📄 Supply Chain Demand Forecasting Project Report

Course/Subject: Data Analyst

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Abstract

This project focuses on demand forecasting within the supply chain using machine learning techniques. A dataset with 100 records and 24 features related to products, pricing, stock levels, manufacturing, and logistics was analyzed. A neural network model was implemented to predict the number of products sold. The study highlights the role of AI-driven forecasting in optimizing supply chain operations and reducing inefficiencies.

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1. Introduction

Supply chain management is crucial in ensuring timely product delivery and cost efficiency. Demand forecasting helps companies plan better, reduce waste, and meet customer needs. This project applies machine learning techniques to predict sales volume, helping businesses enhance decision-making and overall efficiency.

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2. Dataset Description

The dataset contains 100 entries with 24 features:

- Product type, SKU, and price
- Availability, sales, and revenue generated
- Customer demographics
- Stock levels, lead times, and order quantities
- Manufacturing lead time, costs, and inspection results
- Transportation modes, routes, and costs

This comprehensive dataset provides insights into the full supply chain cycle.

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3. Methodology

1. **Data Cleaning:** Missing values filled, categorical variables encoded.
2. **Feature Engineering:** Standardization applied on numerical data.
3. **Model Development:** Built a neural network (128-64-32 layers) using TensorFlow/Keras.
4. **Training:** Model trained with 80% of data, validated on 20%.
5. **Evaluation:** Used Mean Squared Error (MSE) and visualizations to measure accuracy.

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4. Results & Discussion

- The neural network achieved a **Test MSE ~126,642**.
- Loss plots showed stable convergence.
- Scatter plots revealed alignment between actual and predicted sales, with some deviations.
- Results confirm that machine learning can significantly improve demand forecasting but further optimization is needed.

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5. Conclusion

This project demonstrates the effectiveness of AI in supply chain forecasting. Neural networks can reduce inefficiencies and improve decision-making. With more data and hyperparameter tuning, forecasting accuracy can be further improved.

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6. Future Work

- Experiment with advanced models like **LSTM** and **XGBoost**.
- Integrate real-time supply chain data for dynamic predictions.
- Explore feature importance to identify main demand drivers.
- Develop optimization models to balance costs and efficiency.

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7. References

- Supply Chain Analytics research papers.

- TensorFlow and Keras documentation.
- Industry reports on logistics and efficiency.