# Forecasting Walmart Sales with Machine Learning

MGMT59000 Machine Learning

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# Table of contents

01

# Project Intro

Background description and project goal

# Background

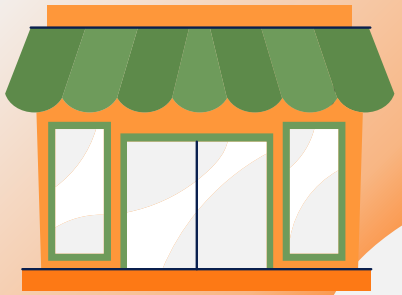

## Project Goal

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

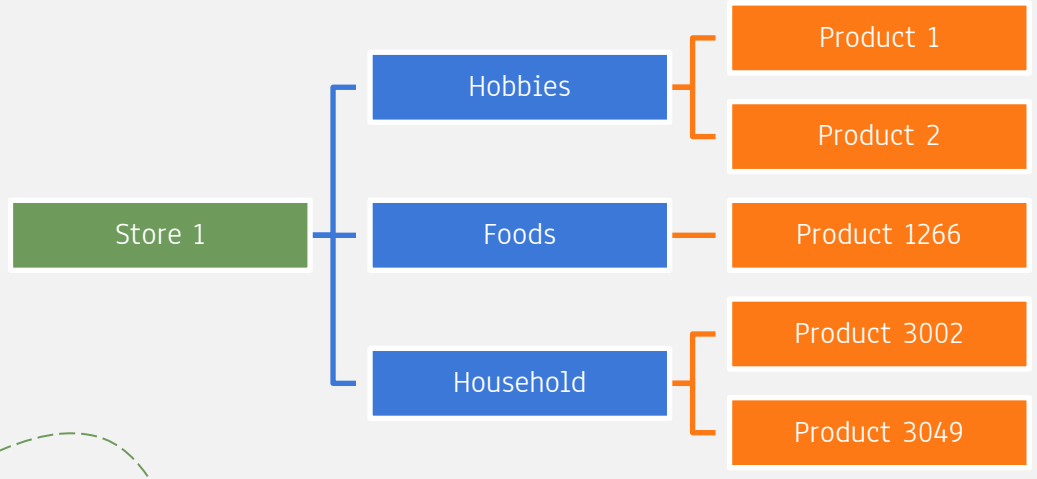
## Scope

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<br>• 1-1913d Training<br>• 1914-1941d Validation<br>• Iterations=150<br>• Learning rate=0.01 | • 10 Models<br>• 1885-1913d Training<br>• 1914-1941d Validation<br>• Attention heads=12<br>• 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<br>AVG: 1.5558<br>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

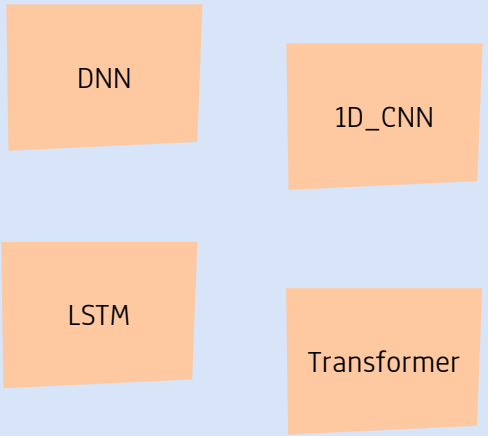
# Another Approach

## Reduce Features

- Historical sales from day 351
- One day before event

Train

## Various Neural Network Models



# Another Approach (Result)

## DNN

Private Score = 1.5520

## 1D_CNN

Private Score = 1.0079

## LSTM

Private Score = 0.6860

## Transformer

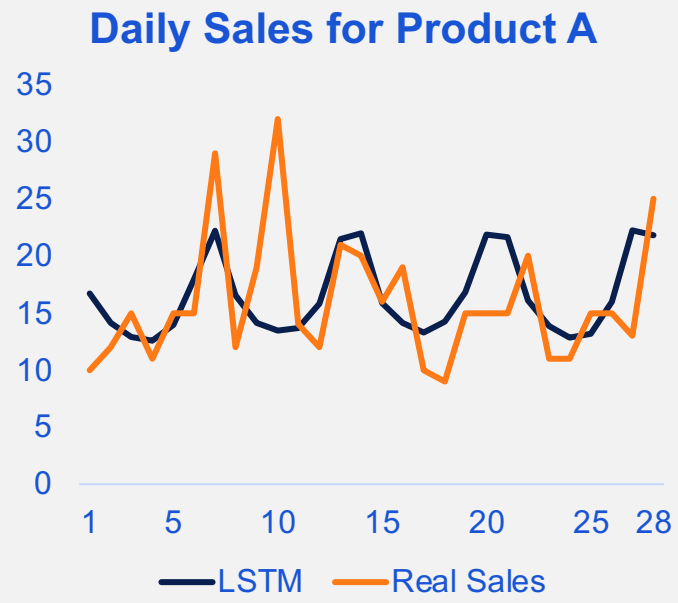
Private Score = 3.6327

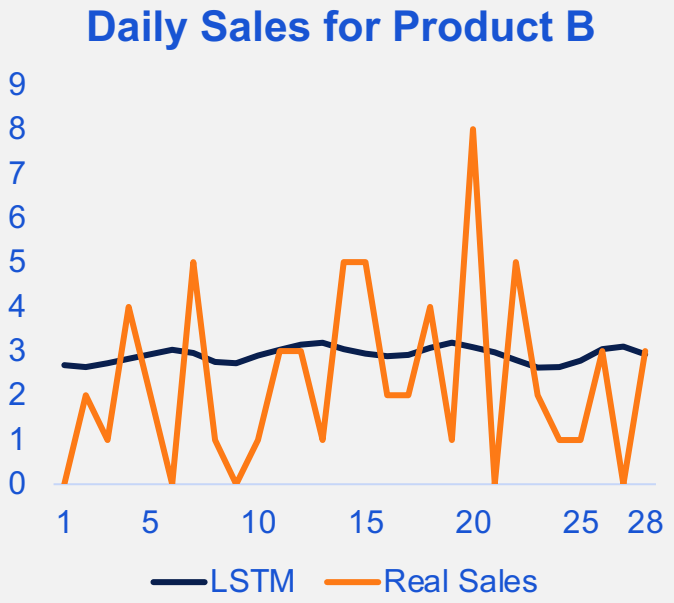
04

# Performance Evaluation

Model prediction results

# Forecasted Sales



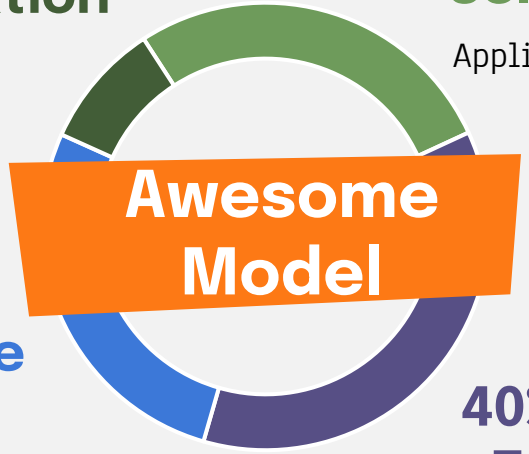



# Conclusion

**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?