AI based enablement of inventory and warehousing management system

Warehousing

“Storage or warehousing provides the place utility as part of logistics for any business and along with Transportation is a critical component of customer service standards”.

Reasons For Warehousing

- To support the company's customer policy.
- To maintain a source of supply without interruptions.
- To achieve transportation economies.
- To support changing market conditions and sudden changes in demand.
- To provide customers with the right mix of products at all times and all locations.
- To ensure least logistics cost for a desired level of customer service

Warehouse Operating Principles

Three Principles are:

1) Design criteria:
    a) Number of stories in the facility
    b) Height utilization,
    c) Product flow
2) Handling technology
    a) Movement continuity,
    b) Movement scale economies.
3) Storage plan

Warehouse Activities

- Receive goods
- Identify goods
- Dispatch goods to storage
- Hold goods
- Pick goods
- Dispatch the shipment
- Operate an information system

Benefits of warehousing

- Consolidation.
- Break bulk warehouse.
- Processing / Postponement.
- Stockpiling.
- Service benefits

Inventory Management

- Inventory

  A physical resource that a firm holds in stock with the intent of selling it or transforming it into a more valuable state.

- Inventory System

  A set of policies and controls that monitors levels of inventory and determines what levels should be maintained, when stock should be replenished, and how large orders should be

Functions Of Inventory

- To separate various parts of the production process
- To decouple the firm from fluctuations in demand and provide a stock of goods that will provide a selection for customers
- To take advantage of quantity discounts
- To hedge against inflation

What is demand forecasting?

- Demand forecasting is the process of predicting future sales by using historical sales data to make informed business decisions about everything from inventory planning and warehousing needs to running promotions and meeting customer expectations. Demand forecasting helps the business estimate the total sales and revenue for a future period of time.

Importance of Demand Forecasting

- Crucial to supplier, manufacturer or retailer
- Business decisions
- Planning for future finished goods
- Satisfying Customers
- Accurate demand forecasts lead to efficient operations and high levels of customers service
- Improve quality & effectiveness of product

Problem 1: Formulate demand prediction system-with identification/design of the related dataset and the associated ML based algorithms.what all factors are to be taken for the demand prediction system and how to rank them on the basis of their importance.

- For the above problem , we have predict the data of sale of any inventory.
- For that we use over here SVM classifier, Which is classify data based on number items which will sale on that particular date.
- Here we have input as particular data and item name/Id so our pradicter algorithm predict the class of that item, Here we use four class , based on that we classify product.

```
[ ]  data_y = []
     for i in data.sales :
        if i > 65:
          data_y.append(3)
        elif i > 48:
          data_y.append(2)
        elif i > 30:
          data_y.append(1)
        else:
          data_y.append(0)
```

➢ In the above figure we have different class based on quantity of items which will sale on the particular date.

Problem 2 & 4:-Identify shortest route for dynamic route management of picking items from the warehouse and deliver it to the respective clients assuming roadways.

- Here we use A-Star algorithm for finding a route and the place where we put the box and take the box
- Here we combine solution of both problem second and fourth.

```
maze = [[0, 0, 0, 0, 0, 0,0],
        [0, 1, 0, 1, 0, 1,0],
        [0, 1, 0, 1, 0, 1,0],
        [0, 0, 0, 0, 0, 0,0],
        [0, 1, 0, 1, 0, 1,0],
        [0, 1, 0, 1, 0, 1,0],
        [0, 0, 0, 0, 0, 0,0]]
```

- In the figure we have one maze matrix.
- In this we describe if value of the position in matrix is 1 then at that position in the warehouse we have box and if 0 then this place is empty.
- In the above we have matrix for route [1,0] to [2,0]. In this we describe step with numbers like(0,1,2,3..) which through only position of the place is 0.
- Here first we find common member based on the input, blank_space and request.

Example:-

```
#input list contains the  location of box that arrives at  warehouse;
# and have to place at their location
Input = [[4,4],[1,4],[1,2],[1,0],[3,2],[5,4]]

#blank_places describes number of empty place in the warehouse
blank_places = [[4,4],[3,4],[1,0],[5,4],[6,6],[2,4]]
```

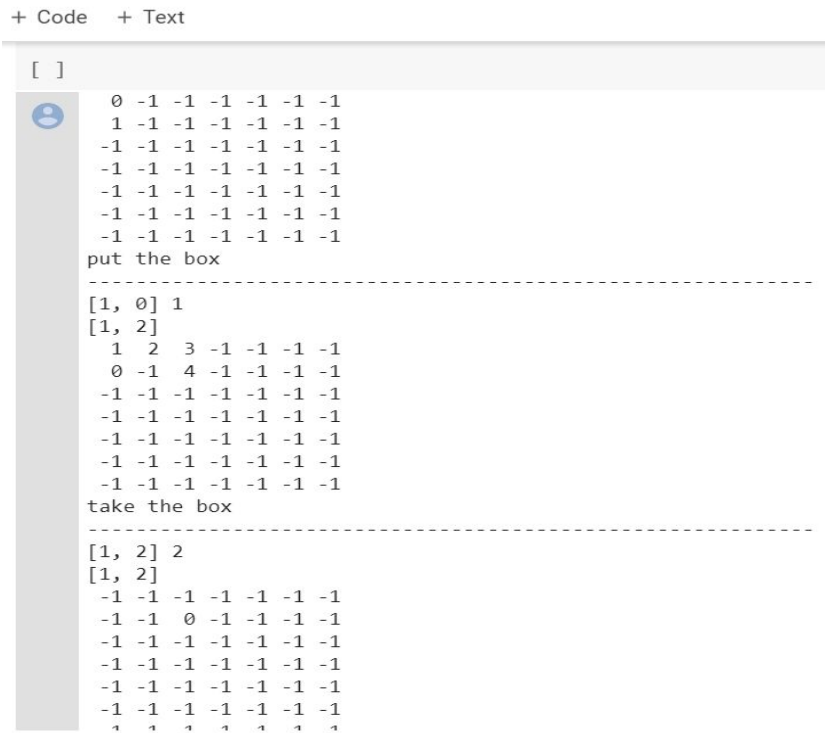
```
#request is the list of all the location of boxes that are requested to the robot
request = [[1,2],[3,4],[5,2],[6,4],[6,2],[1,4]]
```

- Here we find out common member between input, request and blank_place.
- Then we got total_put , this append with 1 and request append with 0.
- Which can distinguish between request and total_put.

Example:-

```
[[1, 0, 1], [1, 2, 0], [1, 2, 1], [1, 4, 0], [1, 4, 1], [3, 4, 0], [4, 4, 1], [5, 2, 0], [5, 4,
1], [6, 2, 0], [6, 4, 0], [0, 0, 0]]
```

- In the above array we have final data, in the row if last element is 0 then we it will define as request and if last element is 1 then it will define as total put(put the box).



- In the above figure we have input like ([1,0] to [1,2]).
- Here we have path like (0,1,2,3,4) total 5 steps required to reach the particular position in the warehouse.

Problem 3:-Identify the shortest route for dynamic route management of picking items from the warehouse and deliver it to the respective clients assuming airways). In this reference you can take reference of the Neo4JS library for dynamic route optimization based on availability of flights from a source to destination. Likewise the logic can be implemented for roadways also.

- For the above problem we make decision tree to identify best possible route for the take the box and put the box in the warehouse.
- In this algorithm we use 2 type of input like distance and time for delivery of the box between 2 place.
- Here we classify track based on value of distance and time.

Example:-

- If we have, distance value is high and time period is long, than we use train for delivery from one place to another place.(Gujrat to Delhi for long time period.)
- If we have, distance value is high and time period is short, than we use Air way for delivery from one place to another place.(Gujrat to Delhi for short time period.)
- If we have distance is less and time period is sufficient than we use bus or traveler within that places which is used for delivery system.(Within Gujarat.)

Advantages & Disadvantages of Inventory Management System

Advantages:-

- Saves cost & time (as it avoids understocking & overstocking of products in warehouse)
- Increase in efficiency (in terms like collection of data, creation of records, performing calculations, etc.)
- Proper warehouse organization (benefitting to wholesalers, distributors, retailers, etc.)
- Data security (authorized person can give different access rights to data to different users)
- Getting insight of trends, minimal losses occurrence, etc.

Disadvantages:-

- Expensive (for availing various benefits of this system, all these features come with a cost, which may not be feasible for small businesses),
- Complexity (learning how to operate such system needs training sessions & manuals in order to get it user-friendly)

Thank You