SUPPLY CHAIN MANAGEMENT USING ARTIFICIAL INTELLIGENCE

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Abstract

When measuring the supply–demand gap, this article takes into account a variety of factors, including product categories, classifications, and spatiotemporal characteristics. For the purpose of closing the supply–demand gap, we developed and implemented a full system that makes use of an extendable deep neural network architecture. The framework is capable of analysing a variety of custom input items and automatically detecting supply and demand trends based on transaction data from previously completed transactions. A generic training model is developed to estimate future demand based on a collection of customizable attributes, which is then tested. In order to consolidate input data, embedding layers are used to map high-dimensional features onto a smaller subspace, resulting in a more compact representation. The model's training architecture is composed of completely connected layers with activation functions that are then coupled together. Custom data attributes can be concatenated from many levels of the deep learning neural network in order to create a more complex model.

Keywords:

Deep Learning, Recurrent Neural Network, Clustering, Cancer

1. INTRODUCTION

As of August 31, 2020, there were more than 26 million confirmed cases of COVID-19, a global pandemic caused by the severe acute respiratory syndrome virus 2 [1], which has spread throughout the world [2]. The virus is extremely contagious [3], and it frequently causes symptoms such as fever, cough, fatigue, and myalgia. Underlying medical conditions and gender are frequently cited as risk factors for a poor prognosis [5]-[6].

COVID-19 deaths are more likely to occur when there is a dearth of medical resources available to treat patients [7], which has been demonstrated in several studies. A higher reported death rate has been observed in areas where COVID-19 cases have suddenly increased, even within the same country.

In Hubei Province, where the outbreak began, death rates were higher than in other parts of China [8]. This is due to a lack of hospital beds, medical professionals, and other critical supplies, among other factors. Patients in critical care should be given first priority in order to avoid wasting resources on patients who are moderate or asymptomatic.

It has been attempted in the past to discover risk factors for a poor prognosis in patients with COVID-19 [10] by studying them. Prior research from China used patient demographics, symptoms, comorbidities, lactate dehydrogenase level, neutrophil–lymphocyte ratio, and radiographic abnormalities to predict intensive care unit (ICU) admission, invasive ventilation, and mortality in the study. In yet another Italian study, researchers discovered a connection between ICU admission or death and the percentage of well-aerated lungs [9]. Furthermore, laboratory data has been employed in other Chinese studies in order to predict the severity of COVID-19. Despite the fact that these models functioned brilliantly, they included laboratory or radiographic evidence that may not be readily available in developing countries. Furthermore, when new information is gathered, it is not possible to make immediate changes to the rating systems.

It was our intention to develop a simple-to-use patient-reported prediction model based on demographics, comorbidities, and subjective symptoms that could be used in clinical practise. A deep learning technique was utilised to predict the need for intensive care in COVID-19 patients. This technique is capable of changing the value of individual features as additional data is acquired.

2. BACKGROUND

It is becoming increasingly common and significant to work in the field of supply chain management (SCM), which is rapidly expanding and gaining a great deal of attention. An alternative definition is that a supply chain is a collection of many goods and services connected through the interchange of products, information and/or services. Most businesses, particularly those involved in the supply chain management of fresh commodities, are concerned with cutting costs and ensuring that they have the appropriate quantity of inventory on hand in order to maintain customer satisfaction.

Demand forecasting enables firms to effectively predict demand and maintain the optimum level of inventory. Artificial Intelligence (AI) is a subset of Machine Learning (ML), which is itself a subset of AI. Making predictions about the future based on prior data, experiences, and patterns is made feasible through machine learning. In general, ML refers to the extraction of predictive information from previously collected data. The three most often used approaches to machine learning are supervised learning, unsupervised learning, and reinforcement learning (RL).

During the training process, algorithms are tested on a large dataset that contains both labelled input data and the desired output data. Unsupervised learning, on the other hand, is based purely on unlabeled data as its source of inspiration. Unsupervised algorithms are frequently used to search for hidden patterns in large amounts of raw data. Machine learning also includes RL, which is a subset of the larger field of artificial intelligence.

In order to achieve human-level performance in a dynamic environment, RL employs a trial-and-error approach. This technique is distinguished from the other two classes by the use of the term semi-supervised learning. When developing these algorithms, it is common to blend little amounts of labelled data with large volumes of unlabeled data to great effect. Deep learning algorithms can be fed data sets that are diverse, unstructured, and interrelated.

Deep learning algorithms are a subset of machine learning that takes inspiration from the human brain and is used to train robots. Multiple layers of algorithmic systems are used to enable them to learn in order to be more effective (deep). Deep architectures can be unsupervised or supervised, and both are conceivable. This biologically inspired programming paradigm can be used to handle a wide range of real-world problems, including image and video processing, voice recognition, text analysis, natural language processing, and the development of many different classifiers. Deep learning algorithms have the potential to improve the accuracy of SCM forecasts. Other deep learning strategies do better than others on specific types of issues, and some techniques perform better than others on all types of problems.

3. DEEP LEARNING ANALYSIS

Through a detailed case study, it was possible to detect input errors in continuous variables. AutoDL was used to create pipelines for the development of machine learning models, such as hyperparameter optimization and model training, among other things. These AutoDL models were created using the H2O.ai [6] software.

The AutoDL prediction models employed in this study were created using a variety of techniques, including a neural network, a decision tree, and a linear algorithm. Linear algorithms are multidimensional linear formulas in their mathematical form.

These algorithms are simple to comprehend, and they are best suited to linear problems that can be explained in detail. In the decision trees that make up a decision tree-based algorithmic framework, multiple true or false conditions for input variables are used in the decision trees.

The final classification was determined by adding up the results of all of the decisions made by the various decision trees. These models perform better when dealing with categorical variables that have multiple levels, and they can also take interactions between variables into account. Biological neurons are modelled after artificial neurons in a neural network, which are then connected to one another by connections between the layers of neurons.

A total of these weighted inputs are output by artificial neurons, which receive inputs that have been multiplied by weights. Although neural network models are difficult to read, they are capable of precisely expressing the intricate relationships that exist between the inputs that they represent when properly trained.

These models are not adequate for categorical inputs with several levels of categorization. It was then determined whether or not the predictive models based on these algorithms were effective at discriminating between different groups of people, because it is unclear which algorithm best describes the current issue.

4. METHODOLOGY

To download tender documents from the Croatian procurement portal and save them in a separate folder, we created a Python script. Once all word documents were converted into the docx file format and all unreadable documents (pdf scans) were excluded from further processing, we were able to access information regarding the technological and professional skills of the organisation. Due to the fact that it is subject to a variety of alterations by the user, we are unable to find and extract the precise portion of this unstructured content that is only concerned with technical and professional expertise. Every bidding document that we reviewed contains a number of technical and professional characteristics that we found to be important. One approach may be to search the document for every occurrence of the terms technical and professional, and then eliminate 1,000 words from the location where the keywords were found to be present. The retrieved material is stored in SQL Server databases. It was the same process that was used to calculate the number of bids received from the tender opening record.

Previously, we eliminated all hashtags and stop words from the tweets and Instagram posts that had been filtered for illegal marketing and sales keywords before performing textual analysis on them. There does not appear to be a training set for the detection of problematic COVID-19 goods in the current pandemic of COVID-19, despite the fact that the virus is currently in widespread use. The combination of unsupervised and supervised machine learning methodologies was required to detect an initial training set of signal postings from each platform, which was then used to train a supervised machine learning classifier using a deep learning model to detect the presence of spam.

To begin, unsupervised natural language processing (NLP) techniques were employed in order to categorise and summarise the content of filtered social media data that had been stratified by multiple product groupings of filtered terms. In order to both detect early signal postings in the absence of labelled data and build an initial labelled training set for supervised machine learning, a biterm topic model (BTM) was employed to analyse the entire COVID-19 filtered data corpus. The BTM has been demonstrated in previous studies to be effective in detecting online discussions involving substance abuse, illegal drug diversion, online wildlife trafficking, and corruption-related activities.

We used a deep learning classifier to classify the entire corpus of filtered social media postings based on the training set we created as a consequence of the BTM portion of our research. When conducting this experiment, we used an existing deep learning model that was previously described by the authors [2] for the purpose of detecting illicit and controlled narcotic transactions on the internet. Deep learning models trained on social media posts tagged with illicit online drug sales include identical signal texts (e.g., seller information and product information features) despite the fact that the initial model was trained on social media posts tagged with illicit online drug sales. This is because the initial model was trained on social media posts tagged with illicit online drug sales. As a result of our findings, this pretrained model was successful in helping us to discover these specific selling characteristics for COVID-19 sellers and products. The fact that our social media posts had previously been scanned for COVID-19 keywords had resulted in the situation that we found ourselves in (i.e., not illicit drug-related terms).

As a result of this combination of unsupervised and supervised machine learning approaches, we were able to rapidly develop a data collection and analysis approach for an emerging infoveillance challenge, which was made possible by the rapidity and large volume of COVID-19-related data, as well as the evolving nature of the pandemic itself, using unsupervised machine learning approaches.

5. RESULTS AND DISCUSSIONS

When it comes to early triage of patients in this pandemic crisis, our machine learning prediction model, which is based on simple patient information and subjective symptoms, can be quite useful. To begin, it relies on information that may be gathered without the use of advanced technology, such as a patient's age, his or her gender, previous medical history, and a list of subjective symptoms, among other things. The use of deep learning has recently been demonstrated to be a feasible alternative to previous scoring systems that relied mostly on laboratory or radiographic data for their decisions. When used in fully equipped medical facilities, such models can be quite beneficial, but they need the use of medical resources and time at the onset of their application. We believe that our scoring approach can be a useful tool for early triage in situations when laboratory exams or CT scans are not readily available. Because our model is built using the AutoML technique [2], it is simple to adjust the relative importance of features based on the information provided by patients. AutoML techniques have been thoroughly investigated by researchers [9], and it is projected that they will be useful in a wide range of disciplines, including health care. AutoML is primarily used for the creation of machine learning pipelines, which is a time-consuming task that necessitates extensive machine learning understanding. When you don't have a lot of time or money to commit to making a high-quality model, this method might be very handy. Our model's rapid adaptation makes it appropriate for use with people from a wide range of ethnic and geographic backgrounds, provided that further data from similar groups is collected. We hope to publish our model soon. [7]. During this pandemic state, a paucity of medical resources has been identified as a major determinant of patient survival [8], and this has been confirmed. When there is a shortage of medical experts, the web-based tool enables clinicians to triage patients who do not have sufficient medical knowledge about COVID-19 in order to avoid unnecessary delays. The entire analysis of the result and the achieved percentages over several parametric measures like accuracy, NMI, ARI, Homogeneity and Completeness are discussed in Table 1 to Table 5.

Table.1. Accuracy

Classification Algorithm	ACC
ANN	0.65
MLP	0.72
RBN	0.73
DPNN	0.78
RNN	0.80

Table.2. NMI

Classification Algorithm	NMI
ANN	0.7
MLP	0.83
RBN	0.81
DPNN	0.76
RNN	0.73

Table.3. ARI

Classification Algorithm	ARI
ANN	0.56
MLP	0.62
RBN	0.66
DPNN	0.68
RNN	0.82

Table.4. Homogeneity

Classification Algorithm	Homogeneity
ANN	0.57
MLP	0.68
RBN	0.69
DPNN	0.66
RNN	0.70

Table.5. Completeness

Classification Algorithm	Completeness
ANN	0.69
MLP	0.75
RBN	0.76
DPNN	0.80
RNN	0.82

6. CONCLUSION

The proposed model is unique in that it combines blockchain technology with machine learning to create a system with two distinct modules: a drug supply chain and a medicine recommendation system. There have been great results using machine learning algorithms and blockchain technologies in healthcare. The performance of our system was tested in a number of ways, including throughput, transaction response time, and latency, among others. The results of our system's simulations suggest encouraging results. Anti-counterfeiting and company growth are both made possible by this approach for pharmaceutical companies. Next, we plan to enhance the network size and use our system in real-time pharmaceutical firms in order to assess its performance and authenticity. To further enhance our machine learning models, we'll also work to increase their performance in terms of accuracy and recommendation accuracy

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