# PRODUCT_DELIVERY_EFFICIENCY

INDUSTRY : Transportation

DEPARTMENT : SCM (Supply Chain Management) pain points.

## Supply Chain Management :

Supply chain management is the management of the flow of goods and services and includes all processes that transform raw materials into final products. It involves the active streamlining of a business's supply-side activities to maximize customer value and gain a competitive advantage in the marketplace.

## Transportation :

SCM in transportation industry involves the coordination and management of all activities in the movement of goods from point of origin to point of destination.This includes the planning and procurement and execution of transportation services as well as management of inventory and the coordination of delivery schedules.

## Pain Points of SCM :

1. Communication (Distributers,Service providers,Retailers,Customers).

2. Safety reach of products to the customer.

3. Modes of transportation.

4. Delay of product shipment.

5. Complex and constantly changing routes.

6. Weather disruptions.

7. Inadequate technology.

## PROBLEM STATEMENT :

Challenges faced by supply chain management in terms of transportation.

## OUTCOME :

Efficient product delivery to the customer.

## FEATURE ENGINEERING :

1. FEATURE CREATION :

- Technology
- Communication
- Manual entry
- Vendor support
- Integration
- Invalid Information by the user
- Quality management of materials
- Stock control
- Wrong delivery due to incorrect details by the user
- Carrier performance

- Weather conditions
- Capacity constraints
- Geopolitical risks
- Route optimization
- Relationship with suppliers and customers
- Tracking and monitoring
- Carrier selection
- Transportation mode
- Collaboration
- Orders delivered
- Rating by customers

2. FEATURE SELECTION :

- Technology
- Modes of transportation
- Orders delivered
- Rating by customers
- Carrier selection
- Tracking and monitoring
- Relationship with suppliers and customers
- Route optimization
- Geopolitical risks
- Communication
- Wrong delivery
- Carrier performance
- Capacity constraint
- Invalid information
- Quality management of products

- Weather conditions

3. FEATURE EXTRACTION :

- Old and New technology
- Communication to customers
- Quality management of materials
- Weather conditions
- Carrier selection
- Mode of transportation
- Relationships with suppliers and customers
- Orders delivered
- Customer rating
- Tracking and monitoring
- Route optimization
- Customer details
- Geopolitical risks
- Wrong product delivery

4. FEATURE TRANSFORMATION :

- Mode of transportation
- Route optimization
- Weather conditions
- Geopolitical risks
- Customer rating
- Orders delivered

## DATA SET GENERATION :

## CODE :

```
import random

import pandas as pd

[w1,w2,w3,w4,w5,w6] = [-0.541,0.808,2.197,1.496,0.853,0.076]

vals = []

for i in range(10000):

    x1 = random.randint(1, 3)

    x2 = random.randint(1, 4)

    x3 = random.randint(0,1)

    x4 = random.randint(1,10)

    x5 = random.randint(1, 100)

    x6 = random.randint(1, 10)

    eq = w1*x1+w2*x2+w3*x3+w4*x4+w5*x5+w6*x6

    cl=0

    if x4>6 and x5>60:

        k='BEST'

    else:

        k='NOT'
```

```
    if eq>70:
        cl=1
    else:
        cl=0
    vals.append([x1,x2,x3,x4,x5,x6,eq,cl,k])
df =
pd.DataFrame(vals,columns=['MODE_OF_TRANSPORTATION','WEATHER','GEOPOLITICAL_RISKS','ROUTE_OPTIMIZATION','NO_OF_DELIVERED','CUSTUMER_RATING','EFFICIENCY','EFFICIENT','BEST OR NOT'])
df.to_csv('Effi.csv',index=False)
```

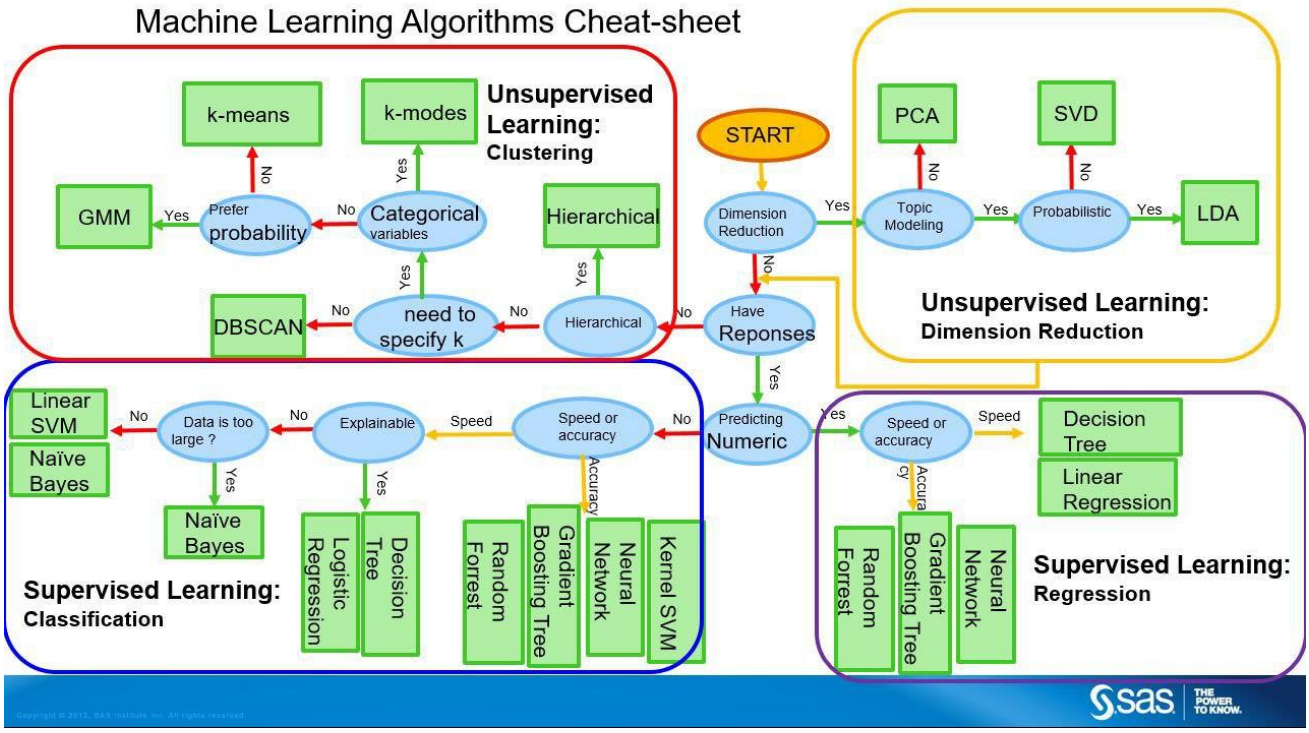
## CSV FILE :

| MODE_OF_TRANSPORTATION | WEATHER | GEOPOLITICAL_RISKS | ROUTE_OPTIMIZATION | NO_OF_DELIVERED | CUSTUMER_RATING | EFFICIENCY | EFFICIENT | BEST OR NOT |
|---|---|---|---|---|---|---|---|---|
| 2 | 2 | 0 | 6 | 52 | 3 | 54.094 | 0 | NOT |
| 1 | 3 | 1 | 8 | 63 | 6 | 70.243 | 1 | BEST |
| 1 | 2 | 1 | 8 | 80 | 8 | 84.088 | 1 | BEST |
| 2 | 2 | 0 | 4 | 29 | 4 | 31.559 | 0 | NOT |
| 2 | 3 | 1 | 6 | 69 | 3 | 71.6 | 1 | NOT |
| 1 | 1 | 1 | 9 | 37 | 4 | 47.793 | 0 | NOT |
| 2 | 3 | 1 | 3 | 36 | 10 | 39.495 | 0 | NOT |
| 1 | 4 | 1 | 1 | 52 | 6 | 51.196 | 0 | NOT |
| 2 | 4 | 0 | 1 | 24 | 2 | 24.27 | 0 | NOT |
| 1 | 1 | 0 | 1 | 82 | 9 | 72.393 | 1 | NOT |
| 3 | 2 | 1 | 2 | 99 | 7 | 90.161 | 1 | NOT |
| 3 | 1 | 1 | 6 | 2 | 6 | 12.52 | 0 | NOT |
| 2 | 3 | 0 | 10 | 39 | 4 | 49.873 | 0 | NOT |
| 2 | 2 | 0 | 6 | 82 | 10 | 80.216 | 1 | NOT |
| 3 | 1 | 0 | 6 | 73 | 6 | 70.886 | 1 | NOT |
| 1 | 3 | 0 | 9 | 6 | 7 | 20.997 | 0 | NOT |
| 1 | 3 | 0 | 7 | 37 | 7 | 44.448 | 0 | NOT |
| 3 | 4 | 1 | 6 | 100 | 3 | 98.31 | 1 | NOT |
| 2 | 1 | 0 | 2 | 50 | 5 | 45.748 | 0 | NOT |
| 2 | 1 | 1 | 4 | 64 | 4 | 62.803 | 0 | NOT |

## MODEL SELECTION :

As we are predicting the efficiency of the product delivery we go with regression.

## RANDOM FOREST




## CODE AND OBSERVATION :

## CODE :

#IMPORTS

import pandas as pd

from matplotlib import pyplot as plt

#DATA HANDLING

data = pd.read_csv('PRODUCTe.csv')

```
print(data.head())
print(data.describe())
X =
data[['MODE_OF_TRANSPORTATION','WEATHER','GEOPOLITICAL_RISKS','R
OUTE_OPTIMIZATION','NO_OF_DELIVERED','CUSTUMER_RATING']]
Y = data["EFFICIENCY"]
Y_ = data["EFFICIENT"]



#DATA ANALYSIS
plt.scatter(X['WEATHER'], Y, color='b')
plt.xlabel('WEATHER')
plt.ylabel('EFFICIENCY')
plt.show()

#DATA ANALYSIS
plt.scatter(X['GEOPOLITICAL_RISKS'], Y, color='b')
plt.xlabel('GEOPOLITICAL_RISKS')
plt.ylabel('EFFICIENCY')
plt.show()

#DATA ANALYSIS
plt.scatter(X['ROUTE_OPTIMIZATION'], Y, color='b')
plt.xlabel('ROUTE_OPTIMIZATION')
```

```
plt.ylabel('EFFICIENCY')
plt.show()

#DATA ANALYSIS
plt.scatter(X['NO_OF_DELIVERED'][:100], Y[:100], color='b')
plt.xlabel('NO_OF_DELIVERED')
plt.ylabel('EFFICIENCY')
plt.show()

#DATA ANALYSIS
plt.scatter(X['CUSTUMER_RATING'], Y, color='b')
plt.xlabel('CUSTOMER_RATING')
plt.ylabel('EFFICIENCY')
plt.show()

#OBSERVATIONS
print("THE EFFICIENCY")

#INPUTS
inps = [[2,2,0,2,44,7]]

#RANDOM FOREST CLASSIFICATION
from sklearn.ensemble import RandomForestClassifier
mdl = RandomForestClassifier(criterion='entropy')
```

```
mdl.fit(X, Y_)
pred = mdl.predict(inps)
print("Predicted value (RFC): ",pred[0])
print("Accuracy (RFC): ",mdl.score(X[:100], Y_[:100])*100)


plt.scatter(X['NO_OF_DELIVERED'][:100], Y_[:100], color='b')
#plt.plot(X['MODE_OF_TRANSPORTATION'],
mdl.predict(X),color='black',linewidth=3)
plt.xlabel('NO_OF_DELIVERED')
plt.ylabel('EFFICIENT')
plt.show()
```

## OBSERVATION :

Based on the output generated after the application of “Random Forest” algorithm,we have observed that efficiency of the product delivery majorly depends upon the number of deliveries.Though remaining features do effect but it contributes more for the differences.Because the number of deliveries can be decreased by some feature and can be increased by some other feature that can be the mode of transportation or weather conditions or anything.