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Capstone Project

Grocery Store Forecasting Challenge For Azubian Presentation.

Seoul Group

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WHAT THE PROJECT IS

The goal of this project was to develop a model to predict the volume of goods that will be bought each week by each store throughout the course of the next eight weeks, for grocery stores spread across various regions of the same nation.

IMPORTANCE

Inventory Management

Manufacturing

Planning Resource

Distribution Financial

Preparation fulfillment

BENEFITS

Data-driven

assessments, Decisions

lower costs Operating

Effectiveness

Competitive Benefit

DESCRIPTION OF DATA

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This time series forecasting project involves daily sales data for 4 years, and the dataset is comprised of several files:

01 **train.csv**

Contains the target. This is the dataset that you used to train the model.

```
date  store_id  category_id  target  onpromotion  nbr_of_transactions
```

02 **holidays.csv**

Information about holidays

```
date  type
```

03 **test.csv**

Resembles Train.csv but without the target-related columns. This is the dataset on which the trained model will be applied to

```
date  store_id  category_id  onpromotion
```

04 **stores.csv**

Information about the different stores such as their locations

```
store_id  city  type  cluster
```

05 **dates.csv**

Information about the time periods with their associated date features

```
date  year  month  dayofmonth  dayofweek  dayofyear  weekofyear  quarter  is_month_start  is_month_end  is_quarter_start  is_q
```

06 **SampleSubmission.csv**

Shows the submission format for this competition, with the 'ID' column mirroring that of Test.csv.

THE ISSUES	THE SOLUTIONS
♦ The data type for the date column in train, test, holidays, dates datasets are in numerical format	♦ Convert to Datetime format
♦ stores dataset: the city, type & cluster are in numerical format	♦ Convert to string and make the categories more descriptive
♦ The type column in holidays dataset is in a numerical format and the types of holidays do not have an ordinal relationship	♦ Convert to string and make it more descriptive
♦ After checking for unique values in year of day column in the dates dataset, we found 366 unique values which showed that there was a leap year.	♦ Create two new columns called "sin(dayofyear)" & "cos(dayofyear)". These new columns will help our machine learning models understand the cyclic nature of a year.

ANALYSIS & CLEANING OF THE DATA

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Observations

- The date column in dates data frame is from 365 – 1684 which covers the date column in the train and test datasets.
- There are no null values in any of the datasets
- There are no missing values
- There is no holiday column in any of the other datasets.

Data Cleaning

- The Year column in dates dataframe has 4 unique vales. Replace them with [2001, 2002, 2003, 2004] by creating a dictionary called replacements and using the replace method.
- Combine the year, month and day columns in dates data frame to create a fulldate column. This column will be used as the index for dates, train, test and holidays data frames.
- Create a new column in the train DataFrame called "holiday_type". The value of this column is the type of holiday in the holidays DataFrame for the corresponding date in the train DataFrame. If the date is not a holiday, the value of the column is "WD".

HYPOTHESIS & QUESTIONS

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HYPOTHESIS

H0: Holidays do not affect Sales, therefore the sales data is stationary.
H1: Holidays affects Sales, therefore the sales data is seasonal.

QUESTIONS ABOUT THE DATA

1. What is the distribution of sales?
2. What is the average sales for each category?
3. How do sales vary by promotion status?
4. Is there a relationship between sales and the number of transactions?
5. How do sales vary during holidays compared to non-holidays?

QUESTIONS ABOUT THE DATA

6. How do sales vary by holiday type?
7. What is the trend in sales over time?
8. How do sales vary across different store IDs?
9. Are there any seasonal patterns in sales?
10. How do sales vary across different combinations of category and promotion?

HYPOTHESIS VALIDATION

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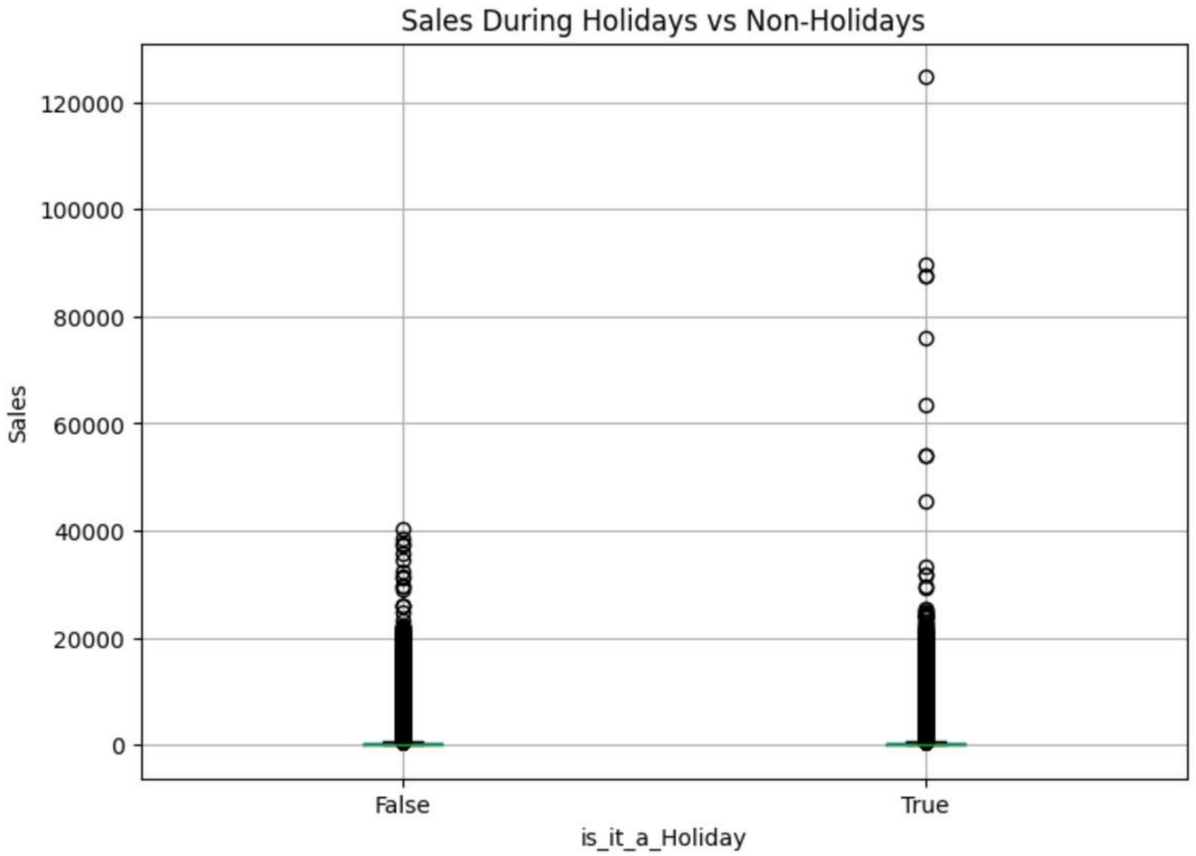

Conclusion

The hypothesis H1, which states that holidays affect sales and the sales data is seasonal, is more likely to be true

Null Hypothesis REJECTED

ANSWERING THE QUESTIONS

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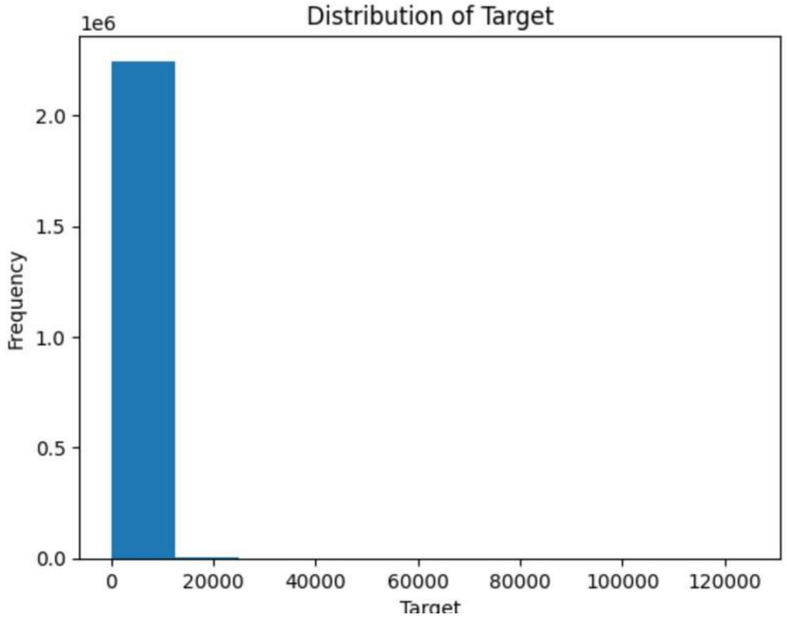
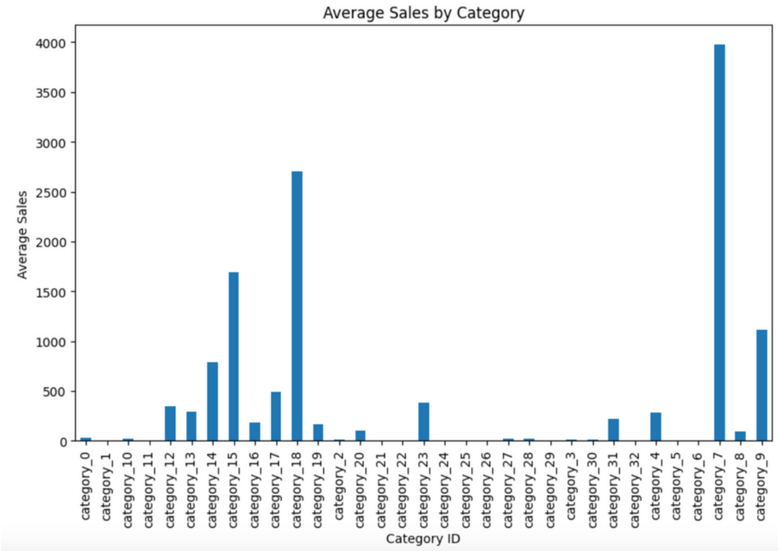
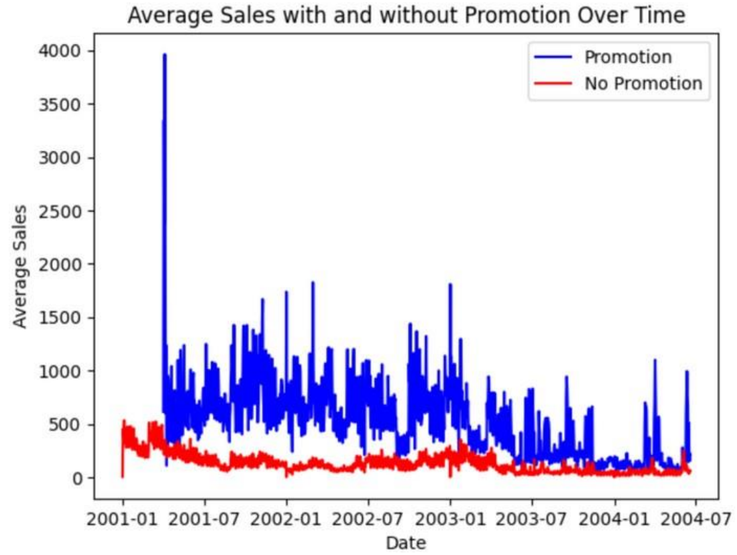
What is the distribution of Sales?



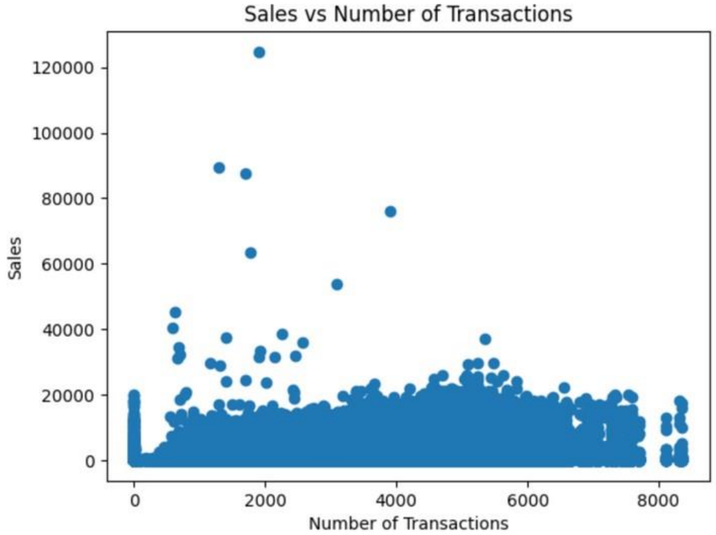
What is the average sales for each category?



How do sales vary by promotion status?



4. Is there a relationship between sales and the number of transactions?



ANSWERING THE QUESTIONS

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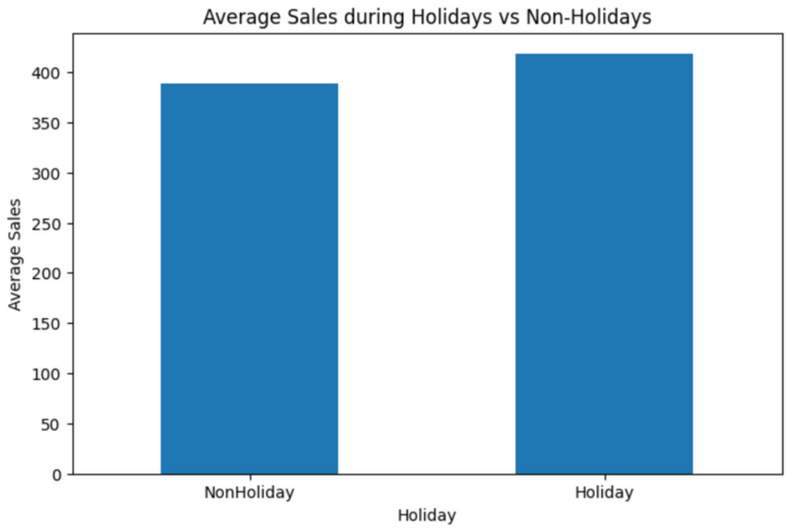
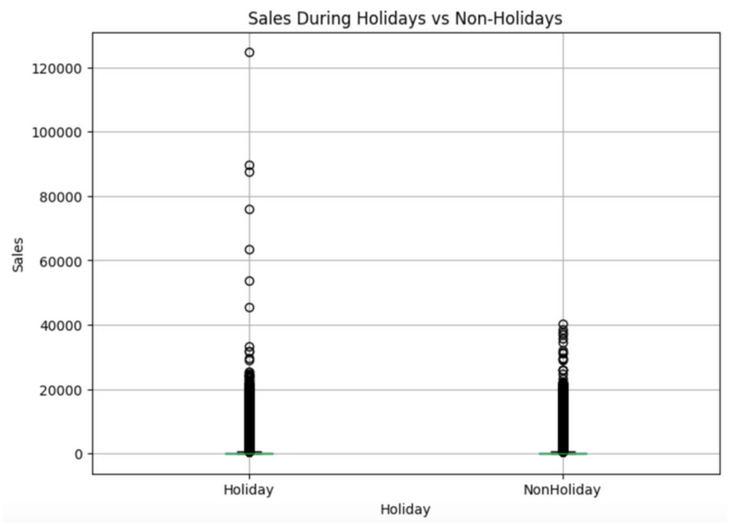
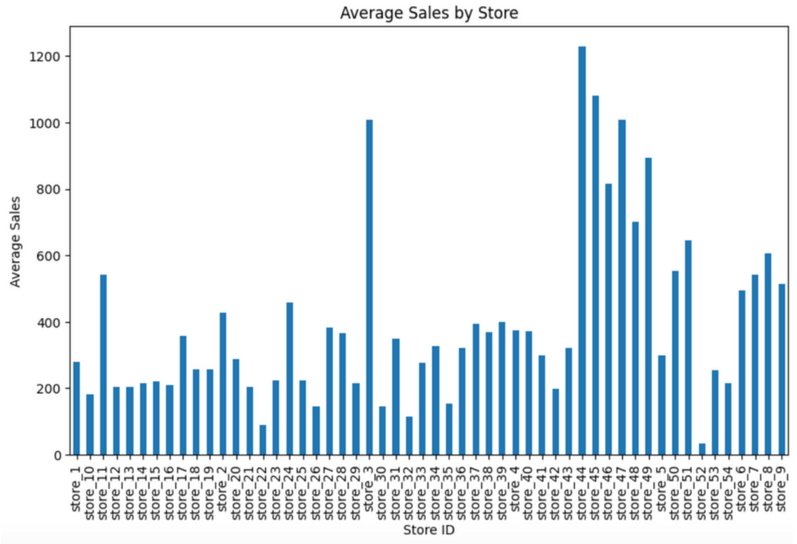
How does sales vary during holidays compared to non-holidays?

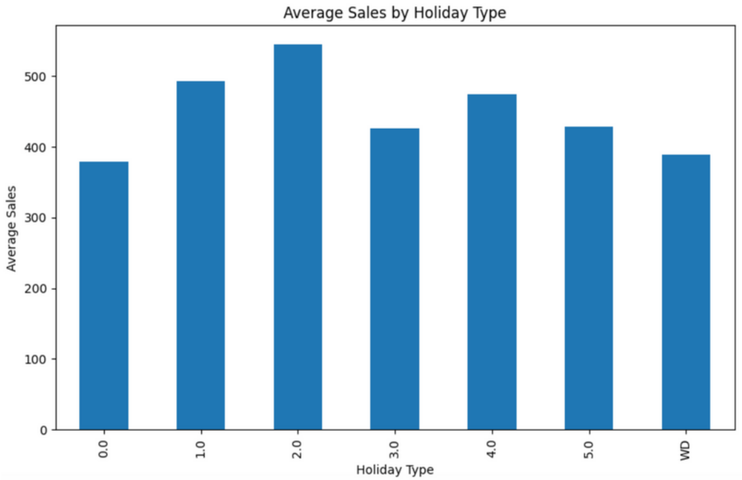




How do sales vary across different store IDs?



How do sales vary by holiday type?



ANSWERING THE QUESTIONS

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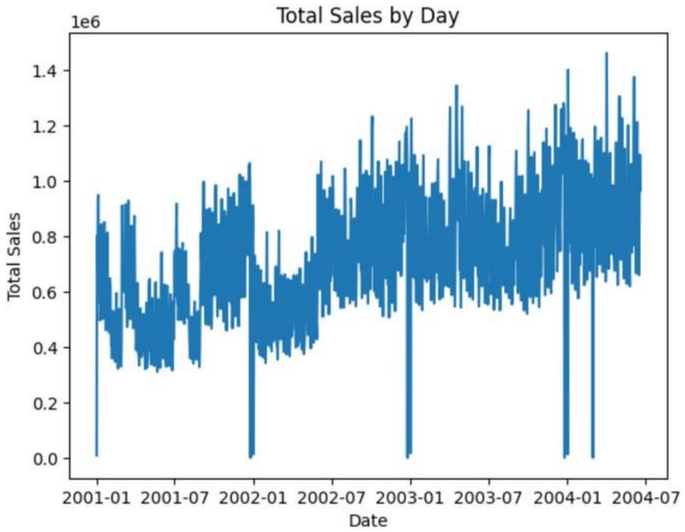
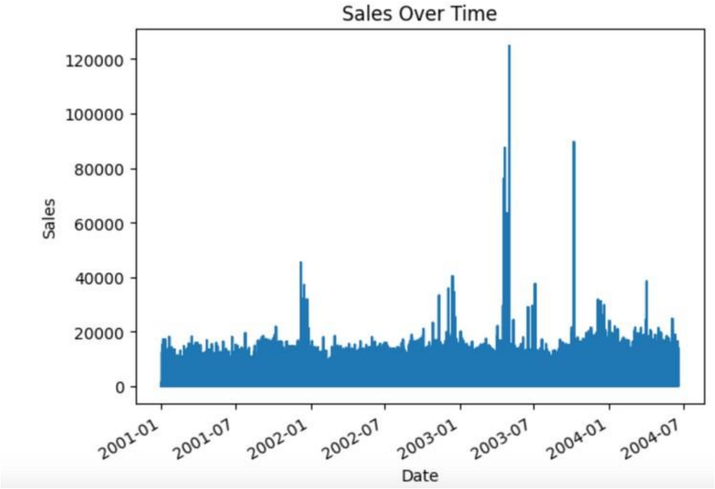
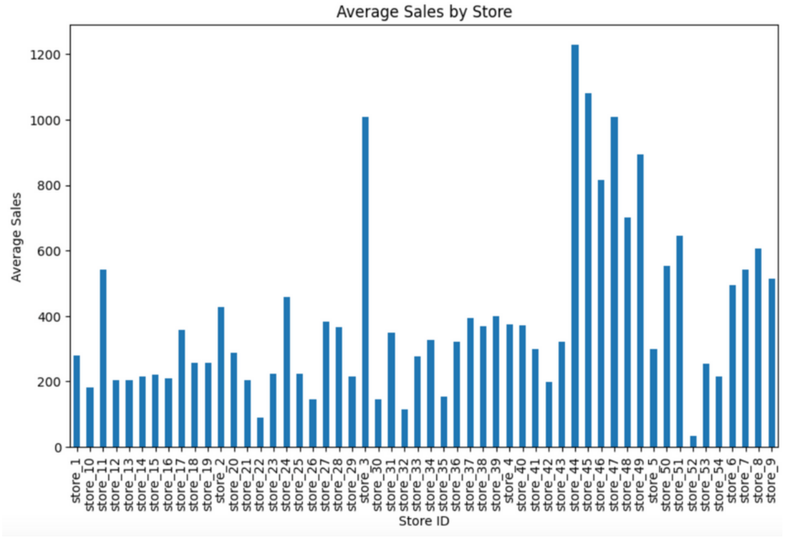
What is the trend in sales over time?

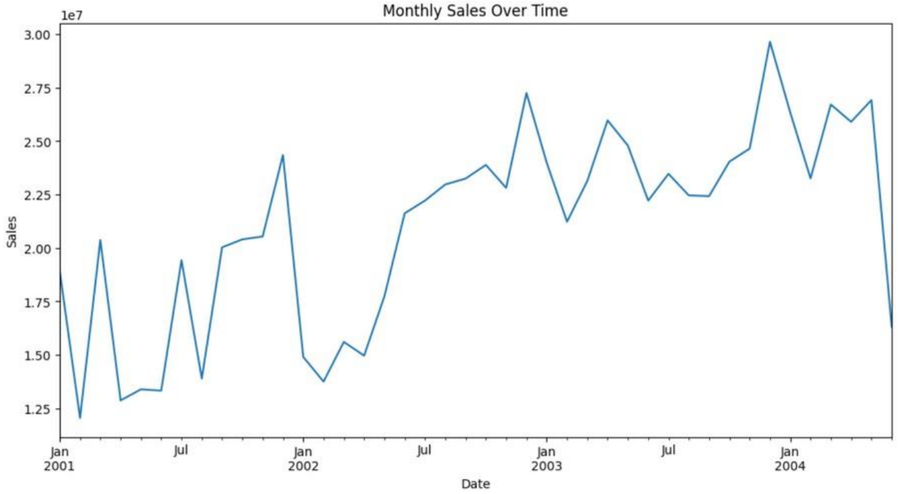


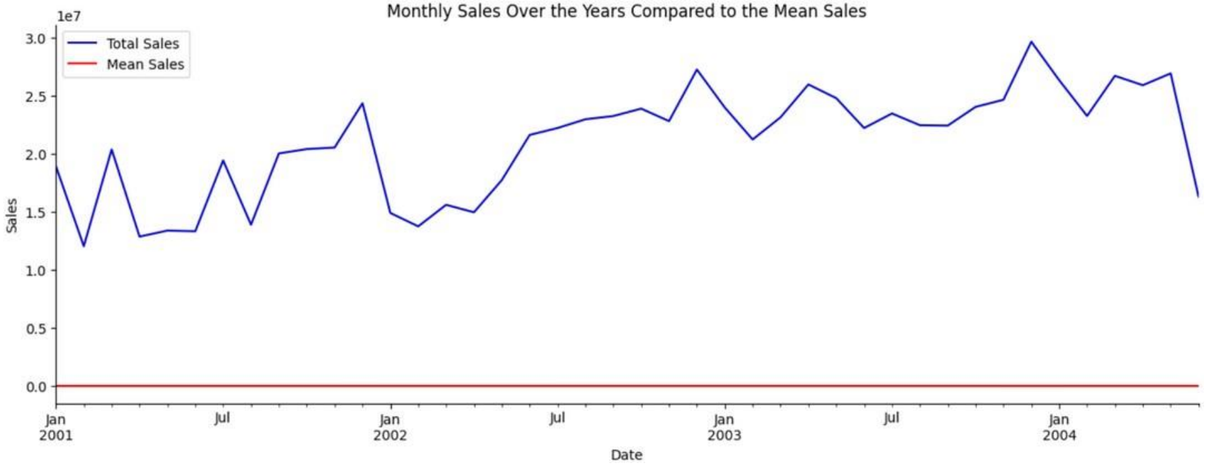


How do sales vary across different store IDs?



Are there any seasonal patterns in sales?





ANSWERING THE QUESTIONS

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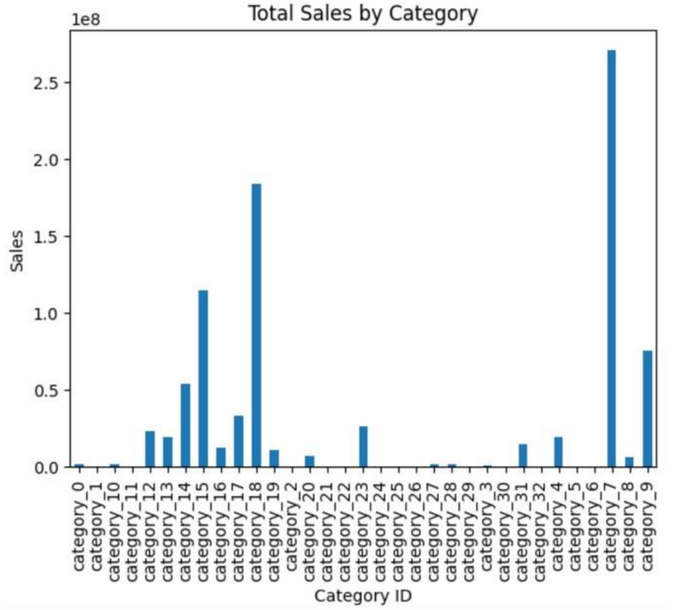
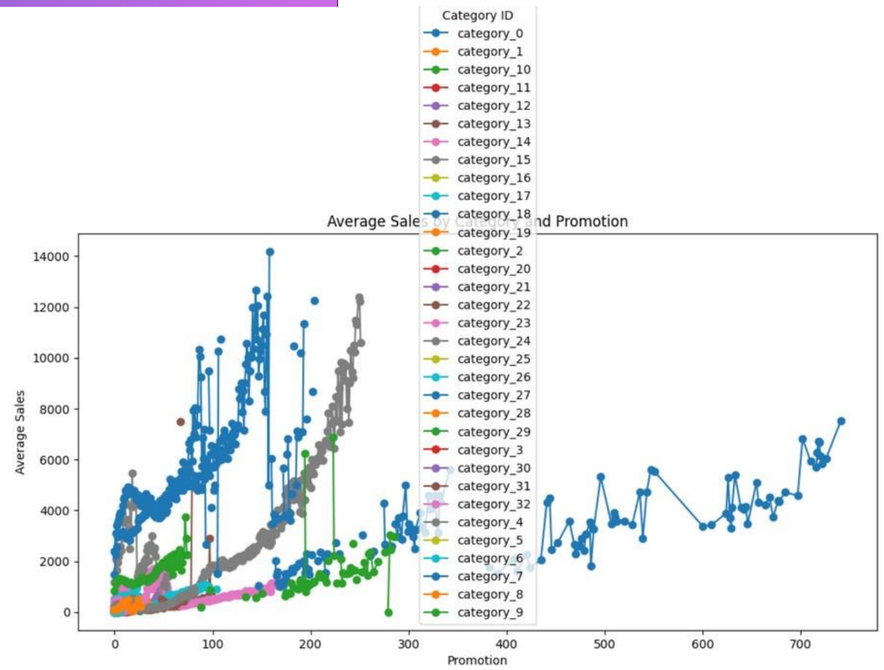
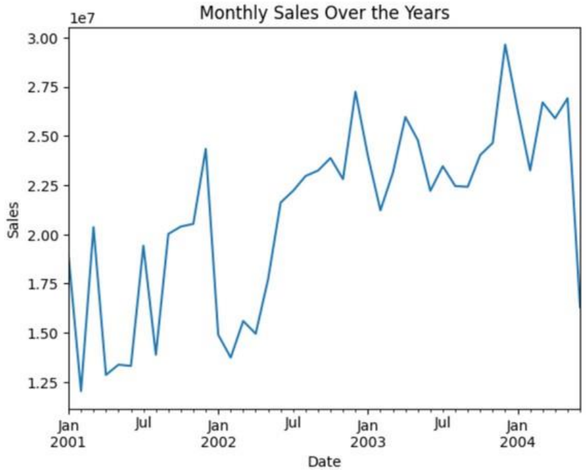
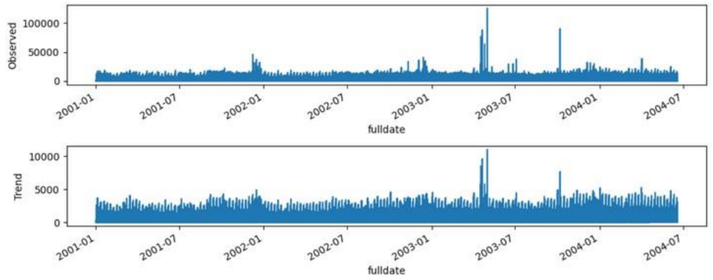
How do sales vary across different combinations of category and promotion?

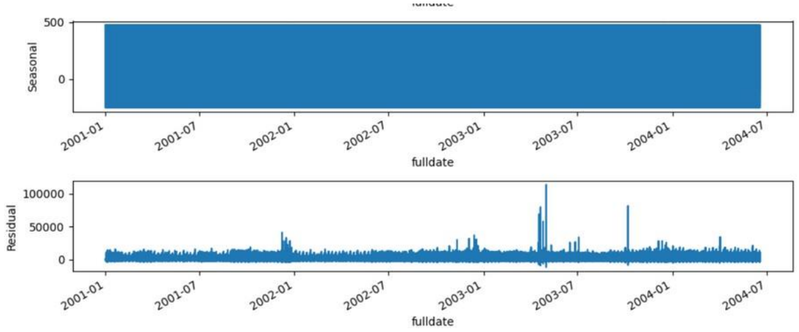




Monthly Statistics







MACHINE LEARNING MODELS

(TIME SERIES)

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MODELS

- DecisionTreeRegressor
- K-Nearest Neighbors (KNN)
- RandomForestRegressor
- Support Vector Regression (SVN)
- Gradient Boosting
- XGBoost
- Linear Regression

MODELS COMPARISON

	Model	MSE	MSLE	RMSE	RMSLE
0	DecisionTree	17878.36	0.12	133.71	0.35
1	KNN	15157.08	0.11	123.11	0.33
2	Random Forest	18626.54	0.13	136.48	0.36
3	SVR	16025.20	0.11	126.59	0.34
4	Gradient Boosting	18096.48	0.12	134.52	0.35
5	XGBoost	21284.22	0.14	145.89	0.37
6	Linear Regression	1043641.46	1.65	1021.59	1.28

CONCLUSION

Based on the provided results, the best performing model was the **KNN model** with an **RMSE score of 123.11**

The worst performing model was **Linear Regression** with an **RMSE score of 1029.59**

THE APP

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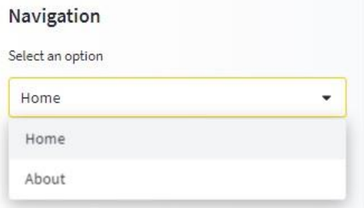

Welcome

SEER

A Streamlit Sales Forecasting / Prediction App

Welcome

This is a Sales Forecasting App.

SEER- A Sales Forecasting APP

Enter the required information to forecast sales:

Date: 2023/06/22

How many products are on promotion?: 0

Category: Category_4

Store_type: Store_3

Store_id: Store_2

City: city_4

Cluster: cluster_0

Predict

Total sales for this week is: #657.0

Meet Our Team

Justin Jabo

Wycliffe Omondi Ayodo

Stephen Arhin-Aidoo

Lionel Boris Rene Bizo Mendome

Alex Saruni Lodaru

Marydiana Njeri Njoroge

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Quotes Today

"The goal of forecasting is not
to predict the future but
to tell you what you need to know
to take meaningful action in the present."

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Thank You

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