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Applications of artificial intelligence in business management, e-commerce and finance

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ABSTRACT

In the e-commerce and financial industries, AI has been deployed to achieve better customer experience, efficient supply chain management, improved operational efficiency, and reduced mate size, with the main goal of designing standard, reliable product quality control methods and the search for new ways of reaching and serving customers while maintaining low cost. Machine learning and deep learning are two of the most often used AI approaches. Individuals, businesses, and government agencies utilize these models to anticipate and learn from data. Machine learning models for the complexity and diversity of data in the food industry are being developed at the moment. This article discusses machine learning and artificial intelligence applications in e-commerce, corporate management, and finance. Sales growth, profit maximization, sales forecast, inventory management, security, fraud detection, and portfolio management are some of the major uses.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Nanoelectronics, Nanophotonics, Nanomaterials, Nanobioscience & Nanotechnology.

1. Introduction

Artificial intelligence usually refers to the artificial fabrication of human minds that can learn natural language, plan it, perceive it or process it [1]. It is the theory and development of computer systems that can generally carry out activities requiring human intelligence, such as visual perception, recognition of speech, decision-making and language translation [3]. Artificial intelligence is an IT industry that mostly works with machines which are built to operate like a human being. John McCarthy (AI's dad) described AI as "the scientific and technical knowledge of developing smart computer programs in particular".

Machine learning and profound learning are two of the most often utilized AI methods. These models learn from data and are used for predicting by individuals, firms and government organizations. Machine learning models for the complexity and diversity of data in the food business are nowadays being developed [2,3].

In e-commerce and financial industries with a major aim to design standard, reliable product quality control methods and the search for new ways of reaching and serving customers, while at the same time maintaining low cost, has required deployed AI in order to achieve better customer experience, efficient management of the supply chain, improved operational efficiency, reduced mate size.

This article presents applications of machine learning and artificial intelligence in e-commerce, business management and finance. Major applications include sales increase, profit maximization, sales prediction, inventory management, security, fraud detection and portfolio management.

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2. Different artificial intelligence and machine learning techniques

Machine learning is the most important AI technique. Relationship between machine learning and artificial intelligence is shown below in Fig. 1. This section contains prominent machine learning techniques.

Machine learning (ML) [4] is a new area of data mining that allows a computer program to grow increasingly accurate in predicting outcomes without explicitly programming it. These ML techniques are often divided into two types: supervised and unsupervised learning techniques employ labeled training data for inference (classification, regression), whereas unsupervised learning techniques employ unlabeled data to identify hidden existing patterns (clustering).

The act of transforming an input collection of instances P into a unique collection of characteristics Q, also known as target attributes or labels, is known as classification. Classification techniques such as decision tree classifiers, bayesian classifiers, and artificial neural networks, nearest neighbor classifiers, random forest, and support vector machines are used in a variety of applications [5]. We'll go through each of them briefly. Each strategy is based on the learning algorithm that it utilizes.

A decision tree is one of the most basic and simple classifiers used to solve classification issues. A decision tree is a graph in which occurrences are classified by sorting them depending on their feature values. The decision tree is composed of nodes and branches, with each node representing a classification instance and each branch representing a value that the node might take on. In decision, instance categorization starts at the root node, and instance sorting is done based on feature values.

Predicting the class label for a given collection of input qualities can be challenging in some situations. Furthermore, even when utilizing the specified input attributes set values to match some of the attributes in the training data set, class variables are non-deterministic. This is possible due to the presence of some noisy data and perplexing features that are not considered during analysis. For example, projecting the possibility of heart disease in a given person based on that individual's daily activity.

In this instance, it is probable that the majority of people who consume nutritious foods and exercise on a regular basis are at risk of acquiring heart disease owing to other variables such as smoking, alcohol intake, and potentially inheritance. In such circumstances, the categorization model is created based on well recognized heart disease characteristics, which cannot offer correct information. In such situations, there is a requirement to describe probabilistic correlations between the attribute collection and the class label, and the Bayesian classifier is all about justifying such duties [6].

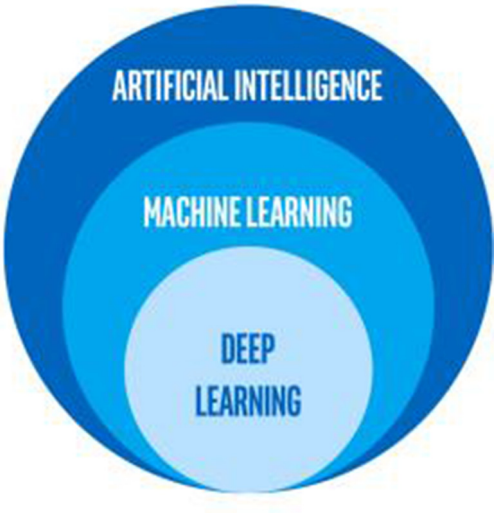

Fig. 1. Relationship between Artificial Intelligence and Machine Learning.

An artificial neural network (ANN) is based on biological neural networks, which are used to build animal brains. ANN is also known as a connectionist system since it is built up of linked nodes and directed linkages. Each linked connection is assigned a weight and is responsible for sending a signal from one node to another. When a node gets a signal, it processes it before passing it through to another node.

In ordinary ANN implementations, the signal at the link between artificial neurons is basically a real number, and the output of each neuron is determined by a non-linear function of the sum of all its inputs. Because of the weights of artificial neurons and the connections between them, the signal intensity rises or decreases as learning continues [7].

There are two approaches to building a learning model in ML classification. One of them is that the model begins learning as soon as the training set is available; such models are known as eager learners. Another model observes all training examples but only achieves classification if the test instance's properties perfectly match any of the training instances. Such pupils are known as lazy pupils [8].

The Nearest Neighbour (NN) classifier treats each sample as a data point in a d-dimensional space, where d is the number of characteristics. It is determined the distance between the provided test example and all data points in the training set. The data point X's k-Nearest Neighbors are the k points nearest to the X.

The data point is then categorised based on the class labels of its neighbors. If a data point has more than one class labeled neighbor, the class label with the most class labels is applied to the data point. The precise value of k's nearest neighbors should be established. If the value of k is too low, it may misclassify owing to noise in the training data. On the other hand, if the value of k is too big, there is a risk of misclassification since the collection of nearest neighbors may contain data points that are situated far away from the test attribute's neighborhood.

To begin, Random forest is a supervised machine learning technique composed of a forest of judgments produced by many decision trees produced using random vectors. This method may be used to solve classification problems as well as regression operations. The random forest's outcome is connected to the number of trees it combines in the forest in such a manner that as the number of trees in the forest rises, so does the chance of attaining more accuracy. It is critical to understand that establishing the forest is not the same as generating decision trees [8].

The main difference between decision trees and random forests is that in random forest classification, identifying the root node and separating the feature nodes happens at random. Random forest categorization is popular due of its advantages. One of these is that it may be used for both classification and regression. Another advantage of this strategy is that it avoids the problem of overfitting if a sufficient number of trees are available. A random forest classifier, in addition, can handle missing data and can be modelled in the case of categorical data.

Random forest classifiers are used in medical, finance, e-commerce, and the stock market. In banking, random classifiers are used to distinguish between loyal and fraudulent clients. Random Forest is used in medicine to discover the optimal mix of medications and to diagnose illness based on a patient's past medical information. In the stock market, Random Forest classier is used to watch a stock's activity and then detect the loss and profit. Ran-

dom Forest may be used to estimate user product suggestions in the context of e-commerce.

The Support Vector Machine is the supervised learning model used for categorization (SVM). It has received a great deal of interest in the categorization sector. A noticeable gap separates instances of the various categories in vector space in the SVM model. When a new sample arrives, it is mapped into the specified vector space and its label is assigned to a category based on which side of the gap it falls [9]. An SVM can do non-linear classification effectively by employing the kernel technique.

Clustering, also known as cluster analysis, is the job of arranging a collection of things so that elements in one group are more similar to those in another. As the similarities between things in one group and the dissimilarities between things in other groups rose, so did the clustering. Clustering is the cornerstone of data mining and may be employed in a wide range of applications like image processing, data compression, computer graphics, machine learning, and many more.

Clustering can be used in combination with other object-categorization techniques such as classification, segmentation, and partitioning. When comparing Cluster analysis to classification, we may state that clustering is an example of unsupervised learning. Cluster analysis varies from classification in that classification retains knowledge of classes, but clustering does not maintain knowledge of classes. Furthermore, fresh samples are grouped into established classes in the case of classification, whereas groups are recommended in the case of cluster analysis based on data patterns [9].

3. Applications of artificial intelligence in business management, e-commerce and finance

Applications of Artificial Intelligence and Machine Learning in Business management, e-commerce and finance are discussed in this section [10–15].

- **Chatbots**

Most of the E-commerce and financial web sites are using chatbots to improve customer satisfaction and provide enhanced services to customers. These chatbots are developed using artificial intelligence and machine learning techniques. They are capable of behaving like humans. These chatbots have learning capability; on the basis of availability of past data they are capable of providing best recommendation to customers.

- **Image search**

Image search on e-commerce web site is implemented using artificial intelligence. It is based on image processing algorithms. It helps in improving customer services. Customers are able to search item by images it. There is no need to search item using the keywords.

- **Handling Customer Data**

E-commerce has a large amount of associated data. Machine learning algorithms are capable of performing analytical study on past data related to sales, human resources, marketing, and customer purchase pattern. This analytical result can help in profit maximization, sales maximization, resources optimization. This helps ecommerce and fintech companies to finaliz their products for a particular type of customer.

- **Recommendation Systems**

Machine learning algorithms are able to perform analysis of customer past data related to customers choice, behavior. They can predict customer choices effectively and can suggest or recommend most suitable products to customer. It helps e-commerce and financial companies in increasing sales and customer satisfaction.

- **Inventory Management**

Artificial intelligence algorithms help e-commerce companies in managing inventory. These algorithms perform analytical study on past sales data and they find a correlation between the current sales and future sales. It helps managers in predicting future sales and maintain inventory accordingly.

- **Cybersecurity**

Machine learning algorithms are capable of detecting vulnerabilities in system and provide suitable security solutions to keep e-commerce platform secure. Financial companies also find machine learning algorithms suitable for fraud detection and prevention.

- **CRM**

In the past, CRM used the employees to gather a vast quantity of data to collect the data and to service the customers. Today, however, artificial intelligence is able to forecast which clients will buy and how we can better deal with them. Artificial intelligence applications may be used to assist determine trends and plan activities based on the newest trends. Advanced CRM may learn and improve over time with the aid of machine learning techniques.

- **Credit Scoring, Loan Underwriting, Portfolio management**

Machine learning algorithms are able to classify past data and can predict future data on the basis of analysis of past data. These algorithms help up to a great extent in Credit Scoring, Loan Underwriting and Portfolio management. It helps companies in cutting down risk.

- **Human Resources**

The proper source to obtain the candidate is identified by AI Engines. NLP may also assist select applicants using screen resumes. Today, AI bots are utilized for video interviews, even for first-tier screening. This can save time and enhance the process of recruiting. But after recruiting and selection, the work of an HR does not cease. The commitment of employees is also an important part that AI can improve. Machine learning can propose innovative training techniques.

- **Sales**

Sales begin with customer acquisition. AI can assess your company goals together with multiple data sources and then propose the most relevant client acquisition possibilities. Price optimization with the aid of AI and ML may also be achieved to maximize profit. AI and ML may also contribute to the improvement of consumer suggestions and market basket analysis for improved sales.

4. Conclusion

AI has been used in the e-commerce and financial industries to improve customer experience, efficient supply chain management,

operational efficiency, and mate size, with the main goal of designing standard, reliable product quality control methods and the search for new ways of reaching and serving customers while keeping costs low. Deep learning and machine learning are two of the most popular AI techniques. These models are used by individuals, corporations, and government organizations to predict and learn from data. At the moment, machine learning models for the complexity and diversity of data in the food sector are being created. This article addresses the uses of machine learning and artificial intelligence in e-commerce, business management, and finance. Some of the most common applications include sales growth, profit maximization, sales forecasting, inventory management, security, fraud detection, and portfolio management.

CRediT authorship contribution statement

Harikumar Pallathadka: . **:** Conceptualization, Methodology. **Edwin Hernan Ramirez-Asis:** Data curation. **Telmo Pablo Loli-Poma:** . **:** Visualization, Investigation. **Karthikeyan Kaliyaperumal:** Writing - review & editing. **Randy Joy Magno Ventayen:** Validation. **Mohd Naved:** . **:** Writing - original draft, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] Paulraj Prabhu, Neelamegam Anbazhagan, 2014. Improving Business Intelligence Based on Frequent Itemsets Using k-Means Clustering Algorithm. In: Meghanathan N., Nagamalai D., Rajasekaran S. (eds) Networks and Communications (NetCom2013). Lecture Notes in Electrical Engineering, vol 284. Springer, Cham, ISSN 1876-1100, ISBN 978-3-319-03691-5, ISBN 978-3-319-03692-2 (eBook), DOI : 10.1007/978-3-319-03692-2_19, pp 243-254.

[2] P. Prabhu, N. Anbazhagan, FI-FCM Algorithm for Business Intelligence. In: Prasath R., Kathirvalavakumar T. (eds) Mining Intelligence and Knowledge Exploration. Lecture Notes in Computer Science, vol 8284. Springer, Cham, pp 518-528 ISSN 0302-9743(Print ISBN 978-3-319-03843-8), (Online ISBN 978-3-319-03844-5), 2013. doi: 10.1007/978-3-319-03844-5_52 December 2013

[3] R. Manne, S.C. Kantheti, Application of artificial intelligence in healthcare: chances and challenges, Curr. J. Appl. Sci. Technol. 40 (6) (2021) 78–89, https://doi.org/10.9734/cjast/2021/v40i631320.

[4] R.S. Ganesh, K.J. Jausmin, J. Srilatha, R. Indumathy, M. Naved, M. Ashok, 2021, April. Artificial Intelligence Based Smart Facial Expression Recognition Remote Control System. In 2021 5th International Conference on Computing Methodologies and Communication (ICCMC) (pp. 1056-1061). IEEE.

[5] R. Kamal, A. Karan, V.S. Arungalai, "Investigations on E-commerce Data for Forecasting the Efficient Promotional Platform Using Supervised Machine Learning," 2019 4th International Conference on Recent Trends on Electronics, Information, Communication & Technology (RTEICT), 2019, pp. 939-943, doi: 10.1109/RTEICT46194.2019.9016688.

[6] P. Szabó, B. Genge, "Efficient Conversion Prediction in E-Commerce Applications with Unsupervised Learning," 2020 International Conference on Software, Telecommunications and Computer Networks (SoftCOM), 2020, pp. 1-6, doi: 10.23919/SoftCOM50211.2020.9238344.

[7] S.C. Bilow, Introduction: AL and machine learning, SMPTE Motion Imaging J. 129 (2) (2020) 14–15, https://doi.org/10.5594/JMI.2020.2964182.

[8] I.H. Sarker, Machine learning: algorithms, real-world applications and research directions, SN Comput. Sci. 2 (2021) 160, https://doi.org/10.1007/s42979-021-00592-x.

[9] M. Ferdous, J. Debnath, N.R. Chakraborty, "Machine Learning Algorithms in Healthcare: A Literature Survey," 2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT), 2020, pp. 1-6, doi: 10.1109/ICCCNT49239.2020.9225642.

[10] S. Nandhini, J. Marseline K.S., "Performance Evaluation of Machine Learning Algorithms for Email Spam Detection," 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), 2020, pp. 1-4, doi: 10.1109/ic-ETITE47903.2020.312.

[11] N. Soni, E.K. Sharma, N. Singh, A. Kapoor, Artificial Intelligence in Business: From Research and Innovation to Market Deployment. Procedia Comput. Sci. 2020, 167, 2200–2210. [CrossRef]

[12] A. Di Vaio, R. Palladino, R. Hassan, O. Escobar, Artificial intelligence and business models in the sustainable development goals perspective: A systematic literature review. J. Bus. Res. 2020, 121, 283–314. [CrossRef]

[13] A. Di Vaio, F. Boccia, L. Landriani, R. Palladino, Artificial Intelligence in the Agri-Food System: Rethinking Sustainable Business Models in the COVID-19 Scenario. Sustainability 2020, 12, 4851. [CrossRef]

[14] T. Kumar, M. Trakru, The Colossal Impact of Artificial Intelligence. E-Commerce: Statistics and Facts. Int. Res. J. Eng. Technol. (IRJET) 2020, 6, 570–572. Available online: https://www.irjet.net/archives/V6/i5/IRJET - V6I5116.pdf (accessed on 3 December 2020).

[15] N. Soni, E.K. Sharma, N. Singh, A. Kapoor, Impact of Artificial Intelligence on Businesses: From Research, Innovation, Market Deployment to Future Shifts in Business Models. arXiv 2019, arXiv:1905.02092.