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The Stocks Management and the Analysis of Calendar Provisioning: A Study Based over the Multilayer Neurons Network

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Abstract: ***The stock control or the stock management of articles is the trouble that comes across the ventures in the industrial, commercial, agricultural, military and in all economical sectors. The best stock management of an article comes back to order the quantity exactly needed or requested at a precise time. Thus, our aim by writing this paper is focused on procurement. Our thesis statement is how much one must order so that the cost may be taken into account for storage. Thanks to neuron network it is possible to plan the quantity to order for each item in order to satisfy the customers' need. So, our contribution in this paper consists to make a multilayer network neurons with application in python to reassure the head and the stock manager the functioning of their stock and at the same time answering to the two key questions i.e. « when and how much » one must shop.***
The aim of this paper is to determine the provisioning calendar.

Keywords: order management, network neurons, stock, calendar

1. Introduction and Definition

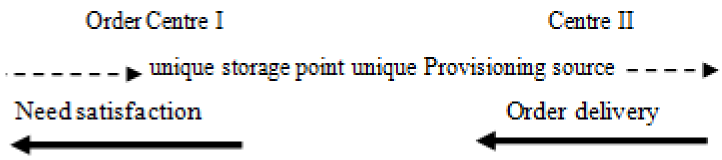
In the balance sheet of the venture, the value of stocks in the active is very important. The stocks management aims at finding the just level of stocks, at the same time, neither very important to avoid useless costs due to immovable capital, nor less important to avoid lack of items and unsatisfied service quality. Thus, the stocks management consists of responding to two important questions:

- When one must order?
- How much must be ordered?

For the last question there are several ways to answer: the quantity Q to order, also named EOQ (Economic Order Quantity).

When the order is constant in the determinism or the stationary case, in random case, this order is constant and its value is a variable to be determined, the order level S, also named recompleted level. It is the level to which the stock level is fetched after reception of the order. The quantity order is then the difference between S and stock level observed [Jacques Teghem, 2013].

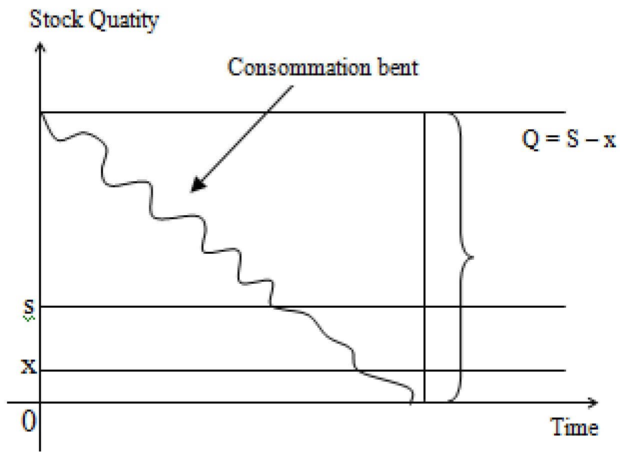
The served orders at Centre II are dispatched to Centre I for the need satisfaction. This can be illustrated by the following scheme.



Scheme 1.1: Storage and Provisioning Centres

The storage Centre I is a continued stock taking (s, S) where S is positive number which designs the maximum level of the potential stock and S is his critique level (s, S € I N, s<S).

The management strategy of continual inventory (s, S) means : the Centre I manager constantly follows the potential stock level becomes at SC≤S after the request, it spears at the same time a quantity order Q = S – X in order to restore the potential stock level at S value, but if the potential stock exceeds the s level, no order can not be speared. The potential stock means: available stock +ordered stock – postponed sale numbers.



Scheme1.2: Management strategy of continued stock taking (Marie Tshiela)

Today, it is more spoken about ‘’ consom’ateur’’. By contrast to passive consumer, the ordinary target marketing, this new consumer is connected and informed so he wants to control his consummation. Nowadays, there is no victim of mono directional adversing speech of mark to the customer, but a responsible consumer thinks about his or her consummation. S/he is emancipated from commercial ways which were thinked for him or her (J.C. Cointot. Y. Eychenne, 2014).

The decision hold is at the centre of managerial practice. A manager who knows how to take a good decision on time is more effective than the one who is untangle.

The main stream of business intelligence projects in its informatics decisional declension are based on the following postulate:
« To decide, it needs maximum information ». Therefore, the inventors build the storage architecture: data warehouse or datamart, and they store whatever is stored [J.C. Cointot, Y. Eycheme 2014].

The network neurons as predicative technique allows the analysis opposed to descriptive analysis, it is based on artificial intelligence. The predictive analysis is, as indicated by its name, a technique which tries to fore see the event evolution based on Data warehouse explanation.

2. Network neurons

2.1 Definitions

Network neurons form algorithm category effective in the context where the relation one tries to learn are very complex and no toadflax. From multiplayer perceptron, the net work neurons (R.N) have their name from the first assays in 1960 for adapting mathematical in the information treatment in the mamales’hoop and particularly in the primates cortex visual. More than half century after, the biological realism of these systems imported less than their efficacity to resolve the recognition problem of form[Pirmin Lemberger, Marc Batty Mederic Moderic Morel, Jean – Luc Raffaellu, 2016].

The inhalation to the origin of networks neurons is to be found in the discovery that the complex learning systems in the animals hoop are made of neurons closely interconnected. Even if one given neuron may be simple in its structure, concentrated networks of interconnected neurons can resolve the complex tasks of learning such as the classification and the characteristics recognition. The human hoop, for example, contains approximately 1011 neurons, each connected in average to 10.000 others neurons, let be a total of 10…..synaptic connections [Daniel T. Larose, Chantal D, Larose, 2018].

By definition, network neurons is an elementary group of units, called artificial neurons, linked between them and they allow to make different changes no toadflax [Massih – Reza Amini – Eric Gaussier, 2017]

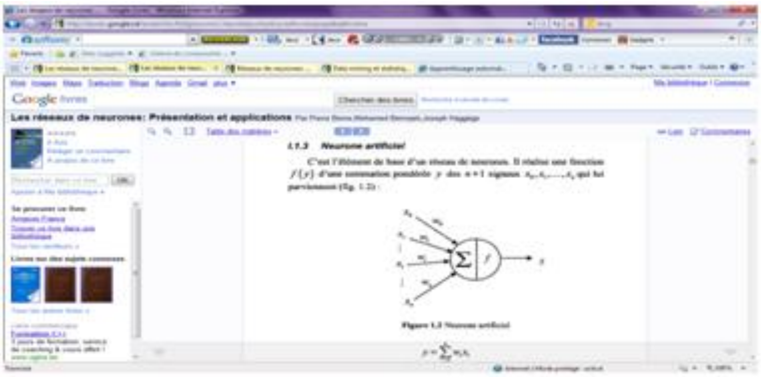


Figure 2.1: Illustrated scheme of artificial neuron

A network neuron consists to the propagation network before connected completely, in beds, of artificial neurons. The predictive nature of network prevents the network to data flow in one direction of flow and it doesn’t allow loops or cycles. The network neuron is made with two or more beds, although the networks consist in three beds: entry bed, hidden bed and exit bed. There may be more than one hidden bed although most of network has one hidden bed, what is sufficient for most of aims. The network neuron is completely connected what means that each bow in a given bed is connected to all bows of the following bed, but not to others bows in the same bed. Each connection between the bows has weight, for example WLA which is associated to it [Daniel T. Larose. Chantal D. Larose, 2018].

2.2 Multilayer Network Neurons

About our case, we are going to limit to the case of net work neurons of three beds. A multilayer network is called PMC which means multilayer perceptron.

$$E(t) = \frac{1}{2}(O_i^l(t) - d_i(t))^2$$

With:
E(t) the criterion value at the moment t
$d_i(t)$ is the value of first exit desired at the moment t

One calls parameter sigmoidal function k > O, the function,

$$\sigma_k(x) = \frac{e^{kx}}{1+e^{kx}} = \frac{1}{1+e^{-kx}}$$

This function is indefinitely approximation derivable of function to threshold of heaviside, as much better than k is big, we are going to take k = l, at last we have

$$\sigma_k(x) = \frac{e^{kx}}{1+e^{kx}} = \frac{1}{1+e^{-kx}}$$

The derivative of this function will be used for the ruler of update weights thanks to the retropropagation algorithm of gradient.

$$g(x) = \frac{e^{x}}{e^{x}+1} = \frac{1}{1+e^{-x}} \quad (2)$$

The retropropagation algorithm of gradient of error for multilayer perceptron having p+l exits (p attributes + bias), q+l quoted from 0 (Co : bed entry) to q (cq : bed exit). Of(t) is exit of PMC for data x ; of(t) is the exit of the bed umpteenth unity l, at the moment t, cfr version francaise, is the weight of the entry connection unity j of the bed l+l at the moment t (k=o corresponds to bias), [ci] is the number of the bed composing unities ci. The data algorithm corresponds to neurons function of logistics activation

$$g'(x) = \frac{e^{x}}{(1+e^{x})^2} = g(x).(1-g(x) \quad (3)$$

2.3 The Retropropation Algorithm of Grandient

The learning algorithm using total error generally guides particularly to complex calculations. It is preferable to use the method said gradient retropropagation which consists to the continuation of partial optimization, bed after bed and manager after manager. The networks neurons show a method of supervised learning, requiring big data group of complet registrations learning including the variable target. As each observation of the all learning is treated through the network, exit value is produced from the exit bow. This exit value is therefore compared with the real value of the variable target for this observation of all learning and the error is calculated [Daniel T. Larose. Chantal D. Larose. 2018].

The retropropagation algorithm takes the prediction error (real value – exit value) for particular registration and « retropropagate » the error through the network assigning a part of responsibility of the error to different connection. The weights on these connections are then adjusted to reduce the term of the error, over using the decreased method of gradient. In short, let be E[W]$E(w) = \frac{1}{2}\sum_{i=1}^{i=N}\left(y_i - \varphi(x_i)\right)^2$.the learning error due thanks to weight W. If the activation function is linear, this error E is written:

$$E(w) = \frac{1}{2}\sum_{i=1}^{i=N}\left(y_i - \sum_{j=0}^{j=P} w_j x_{i,j}\right)^2$$

Over using the signoidal activation function combines a behaviour almost linear, a lined behaviour and a behaviour almost constant in function of a given exit value [Daniel T. Larose. Chantal D. Larose. 2018].

2.4 Algorithm

- Requisity : the insistences N of learning Z
- Requisity : learning rate Oc€] 0, 1] initialize the Coi
  As soon as the storage criteria are not fulfilled to make Oc up to date, mix the examples.
  For all example X, do
  Of(r) network exit for example x, at the moment t .
  $\delta_i^L(t) \leftarrow O_i^L(t)(1 - O_i^L(t))(O_i^L(t) - d_i(t))$
  For all hidden beds / decreased of q – l to l to make.
  For all j neurons of the bed Cj make Of
  $\delta_i^l(t) \leftarrow O_i^l(t)(1 - O_i^l(t)) \sum_{j \in succ(i)} \omega_{ij}^l \delta_j^{l+1}$
  End for
  End for
  Update weight
  For all beds/ creased from O to L.l make
  For all units k of bed l, k varying from 1 to [Ci] make
  For all neurons m connected over exit neuron k of bed l.m varying from l to [Ci] make
  $\omega_{km}^l \leftarrow \omega_{km}^l + \alpha\delta_m^{l+1}.O_k^l$
  End for
  End for
  End for
  End for
  End as much.

3. Application of Computerized Model of Stock Management

3.1 Predictive analysis and network neuron

The network neuron consists to having a classifier more performant than supervised learning. The main idea for the neuron use is to increase the performance. This increasing performance can be translated by more reliability in the reactions, less discharge, if not both of them at the same time. Indeed, most of the time, the researchers have come to the conclusion that there is no any method more superior than others in all problems and situations.

All methods have their strong and weak sides. If none of them can be entirely successful in the application exigency envisaged. The simultaneous use of many methods at the same time can possibly permit to add the profits without addending the inconveniences.

```
In [62]: import numpy as np
         import matplotlib.pyplot as plt
         import pandas as pd
         import seaborn as sns
         from sklearn.neural_network import MLPClassifier
         from sklearn.metrics import confusion_matrix

In [63]: data = pd.read_excel('DataSet.xlsx')

In [64]: data.head()
Out[64]:
```

	Product type	Stock quality	Sold quantity	Result
0	Toilet	1200	1000	1
1	Toilet	1500	880	1
2	Food	5400	2487	0
3	Food	1200	1000	1
4	Toilet	5600	3245	1

```
In [65]: data['type_produit'].value_counts()
Out[65]: ALIMENTAIRE      208
         SCOLAIRE          84
         TOILETTE          45
         COSMETIQUE        44
         OUTILS MENAGER    28
```

The above picture taken resends to the importation of different libraries and the data set display.

```
y = data['Resultat']
X = data.drop('Resultat', axis=1)

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)
print('Train set:', X_train.shape)
print('Test set:', X_test.shape)

Train set: (351, 3)
Test set: (88, 3)
```

This is the test and learning data display ! With the code of Train set and Test set.

```
from sklearn.model_selection import cross_val_score

#Validation avec les données d'apprentissage
# Reseau de Neuron avec 3 couches et 10 neurones par couche
cross_val_score(MLPClassifier(hidden_layer_sizes=(10, 10, 10), max_iter=1000), X_train, y_train, cv=5, scoring='accuracy').mea

0.9688531187122738

#Validation avec les données de test
model = MLPClassifier(hidden_layer_sizes=(10, 10, 10), max_iter=1000)
model.fit(X_test, y_test)
model.score(X_test, y_test)
print('Test score : ', model.score(X_test, y_test),'%')

Test score :  1.0 %

def prediction(model, type_produit=0, qte_stock=600, qte_vendue=430):
    x = np.array([type_produit,qte_stock,qte_vendue]).reshape(1,3)
    print(model.predict(x))

prediction(model)

[1]
```

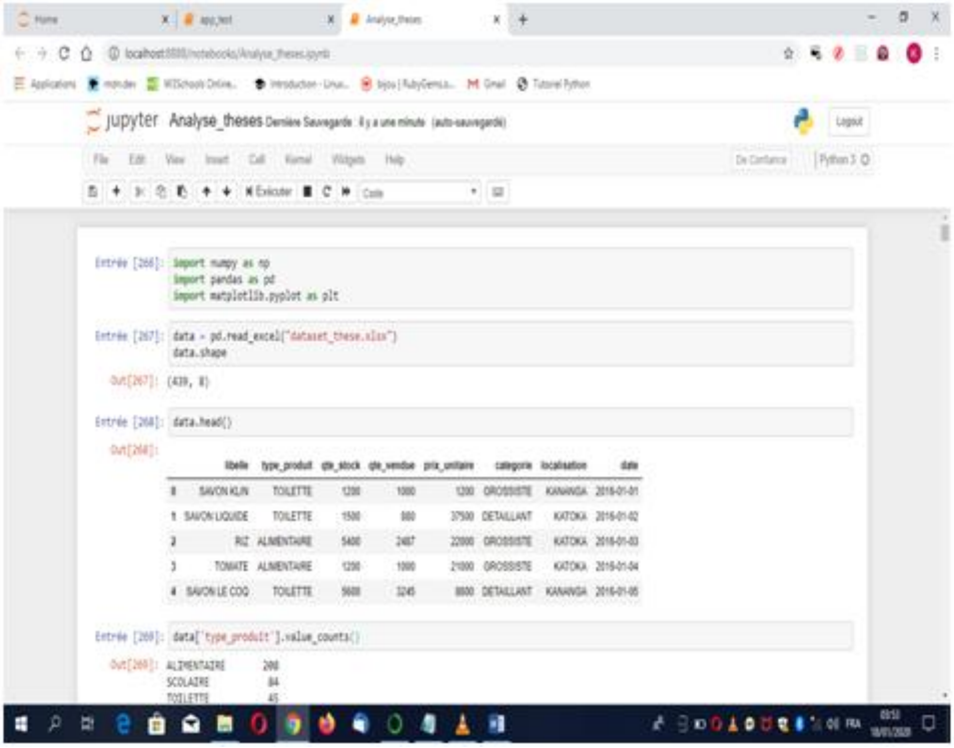
On this interface one can see the capture on a validation with the learning data and the data test. As much the creation of the network neuron modelsliced in block with the code Cross_ al_score. And an iteration of 1000.So the creation of the method to predict with def prediction, etc. Over there by using the product type, its stock quantity and sold quantity, the classifier can predict for us if we can or not provision again the same product.

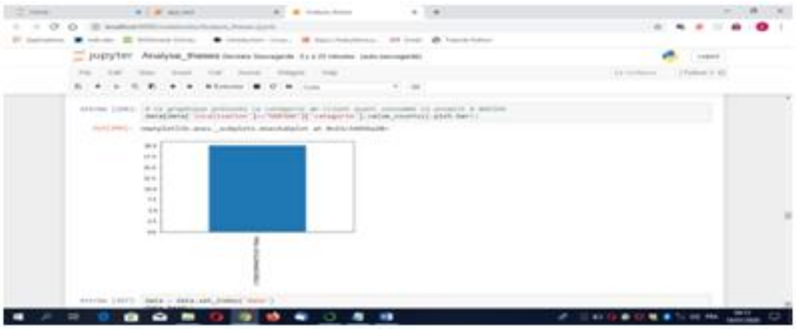
Finally there is the womb realization of confusion

```
#Matrice de confusion
confusion_matrix(y_test, model.predict(X_test))
array([[22,  0],
       [ 0, 66]], dtype=int64)
```

3.2 Descriptive analysis to the calendar determination

Over using the descriptive analysis from the non supervised learning, we have discovered that the calendar determination for the provisions is fixed in February and March, thus during this period, the Beltexco manager can envision to reprovision his stock in order to satisfy his customers.





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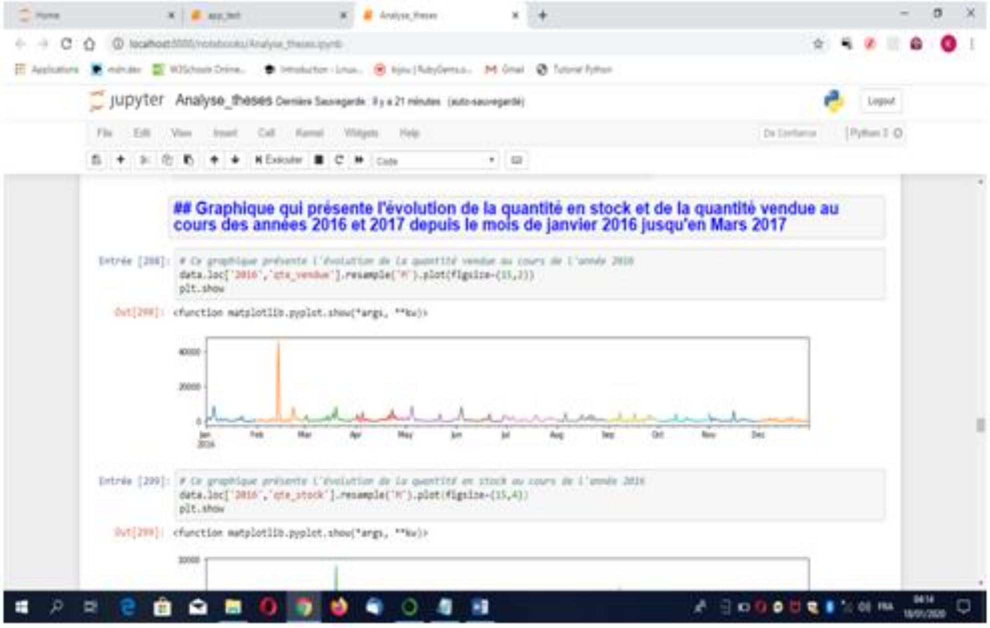

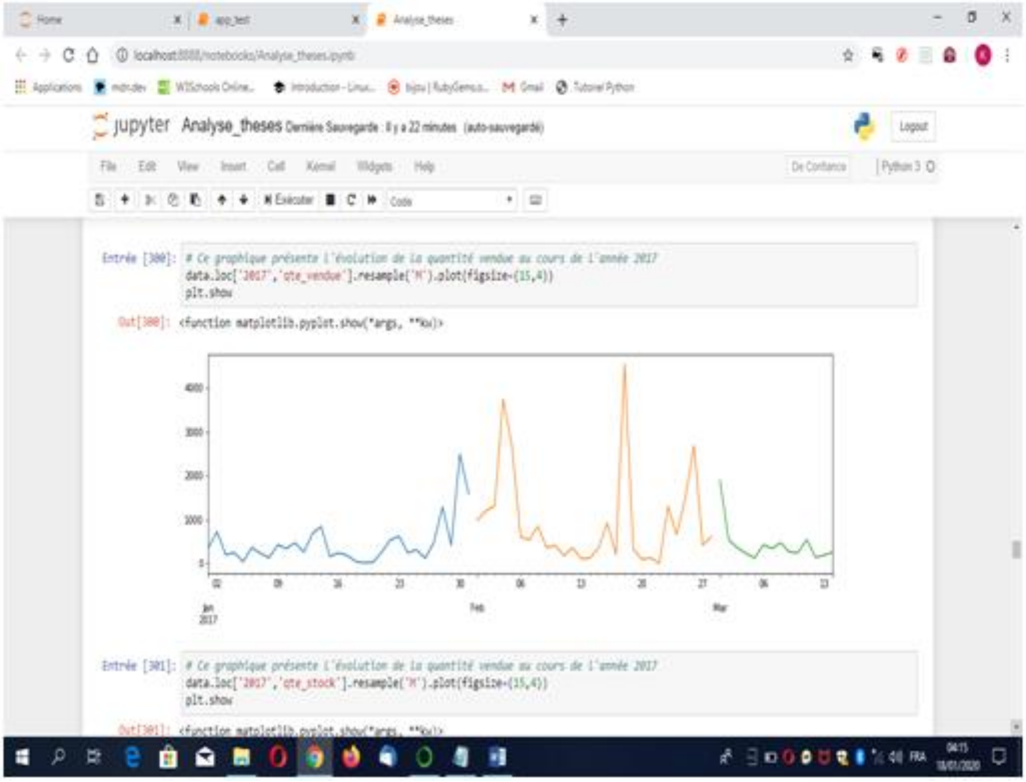

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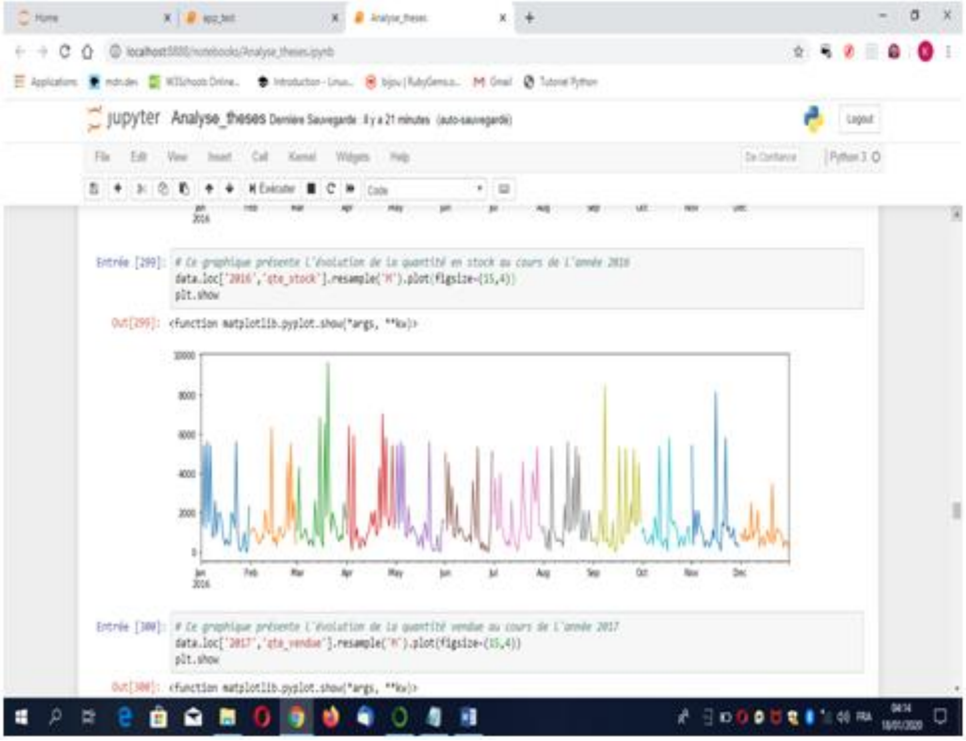
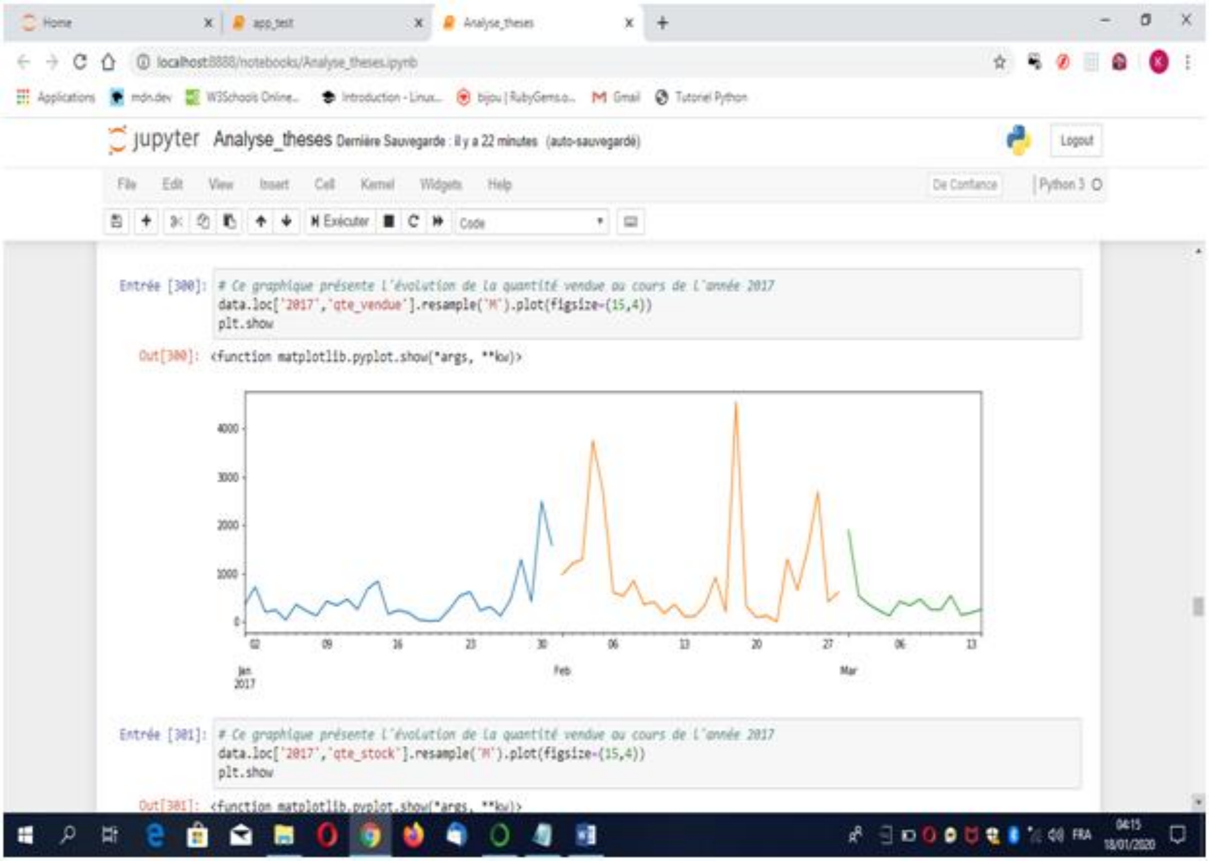
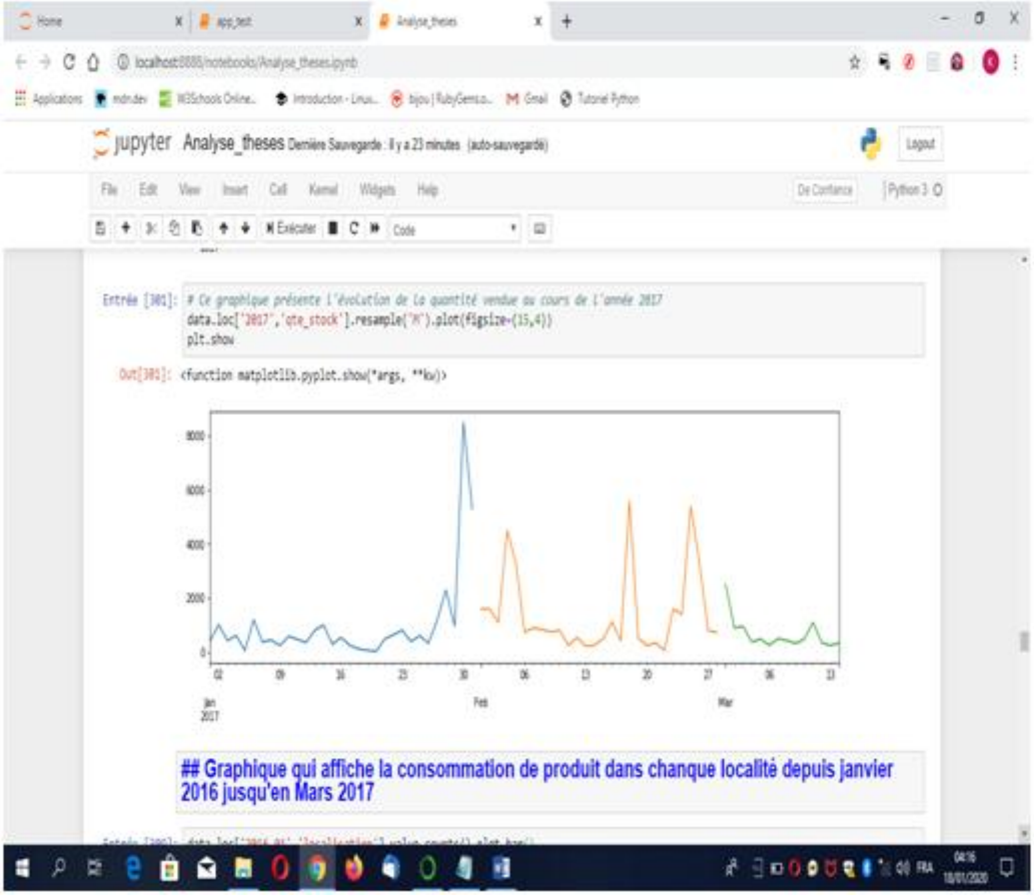

jupyter Analyse_theses
Entrée [299]: # Ce graphique présente l'évolution de la quantité en stock au cours de l'année 2016
data.loc['2016','qte_stock'].resample('H').plot(figsize=(15,4))
plt.show
Out[299]: <function matplotlib.pyplot.show(*args, **kw)>
Entrée [300]: # Ce graphique présente l'évolution de la quantité vendue au cours de l'année 2017
data.loc['2017','qte_vendue'].resample('H').plot(figsize=(15,4))
plt.show


jupyter Analyse_theses Dernière Sauvegarde : il y a 22 minutes (auto-sauvegardé)
Entrée [300]: # Ce graphique présente l'évolution de la quantité vendue au cours de l'année 2017
data.loc['2017','qte_vendue'].resample('H').plot(figsize=(15,4))
plt.show
Out[300]: <function matplotlib.pyplot.show(*args, **kw)>
Entrée [301]: # Ce graphique présente l'évolution de la quantité vendue au cours de l'année 2017
data.loc['2017','qte_stock'].resample('H').plot(figsize=(15,4))
plt.show



4. Conclusion

We have described the theoretical bases of the network neurons operation over insisting on multiplayer networks, the learning no supervised rulers and the learning no supervised.

The network neurons makes able to learn how to resolve the complex problems by adding again to them one or more hidden beds and according to the activation function associated to each bed.

We have been given the possibility to make descriptive analysis and read the data from our data base created in MS Excel. Particular accent was put on the retropropagation algorithm of gradient which is a particular case of the network neurons multilayer and which has consisted in a continuation of partial optimization, bed after bed and manager after manager. The weights on these connections are then adjusted to reduce the error rate by using the decreased method of gradient and for our case the error rate is raised at 4% and our precision rate model is raised at 96% and to find the rates we focused our analysis on the confusion Womb.

The weakness of the network neurons is the lack of the actions interpretation of the treated data. Only the global decision appears in exit. Therefore, this problem can be connected by flow networks neurons or let be by combination of the classifiers.

The determination of provisioning calendar is focused between February and March, during this period, there is a deep request by the customers of the products, mainly food products.

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