DYNAMIC PRICE OPTIMIZATION FOR E-COMMERCE

DEEP LEARNING

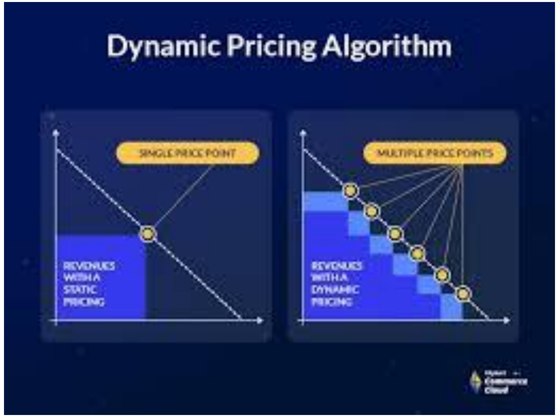
- Deep learning is a subset of machine learning that deals with algorithms inspired by the structure and function of the brain's neural networks.
- It's a powerful technique for solving tasks like image recognition, speech recognition, natural language processing, and many others.
- At the heart of deep learning are Artificial Neural Networks (ANNs), which are composed of layers of interconnected nodes, or "neurons."
- Each neuron takes input data, processes it through some mathematical operations, and passes it to the next layer of neurons through a process called “training”.
- Neural networks adjust their internal parameters to learn patterns and relationships in the data.

PROBLEMS SOLVED USING DL

- **Image and Speech Recognition**: Identifying objects, faces, or patterns within images.
- **Natural Language Processing**: Understanding and generating human language, including translation and sentiment analysis.
- **Medical Diagnostics**: Analyzing medical images for disease detection or patient diagnosis.
- **Autonomous Vehicles**: Enabling vehicles to perceive their environment and make decisions.
- **Recommendation Systems**: Personalizing recommendations for products, movies, or content.
- **Financial Forecasting**: Predicting stock prices or market trends.
- **Drug Discovery**: Identifying potential drugs or molecules for pharmaceutical purposes.
- **Anomaly Detection**: Identifying unusual patterns or outliers in data.
- **Gesture Recognition**: Understanding hand or body movements for interaction with devices or systems.

DYNAMIC RETAIL - PRICING

- Dynamic retail pricing adjusts prices in real time based on demand, competition, inventory, and customer behavior.
- It contrasts with static pricing models, offering flexibility to adapt to market changes for profitability.
- Components include demand forecasting, competitor analysis, and real-time data utilization.
- Price optimization algorithms analyze factors like demand elasticity and seasonality for optimal pricing.
- Personalization tailors prices to individual customer characteristics and behavior.
- Benefits include revenue maximization during peak demand, optimized inventory, and competitiveness.
- It enhances customer satisfaction by offering fair and personalized pricing.



REAL-TIME EXAMPLES

1) Travel and Airline Tickets:

- Websites like Expedia or Skyscanner use dynamic pricing to adjust flight and hotel rates based on demand, booking trends, and competitor prices. For instance, ticket prices can be higher during peak travel seasons or just before a flight's departure.

2) Ride-Sharing Services:

- Companies like Uber and Lyft use dynamic pricing, or "surge pricing," to adjust fares based on demand. during peak hours, weekends, or special events, prices can increase due to high demand.

3) Online Marketplaces:

- Platforms like Amazon and eBay employ dynamic pricing strategies to remain competitive. For example, Amazon might automatically adjust product prices based on competitor pricing, stock levels, or seasonal trends to stay competitive and maximize sales.

4) Retail Sales and Promotions:

- E-commerce sites like Best Buy or Walmart may use dynamic pricing during promotional events, like Black Friday or Cyber Monday. Prices can fluctuate based on inventory levels, customer demand, or sales targets.

5) Subscription Services:

- Streaming platforms or digital content providers might adjust subscription prices based on user activity, new content releases, or market trends. For example, a video streaming service may offer promotional pricing when launching new shows to attract more subscribers.

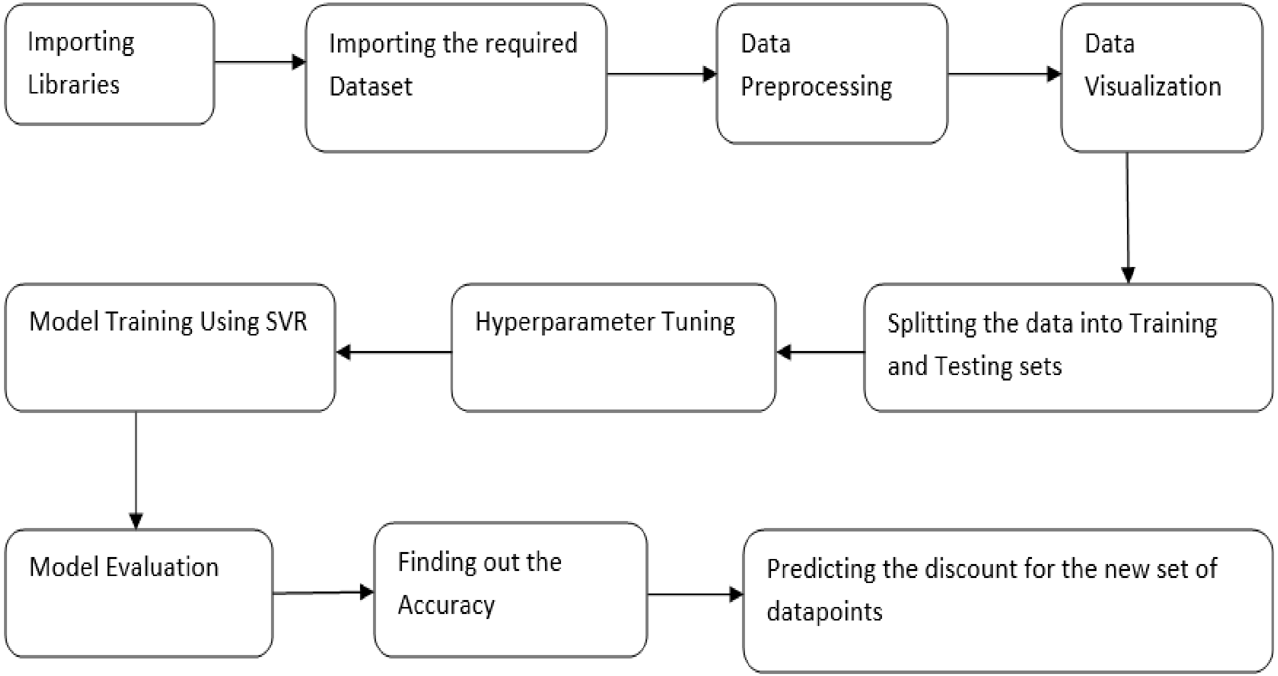
6) Rental Services:

- Platforms like Airbnb and Turo (for car rentals) use dynamic pricing to adjust rates for properties or cars based on factors like seasonality, location, events, and customer reviews. For example, Airbnb hosts might raise prices during local events or holidays.

LITERATURE SURVEY

Title	Author	Algorithm Used	Dataset	Advantages	Disadvantages
An Efficient Novel Approach To E-Commerce Retail Price Optimization Through Machine Learning	Yerragudipadu Subbarayudu, G Vijendar Reddy, M Vamsi Krishna Raj, K Uday, MD Fasiuddin And P Vishal	Random Forest Regression Model, Multiple Regression Model	Retail-Price-Optimization	Data-Driven Decisions, Improved Profitability, Increased Efficiency, Personalization	Data Quality Dependence, Model Bias, Interpretability, External Factors
Optimizing E-Commerce Profits: A Comprehensive Machine Learning Framework For Dynamic Pricing And Predicting Online Purchases	Malay Sarkar, Eftekhar Hossain Ayon, Md Tuhin Mia	Logistic Regression	Sales Store Product Details	Efficiency, Interpretability	Overfitting Potential, Assumes Linearity, Limited To Binary Classification
Dynamic Pricing On E-Commerce Platform With Deep Reinforcement Learning: A Field Experiment	Jiaxi Liu, Yidong Zhang, Xiaoqing Wang, Yuming Deng, Xingyu Wu	Deep Reinforcement Learning	Real Dataset Of Alibaba Inc.	Adaptability, Real-Time Learning, Complexities Handling, Offline Evaluation	Data Dependency, Interpretability, Computational Cost, Exploration Vs Exploitation Tradeoff
A Machine Learning Framework For Predicting Purchase By Online Customers Based On Dynamic Pricing	Rajan Gupta And Chaitanya Pathak	Logistic Regression	Acquire-Valued Shoppers-Challenge	Prediction Efficiency, Customer Segmentation And Interpretability	Overfitting Potential, Linear Relationship Assumption, Limited To Binary Purchase Likelihood

PROPOSED SYSTEM



IMPLEMENTATION

Importing Libraries:

```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import statsmodels.api as sm
from sklearn.svm import SVR
from sklearn.metrics import mean_squared_error
from sklearn.preprocessing import StandardScaler
```

Importing Dataset:

```
data = pd.read_csv('/ecommercedata.csv')
```

Split data into features and target variable:

```
X = data[['Customer_care_calls', 'Customer_rating',
'Cost_of_the_Product', 'Prior_purchases', 'Weight_in_gms']]
y = data['Discount_offered’]
```

Split the data into training and testing sets:

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
random_state=42)
```

Standardize features:

```
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
```

Hyperparameter Tuning :

```
from sklearn.model_selection import
GridSearchCV
param_grid = {
    'kernel': ['linear', 'rbf', 'poly'],
    'C': [0.1, 1, 10],
    'epsilon': [0.01, 0.1, 0.2]
}
svr = SVR()
grid_search = GridSearchCV(svr, param_grid,
cv=5, scoring='neg_mean_squared_error',
n_jobs=-1)
grid_search.fit(X_train_scaled, y_train_scaled)
```

Model Training using SVR:

```
svr_model = SVR(kernel='linear', C=1.0)
svr_model.fit(X_train_scaled, y_train_scaled)
```

Accuracy:

```
# Calculate Mean Absolute Percentage Error (MAPE):
def calculate_mape(actual, predicted):
    return np.mean(np.abs((actual - predicted) / actual)) *100
#Calculate MAPE for the selected data points:
mape = calculate_mape(y_test_percentage.values,
y_test_pred_percentage)
print(f"Mean Absolute Percentage Error (MAPE): {mape:.2f}%")
# Calculate accuracy as the percentage of correct predictions
accuracy = 100 - np.mean(np.abs(y_test_percentage.values -
y_test_pred_percentage) * 100)
print(f"Accuracy: {accuracy:.2f}%")   O/P: MAPE: 110.18%%,
acc: 91.12%
```

Discount Prediction:

```
new_data = pd.DataFrame({
    'Customer_care_calls': [3],
    'Customer_rating': [4],
    'Cost_of_the_Product': [80],
    'Prior_purchases': [2],
    'Weight_in_gms': [1500]
})
print("\nExample data for price optimization:")
print(new_data)
new_data_scaled = scaler_X.transform(new_data)
predicted_discount_scaled = svr_model.predict(new_data_scaled)
predicted_discount =
scaler_y.inverse_transform(predicted_discount_scaled.reshape(-1,
1)).ravel()[0]
print(f'Predicted Discount: {predicted_discount}’)
```

Result:

```
Example data for price optimization:
   Customer_care_calls  Customer_rating  Cost_of_the_Product  Prior_purchases  \
0                    3                4                   80                2

   Weight_in_gms
0           1500
Predicted Discount: 18.080446223898118
```

CONCLUSION

- **Boosts Revenue:** Dynamic pricing allows businesses to optimize profits by adjusting prices based on real-time market conditions, customer behavior, and competitor activity.
- **Enhances Customer Experience:** Personalized pricing strategies can increase customer satisfaction by offering customized discounts and deals, leading to better customer retention.
- **Maintains Competitiveness:** By dynamically adjusting prices, e-commerce platforms can stay competitive, responding quickly to market trends and competitors' moves.
- **Data-Driven Approach:** The use of advanced analytics and machine learning in dynamic pricing helps e-commerce businesses make informed and effective pricing decisions.
- **Ethical and Transparent:** Successful dynamic pricing requires careful consideration of ethical practices, ensuring pricing is fair, transparent, and compliant with regulations.
- **Adapts to Market Changes:** Dynamic pricing positions e-commerce businesses to be agile and responsive, preparing them for future shifts in the market landscape.

FUTURE SCOPE

- **Advanced AI and Machine Learning:** The future of dynamic price optimization will see the increasing use of sophisticated AI and machine learning algorithms to predict market trends, automate pricing decisions, and personalize pricing based on individual customer behaviors.
- **Integration with Real-time Data Sources:** Future systems will integrate with a wider range of real-time data sources, including social media, IoT devices, and external market trends, enabling more accurate and contextually relevant pricing adjustments.
- **Greater Personalization:** As e-commerce platforms collect more data about customer preferences and buying habits, dynamic pricing will become increasingly personalized, offering unique deals and pricing tailored to individual users.
- **Ethical Pricing and Fairness:** Future dynamic price optimization strategies will place greater emphasis on ethical considerations, ensuring pricing practices are transparent, fair, and compliant with evolving regulations.

THANKYOU