 338–349 (2004).

[17] J. D. Collins, W. J. Worthington, P. M. Reyes, and M. Romero, "Knowledge management, supply chain technology and firm performance," *Management Research Review*, vol. 33, no. 10, pp. 947–960 (2010).

[18] M. C. Cooper, D. M. Lambert, and J. D. Pagh, "Supply chain management: more than just a new name for logistics," *International Journal of Logistics Management,* vol. 8, no. 1, pp. 1–14 (1997).

[19] C. H. Corbato, M. Bharatheesha, J. Van Egmond, J. Ju, and P. Wisse, "Integrating Different Levels of Automation: Lessons from Winning the Amazon Robotics Challenge," *IEEE Transactions on Industrial Informatics*, vol. 14, no. 11, pp. 4916–4926 (2018).

[20] L. Custodio and R. Machado, "The flexible automated warehouse: a literature review and an innovative framework," *The International Journal of Advanced Manufacturing Technology,* vol. 106, no. 1–2, pp. 533–558 (2020).

[21] B. Lal, N. Chinthamu, and Harichandana, "Monitoring and Sensing of Real-Time Data with Deep Learning Through Micro- and Macro-analysis in Hardware Support Packages," *SN Computer Science,* vol. 4, no. 606 (2023). [Online]. Available: https://doi.org/10.1007/s42979-023-02037-z

[22] M. Deng, J. Mao, and X. Gan, "Development of an automated warehouse management system," in MATEC Web of Conferences, vol. 232, pp. 03051 (2018).

[23] H. Forslund, "Options of ERP systems for supply chain performance management," *Industrial Management & Data Systems* (2010).

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