Sales Forecasting of Product-Based Company

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Aim

- **Forecasting of Sales** aims to fit different Machine Learning and Statistical models on a data set in order to accurately predict future sales. Moreover, it aims to construct different visualization plots to easily and effectively draw business insights. Accurately Forecasting data is essential for any product based company as it not only helps in making better business decision but also helps in making informed decision in order to optimize the inventory.

Gaps

- Inefficient Handling of Data
- Lack of expertise
- Lack of Proper Visualization Plots

Data

Data Set - Superstrore.csv (Kaggle)

Resolution – Sales per day from January 2014 to December 2017

Row ID	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	...	Postal Code	Region	Product ID	Category	Sub-Category	Product Name	Sales
7981	CA-2014-103800	2014-01-03	2014-01-07	Standard Class	DP-13000	Darren Powers	Consumer	United States	Houston	...	77095	Central	OFF-PA-10000174	Office Supplies	Paper	Message Book, Wirebound, Four 5 1/2" X 4" Form...	16.448

Models

Facebook's Prophet Model:

RMSE (Furniture): 194.91

Mean (Furniture): 789

Error (Furniture): 24.7% (approx.)

RMSE(office supply): 398.67

Mean(office supply): 781

Error(office supply): 51.04%

SARIMA Model:

RMSE(Furniture): 252.82

Mean(Furniture): 789

Error(Furniture): 32.09%

RMSE(office supply): 364.744

Mean(office supply): 781

Error(office supply): 46.70 %

More Models

LSTM Model:

RMSE (Furniture): 250.8

Mean (Furniture): 789

Error (Furniture): 31.78% (approx.)

RMSE(office supply): 432.9

Mean(office supply): 781

Error(office supply): 55.4%

Linear Model:

RMSE(Furniture): 300.82

Mean(Furniture): 789

Error(Furniture): 38.12%

RMSE(office supply): 388.65

Mean(office supply): 781

Error(office supply): 49.76 %

These models give poor results

Improved Results

Improved Results by tuning parameters of SARIMA model for office supply

Error(Before):46.7% ⟹ Error(After): 34.82%

AIC(Before): 640.0 ⟹ AIC(office supply): 510.44

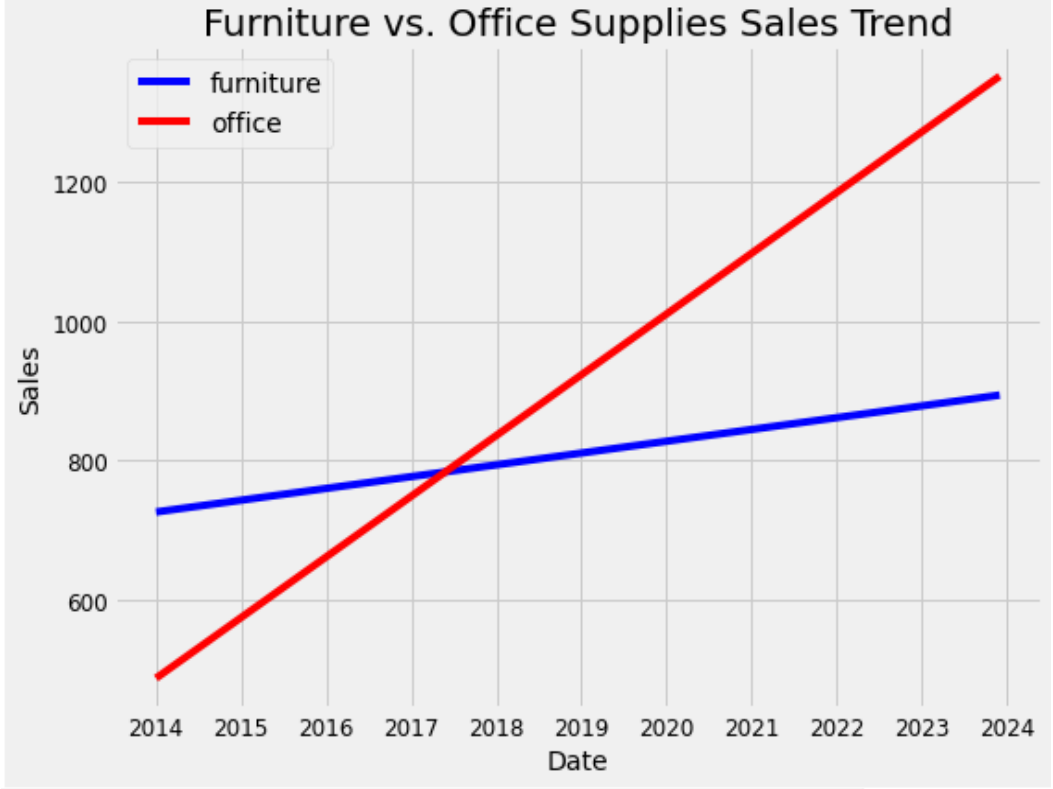
BIC(Before): 630.2 ⟹ BIC(office supply): 518.35

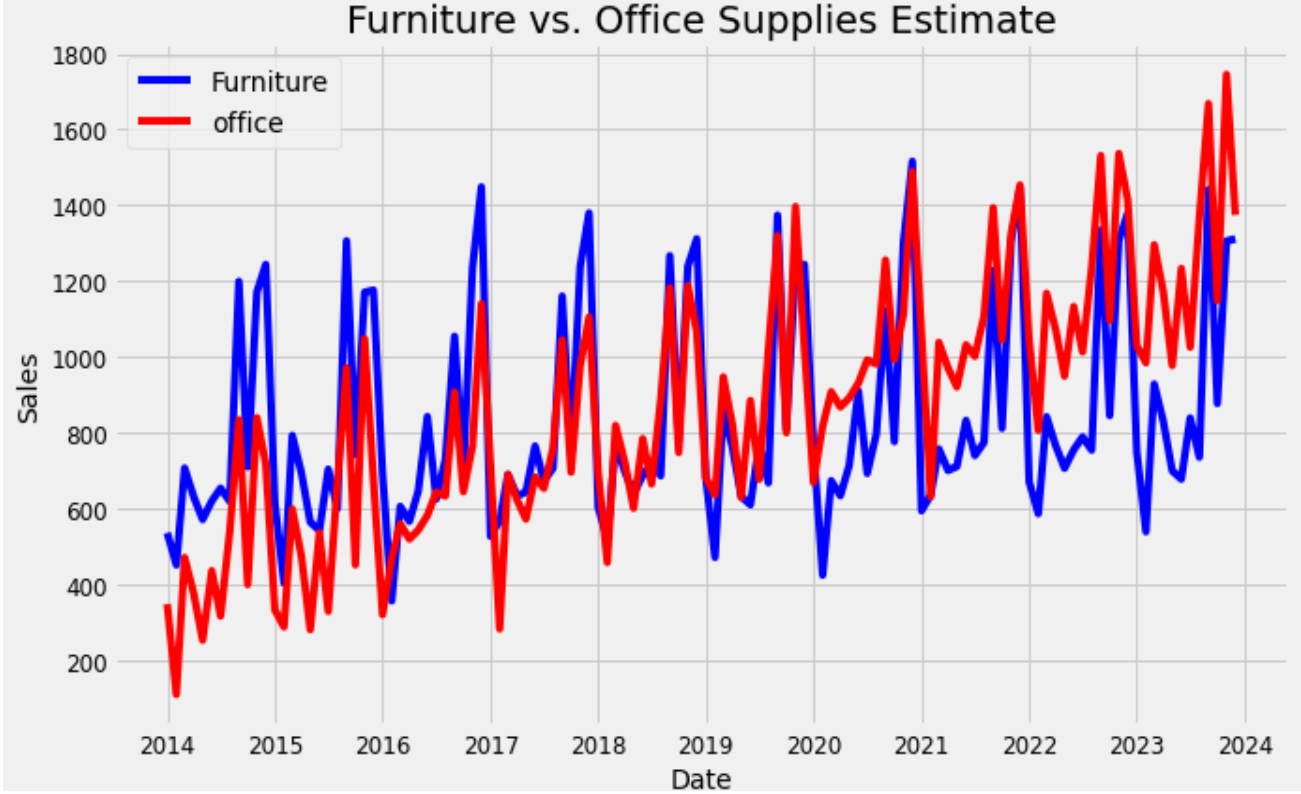
Problems:

- **Resolution of data**:
  - Per day data led to fluctuations and higher error
  - Fixed by computing monthly sales average and fitting the models on that.

- **Model Parameters**:
  - SARIMA model takes in 6 different parameters (p, d, q) and (P,D,Q)
  - Fixed by using Auto Arima in built library function.

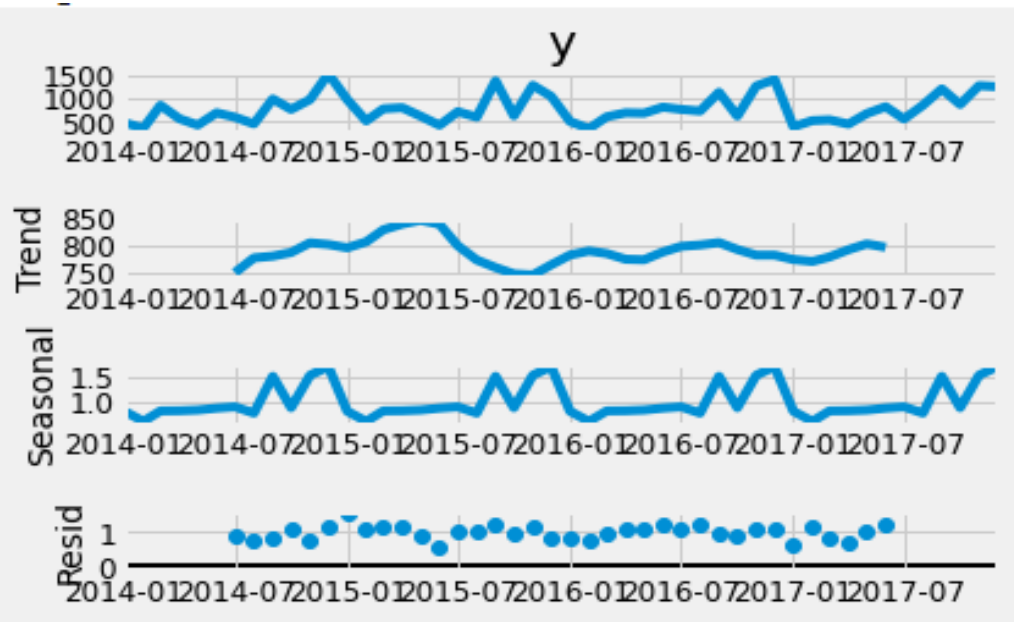
Visualizations and Insights



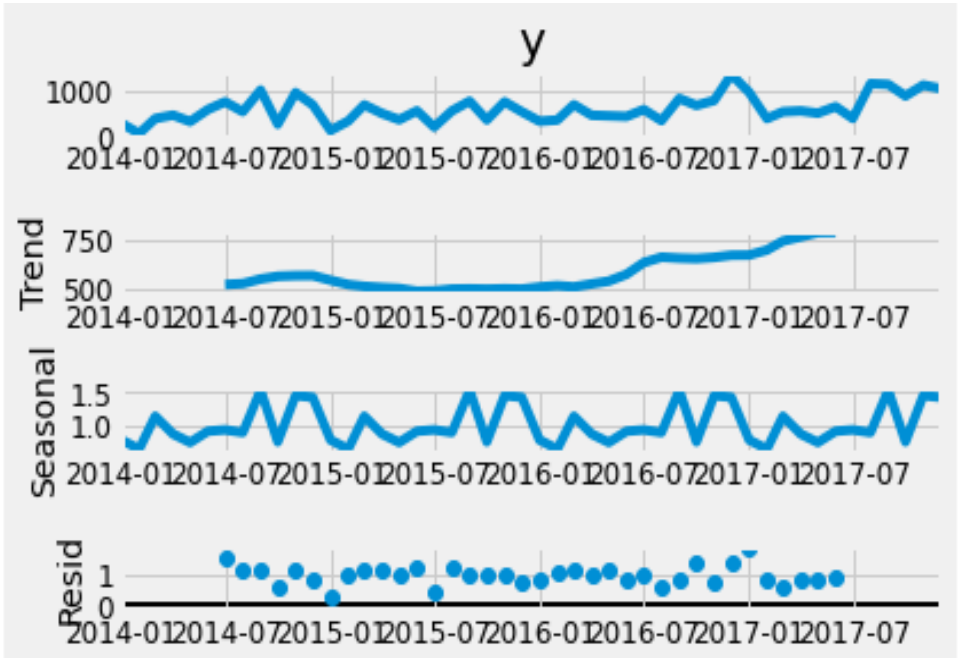


Seasonality in Data

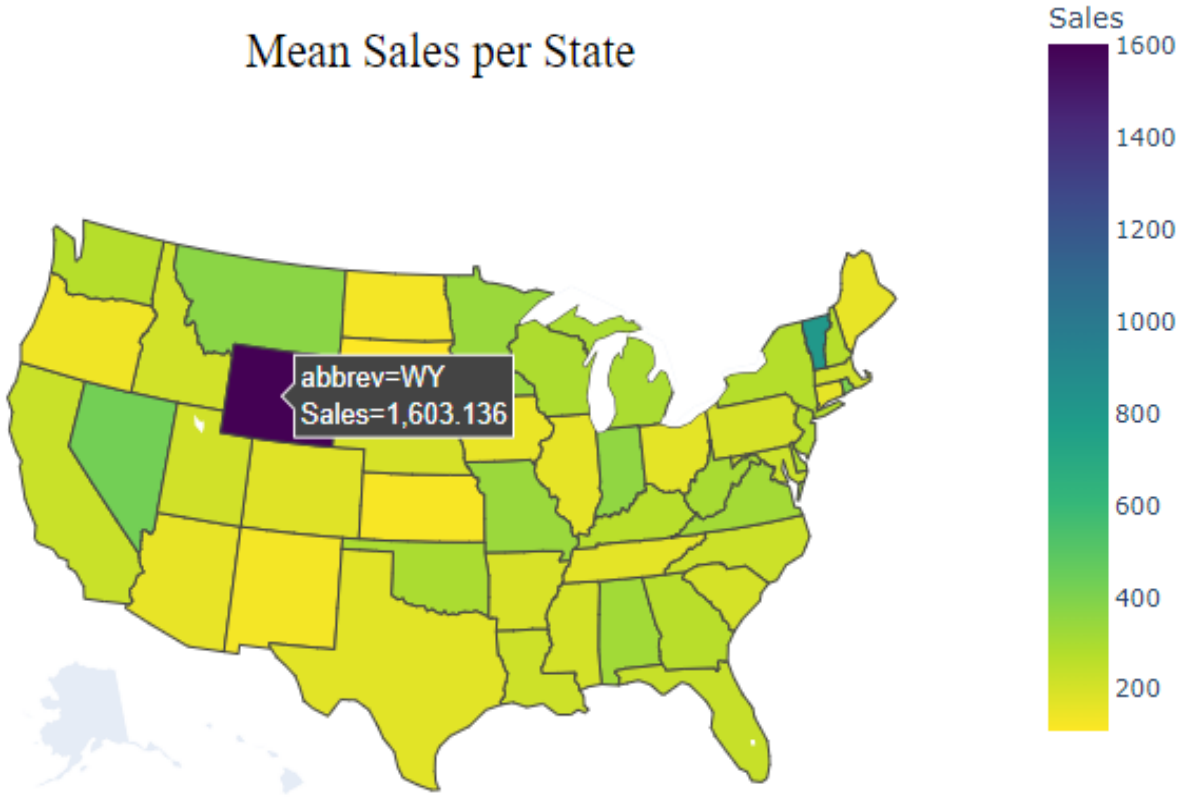
Office Supply



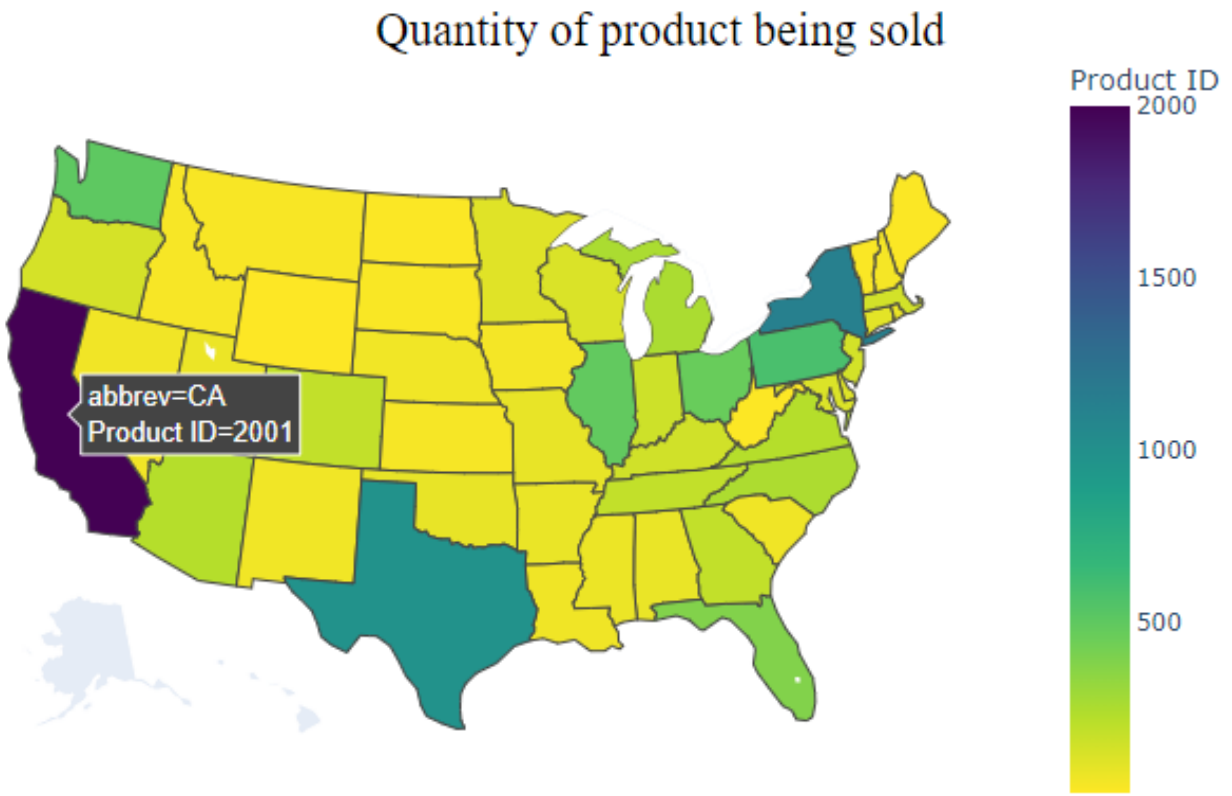
Furniture



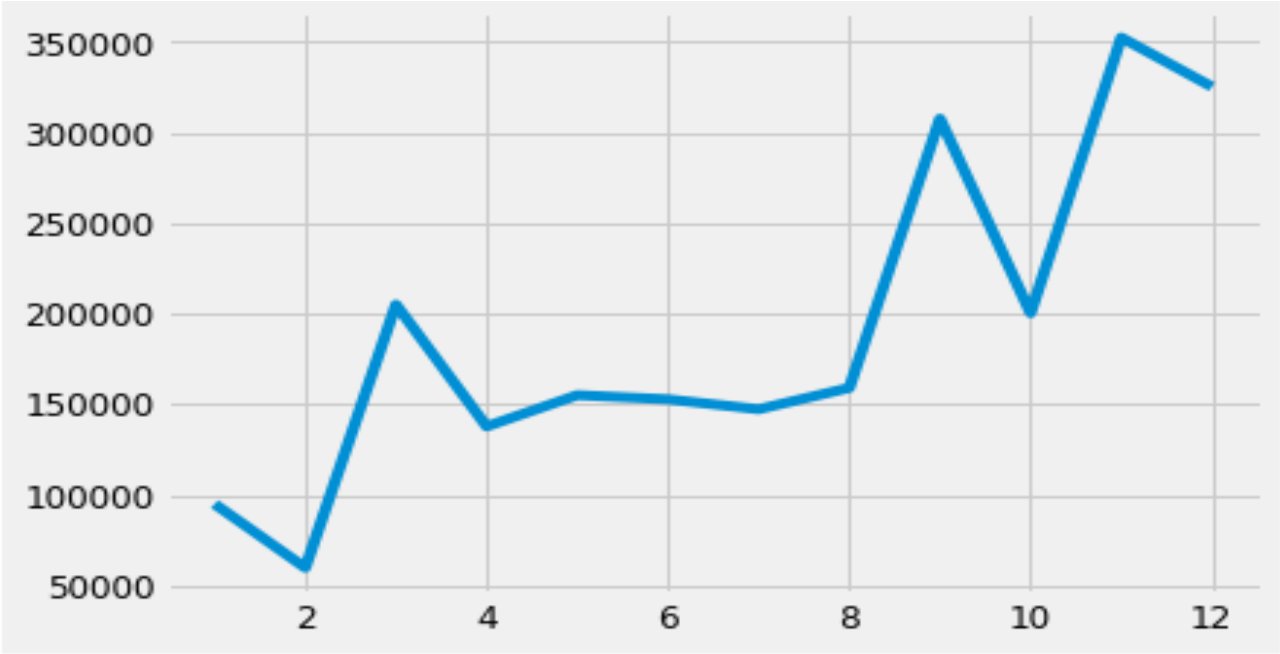
Sales on MAP


Mean Sales per State
abbrev=WY
Sales=1,603.136
Sales
1600
1400
1200
1000
800
600
400
200

Quantity of Products Sold



Sales per Month



Worst Month: February

Best Month: November

Other Insights

Customer Order Count

	Customer Name	Quantity
0	William Brown	37
1	Matt Abelman	34
2	John Lee	34
3	Paul Prost	34
4	Edward Hooks	32
...	...	...
788	Carl Jackson	1
789	Jocasta Rupert	1
790	Ricardo Emerson	1
791	Anthony O'Donnell	1
792	Lela Donovan	1

Count of Sold Products

	Product Name	Count
0	Staple envelope	48
1	Staples	46
2	Easy-staple paper	46
3	Avery Non-Stick Binders	20
4	Staples in misc. colors	19
...	...	...
1845	Xerox 1922	1
1846	4009 Highlighters	1
1847	Belkin 8 Outlet SurgeMaster II Gold Surge Prot...	1
1848	Brother MFC-9340CDW LED All-In-One Printer, Co...	1
1849	Cisco SPA 501G IP Phone	1

Big Picture and Social Impact

- Maximize Profit
- Minimize Inventory Cost
- Generates Employment
- Meet consumer demands.

Future Scope

- Fit more models on the data
- Tuning hyperparameters for better results
- Better visualization
- Draw more business insights

Conclusion

- Fit models for forecasting
- Tuned hyperparameters for better results
- Evaluated models on different metrics
- Visualization
- Business insights

References:

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[2]. S. Cheriyan, S. Ibrahim, S. Mohanan and S. Treesa, "Intelligent Sales Prediction Using Machine Learning Techniques," *2018 International Conference on Computing, Electronics & Communications Engineering (iCCECE)*, 2018, pp. 53-58, doi: 10.1109/iCCECOME.2018.8659115.

[3]. Anđelković, Aleksandra, and Marija Radosavljević. "Improving order-picking process through implementation of warehouse management system." Strategic Management-International Journal of Strategic Management and Decision Support Systems in Strategic Management 23.1 (2018).

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THANK YOU