



The paper talks about the various areas where Artificial Neural Network (ANN) can be applied in the procurement domain. The paper identifies three areas where we have seen ANN getting implemented and discusses briefly about some of the advantages and disadvantages.

Procurement Context and Artificial Neural Networks (ANN) Applicability

Suyog Joshi, Neewee Analytics

Introduction

The central theme of this paper is to discuss the possible areas of applicability of Artificial Neural Networks (ANN) in the Procurement context. The nature of this paper is technical in nature and discusses the pros and cons for some of the applicability contexts. Mathematical references have been avoided to ensure simplicity.

ANN is a rapidly growing field and day by day more and more business areas are adopting this powerful methodology for predictions in their business contexts. Procurement is no exception to this trend and we are seeing more and more solutions coming up with ANN as the base modeling methods. Before we touch upon some of the applicable areas in procurement, let us see what ANN is all about briefly. ANN is basically a classification algorithm and works on a similar philosophy of the way our human brain works. Brain consists of neurons in large numbers and all of them work in unison to make any decision. The output from one neuron is fed into the next one. The neuron which has received the signals processes the information and passes the new output to the next neuron. This process continues till we have a final decision made. There were multiple experiments done by the scientists on birds where the inputs from the eyes were fed to the areas where generally ear receptors are placed on the brain. After a few days, the bird was able to see again as the ear neurons learned to interpret the signals coming eyes and they became perfectly trained to interpret eye signals. This led scientists to believe that neurons are governed by a common learning algorithm. Neurons trained in one disciple can learn to pick up the other one if trained for some time and the learning algorithm will ensure that new routine is learned.

This was a fantastic discovery and mathematicians wondered can this functionality be performed artificially and thus began the quest for ANN.

Each neuron we build artificially is programmed to perform a fixed function. We apply a non linear function to each input coming to the neuron and output of the function is passed on to the next neuron. The next neuron precisely does the same stuff ensuring decision. Thus we build the input layer consisting of nodes which are the number of inputs we need to process followed by something called as a hidden layer. This layer consists of neurons which apply the non-linear function on each of the input neurons. Generally the number of neurons you would put in the hidden layer should be at-least equal or more to the no. of inputs you want to process. There are scenarios where you would need to have multiple hidden layers. Such networks are called as Deep Neural Networks. Since the processing happening inside these layers is kind of a black box to the user these layers are called as hidden layers. All the interconnected hidden layers finally converge into a decision node which will provide an output with a probability. This probability will determine which output class the input belongs to. In case where we need output in more than 2 classes generally one versus all approach is used where the output is evaluated against each output and the output class where we get the maximum probability is chosen. Generally the input and output is defined as a Matrix and vectors and it is a involved discussion and has been kept out of scope as far as this paper is concerned. There is ample amount of documentation publicly available as far as ANN is concerned and interested people can deep dive for more details. We will now see the applicable areas for ANN in the procurement space.

Commodity Classification

Quite a few companies dealing in the areas of commodity classifications claim to have implemented the classifier using ANN. Let us try to analyze how the implementation for these classifications would be. The inputs will be the individual words or the sentences and each of these will be fed to the hidden layer. The inputs will need to be converted into a matrix of numbers and corresponding output class would be defined for each of these records. The model would be adjusting the weight using the forward and back propagation methods and will zero in on the optimal weights. The most popular method in the procurement area considering the relative simplicity in deciding the weights is Gradient Descent. There are other faster methods available but it is out of scope as far as this discussion is concerned. During the training phase, all these input records belonging to the same class will be fed to the network. Let us say if you would need to implement 10000 classes then the output will be having 10000 1xn vectors defined. Let us say we have 100 input rows belonging to 1 class then based on the inputs for each of these 100 rows the network would adjust weights to classify similar inputs to the defined class in the future. This is simplified view of the implementation.

There are some advantages of using ANN for classification. You need not worry on the weights to be given to each input. All we need to bother is tagging the training data set to the right output and provide as much variety as possible in the training data. The model learns by each mistake and adjusts the weights. This ensures that you have a “learn as you go” kind of ecosystem where the model is less likely to make the same mistake again once corrected. In case of other models there will be additional efforts would be needed to ensure similar functionality.

The ANN is very fast and in case of large data volume can be of great advantage.

Even though with the advantages mentioned above, there are some challenges which we would need to address in case decision is made to implement ANN for the classifier

1. Complex Implementation – ANN is involved subject with lot of mathematics. The implementation is quite complex with back propagation and involves some effort in correctly training the model.
2. UNK Data – The problem of unknown data which the model has not seen. The classification of such data into an unknown bucket remains a challenge. There are variations of the model available but you would need to take a call to go ahead with ANN considering the complexity is comes with.
3. Maintenance – Training the model for the new data set is not very intuitive and might involve some bit of mathematical knowledge to ensure correct implementation.

So all in all before taking a call on implementation of the ANN method for your classification problem involving multiple classes you need to trade off between the benefits you are going to derive and the effort you would put in to get the same. In cases of scenarios where bit of accuracy can be sacrificed for the effort it will be advisable to go with other models. But in cases where it is difficult to build business rules, the inputs are very complex and heterogeneous it is advisable to use ANN due to sheer brilliant design to adjust the weights of the inputs automatically.

Strategic Sourcing Decisions

ANN can be used for Supplier performance evaluation and ranking as well. The inputs will be the parameters such as quality, on time delivery, pricing etc. based on the context. These inputs along with their values can be fed to the network along with their ranking or performance rating. The model will adjust the weight based on the output provided and will train itself. You can decide on the number of classes to be designated as output such as high performer, low performer etc. Once the model is trained, it will classify the supplier ranking into appropriate buckets in the future. The model can be retrained for the new set of data and weights will get adjusted automatically.

This method is easy to understand and can be implemented in basic scenarios of basic supplier evaluations and subsequent decisions. Also, the model will not distinguish between input and output variables which reduce the headache a bit. Some of the challenges one can face will be in the training of the model. In case multiple input variables with varied values how do you determine which supplier is best. The same goes with other buckets as well. These decisions can be made based on the past experience with the supplier and its performance. If you want to change the input parameters for the model you would need to start from the scratch and train the model again. Also, the model ranks on the available data and does not simulate the best case scenarios so evaluation is based on “what is” rather than “what should have been”. So, as stated earlier a good model to have in case simple supplier evaluation scenarios. Only care which needs to be taken is to ensure the variables we choose as inputs should not be linearly related as the input matrix will not get inversed causing the problems during implementation. This is little involved subject and is out of scope of this paper.

Procurement Frauds

Fraud or Anomaly detection can be done using ANN. There can be numerous use cases where we can detect Anomaly using ANN. The first step of implementation is identification of use cases where we can detect an anomaly and then the corresponding normal behavior. Once the parameters of the normal behavior are determined then it can be fed into the model. There are set of records which determine the normal behavior. All these inputs can be tagged to the correct output. Based on the variety of the inputs, the model will calculate the weights and tag it to determined class. This implementation will have only 2 classes and the output can be interpreted if there is an anomaly or not. This is classical ANN implementation.

The advantage is the simplicity of the model. Also, you can have set of conditions which determine the normal behavior and then accordingly train the model. This will ensure you have wide variety of cases considered as valid cases thus reducing the false positives. The model is fast and can be implemented in real time scenarios as well. Other advantage is we can use the category variables as input which may not be the case with other Anomaly detection models. As mentioned in the earlier section, care needs to be taken that variables are not linearly related so that matrix is invertible.

So we looked into some of the areas within procurement domain where we can use ANN. The decision needs to be made based on trade off of complexity and maintenance of the models.

Summary

The paper talks about the various areas where Artificial Neural Network can be applied in the procurement domain. The paper identifies three areas where we have seen ANN getting implemented and discusses briefly about some of the advantages and disadvantages. While making a decision about using ANN as a model of choice, it is a good idea to have a trade-off between the complexity and maintenance. ANN no doubt has better accuracy as compared to other models and can be very useful in complex scenarios but it comes with high cost of implementation and maintenance as well. So it is important to have a watch on the above aspects before making a final decision.

5 ways to go with Neewee

PROCUREMENT DQ SERVICES

Remove Data Quality
Hurdles

COMMODITY CLASSIFIER

End Your Commodity
Classification Woes

PROCUREMENT FRAUD ANALYZER

Red Flag High Risk
Fraud Areas

STATISTICAL ANALYTICAL MODELS

Unearth Cost Saving
Opportunities

BUSINESS INTELLIGENCE

Get Tight Handle on
Your Spend



Neewee Analytics is a Bangalore based company Analytics Services Company. We specialize in the Analytics services across domains with specialization in Predictive Maintenance/Condition based Monitoring Solutions for Internet of Things (IoT) domain. We have an open source IoT Enabled platform ATHENA which simplifies the implementation of Analytics Solutions in your IT landscape. It also ensures a faster and smoother implementation with ability to deploy the solutions on Cloud as well as on your premises.



www.neewee.in



+91 804 202 4519



Contact@neewee.in