Forecasting Walmart Sales with Machine Learning

MGMT59000 Machine Learning

Seonkyu Kim
Yu-Hui Lin

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01 Project Intro

Background description and project goal

Background

Project Goal

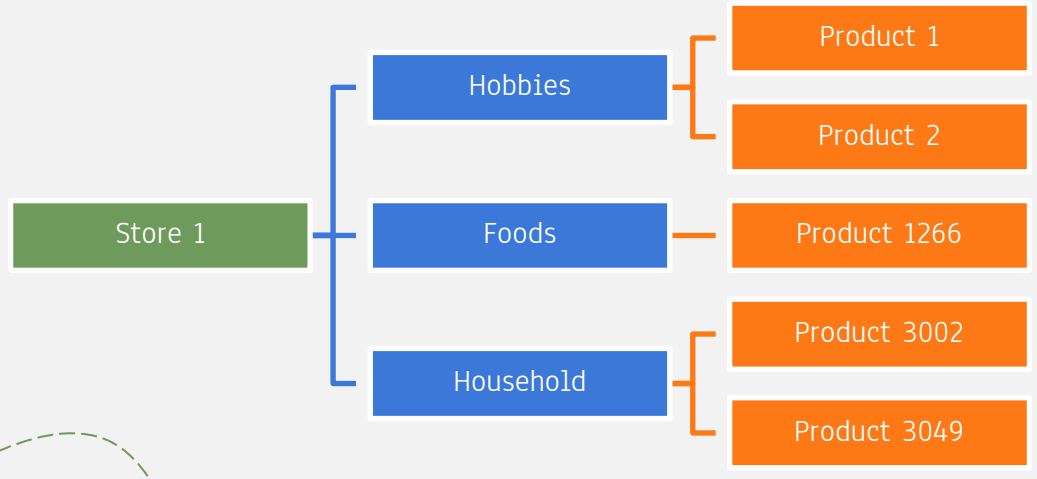
Apply machine learning practice to help Walmart better forecast future product sales

Scope

Future 28-day daily product sales of 10 stores in California, Texas, and Wisconsin

Datasets

- 10 stores across California, Texas, and Wisconsin
- 3,000+ products
- 5yr sales & price time series data (Jan., 2011 – Jun., 2016)
- Holidays and Events



02

Data Preparation

Data preprocessing and feature engineering

Supervised Machine Learning

Features

- 5-year historical prices and sales
- Events and context of products

Predicted Sales

- Forcasting horizon: 28 days ahead
- Loss function: Mean square error

Feature Processing

Historical Sales	Daily Price	Context	Calendar
Lagged sales	Price	State	Event
Sale std.	Max Price	Store	SNAP*
Sale moving average	Min Price	Category	
	Price std.	Product	
		Department	

* Supplemental Nutrition Assistance Program(SNAP), provides food benefits to low-income families to supplement their grocery budget.

Data Analysis

Model building, selection, and comparison

Model Comparison

	Gradient Boosting	Transformer	Ensemble
Structure	• 10 Models • 1-1913d Training • 1914-1941d Validation • Iterations=150 • Learning rate=0.01	• 10 Models • 1885-1913d Training • 1914-1941d Validation • Attention heads=12 • Dropout=0.2	Two models combined
MSE (validation)	6.23-9.38	0.47-3.92	-
Private Score*	2.5986	0.90539	MAX: 1.42651 AVG: 1.5558 MIN: 3.11345

* Private score is based on the submission score on Kaggle. A sample submission of "0" default value for all products scores 5.3907

Another Approach

Reduce Features

- Historical sales from day 351
- One day before event

Train

Various Neural Network Models

DNN

1D_CNN

LSTM

Transformer

Another Approach (Result)

DNN

Private Score = 1.5520

1D_CNN

Private Score = 1.0079

LSTM

Private Score = 0.6860

Transformer

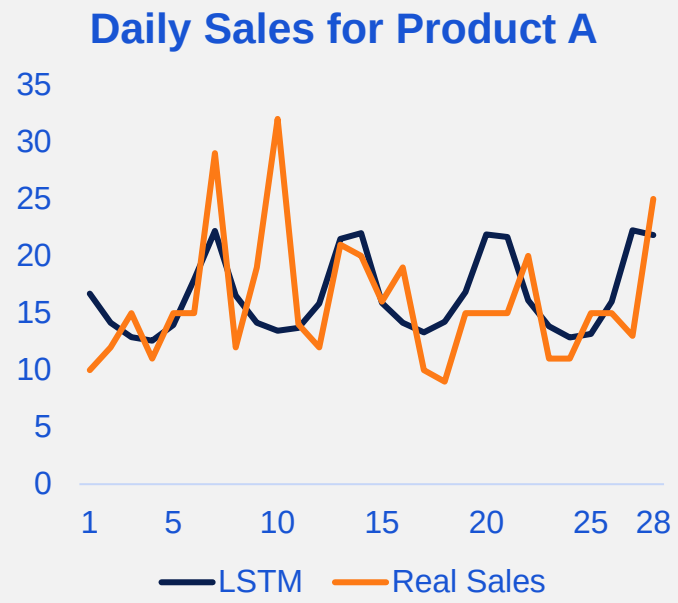
Private Score = 3.6327

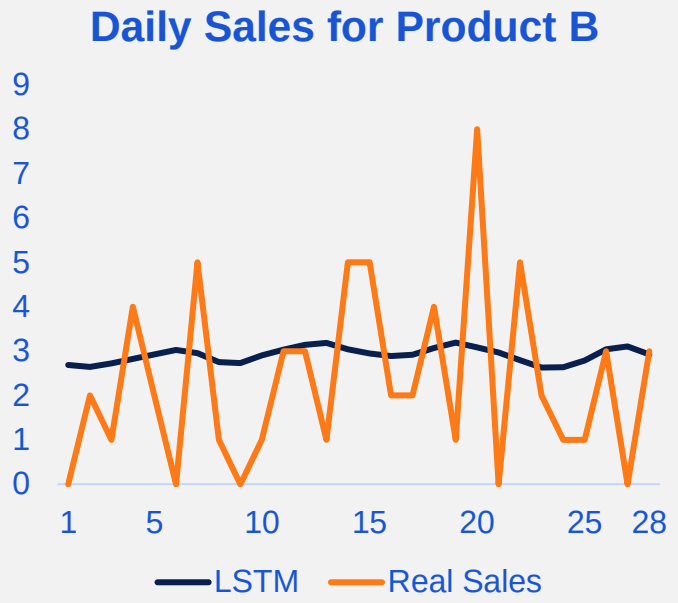
04

Performance Evaluation

Model prediction results

Forecasted Sales



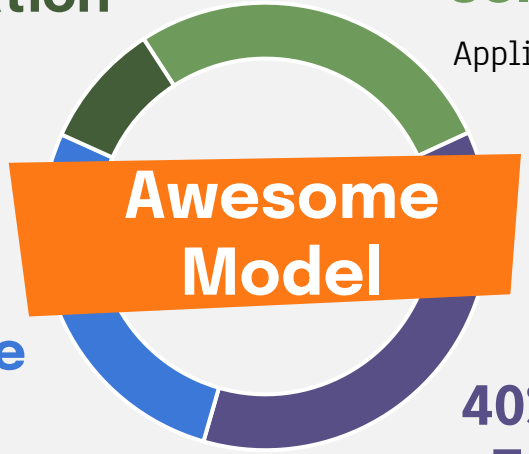


Conclusion

10% Data Manipulation

25% Model Selection

Applicable & Suitable



25% Feature Selection

Common sense vs. Bold guess

40% Model Training

Hardware matters !

Thanks!

Do you have any questions?