Vending Machine Logistics Prediction

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Problems statement

Drink Vending machine with mix ingredients

need to improve **Availability** of each machine through supply chain

by predict transaction and planning to refill beforehand

Datasource

From one of our famous Drink vending machine transaction logs

- from 2023 October
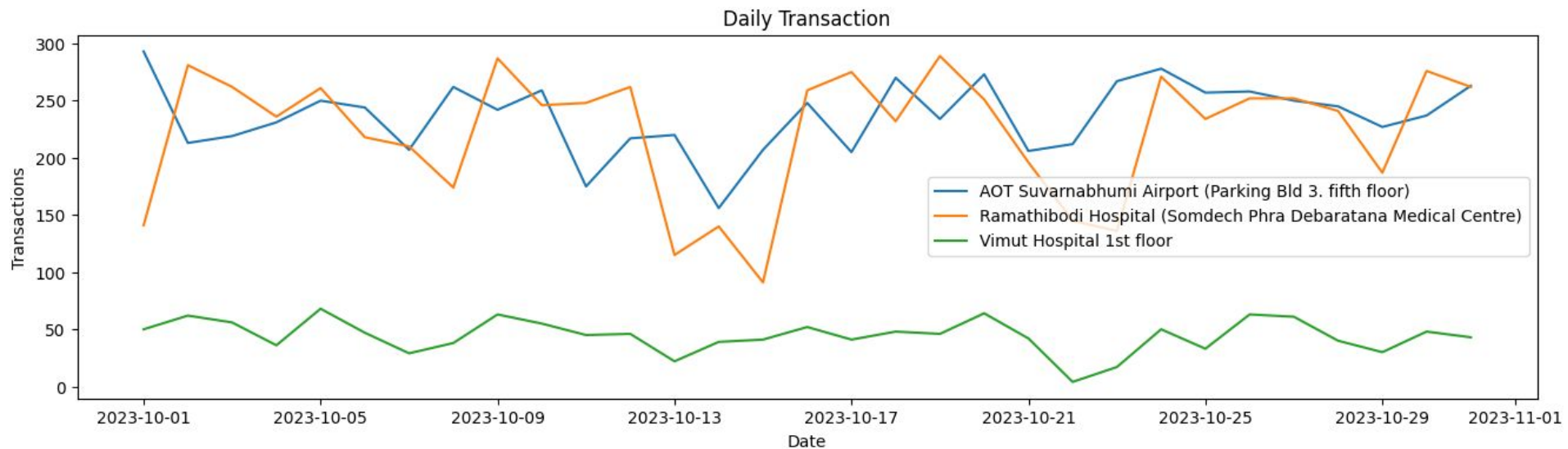- 15,634 rows
- 3 different machine

That included

- Drinking menu ordered
- Payment
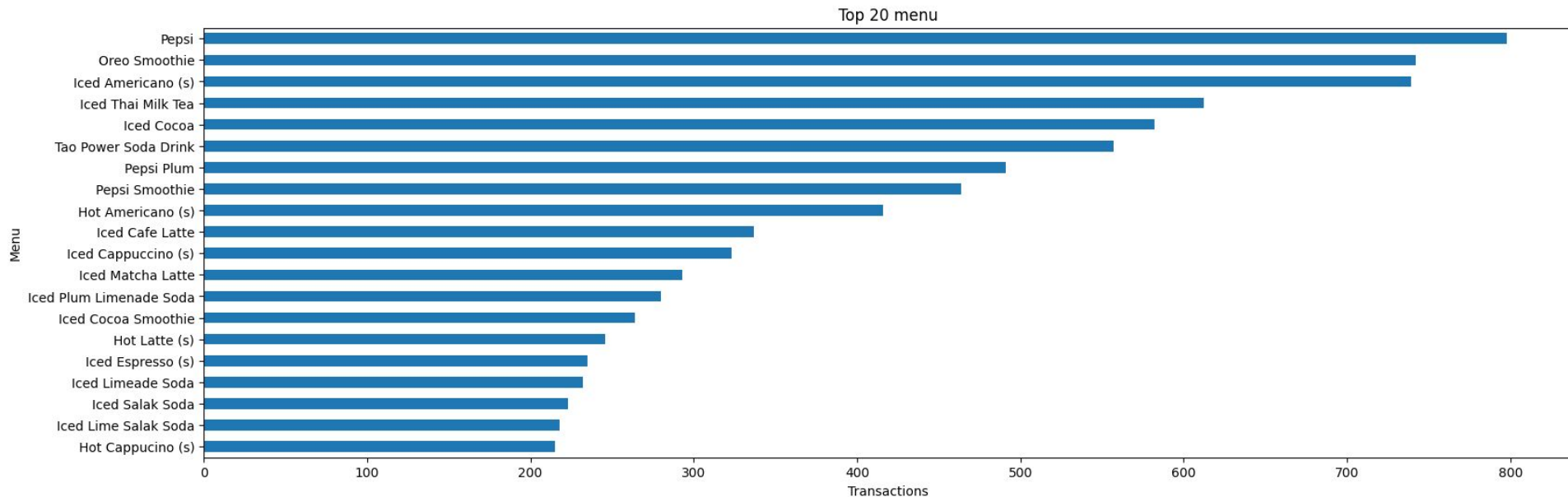- Campaign and promotion used
- Machine information

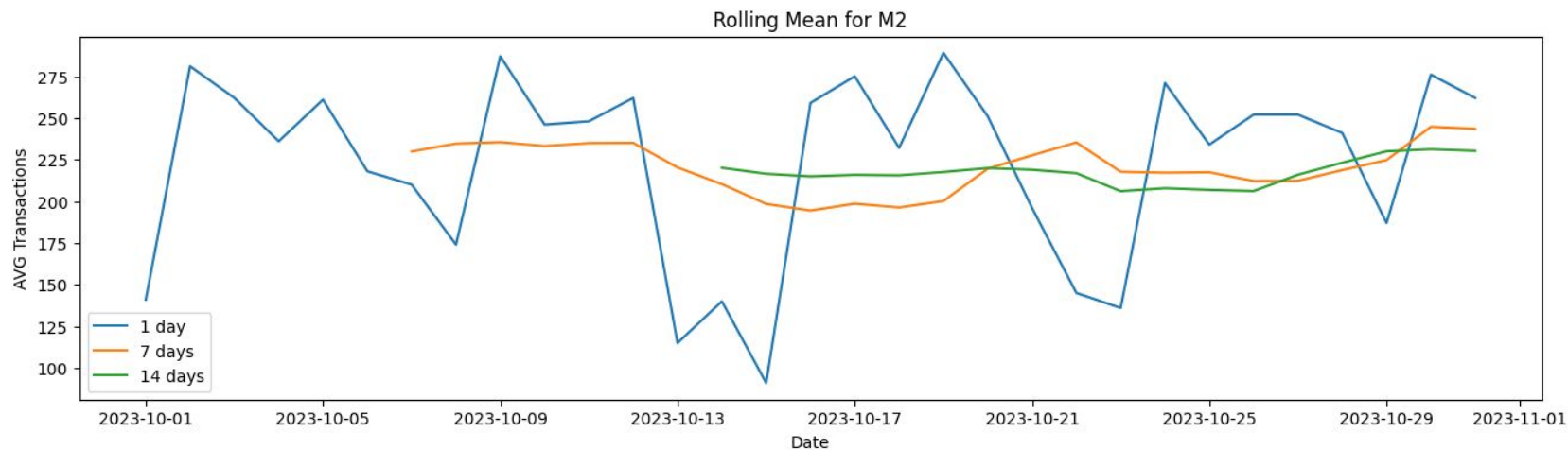Without drinking menu's recipe for each ingredients

EDA

Daily Transaction

EDA

Top 20 menu

EDA - Daily Sampling

Re sampling data into `Daily`

and finding pattern by rolling mean

- 1 day
- 7 days
- 14 days

Rolling Mean for M2
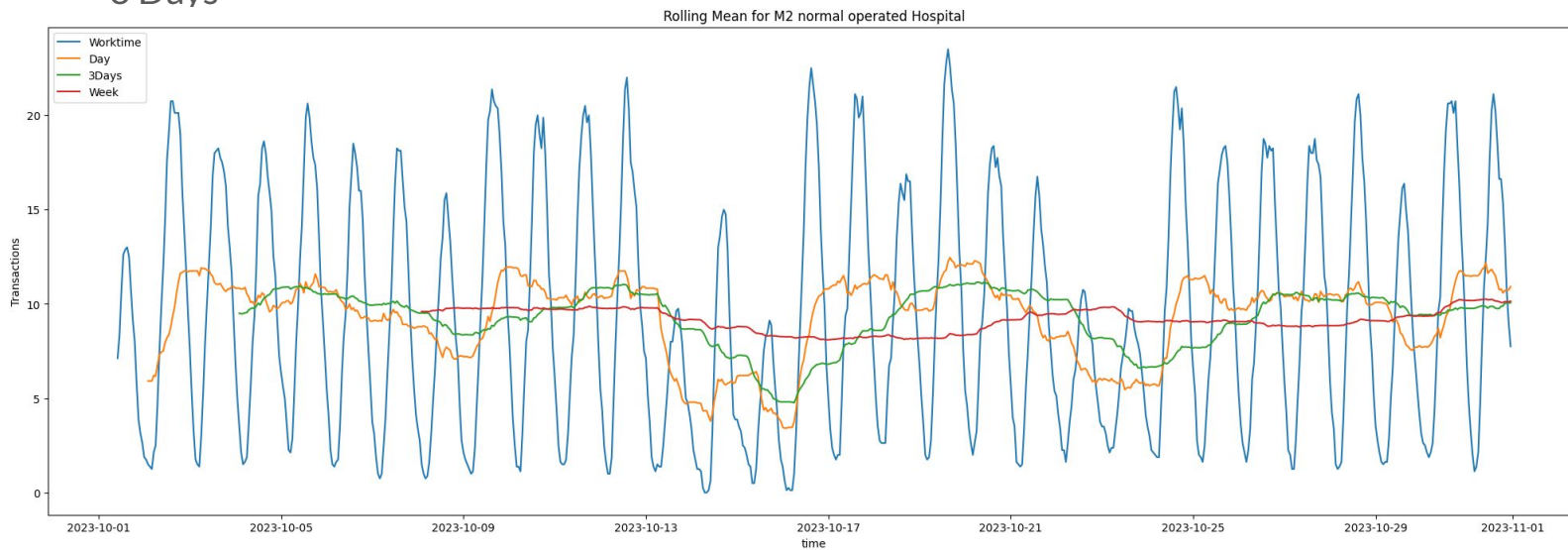
EDA - Hourly Sampling

Re sampling data into `Hourly` and finding
pattern by rolling mean

- Worktime (8hours)
- Day
- 3 Days

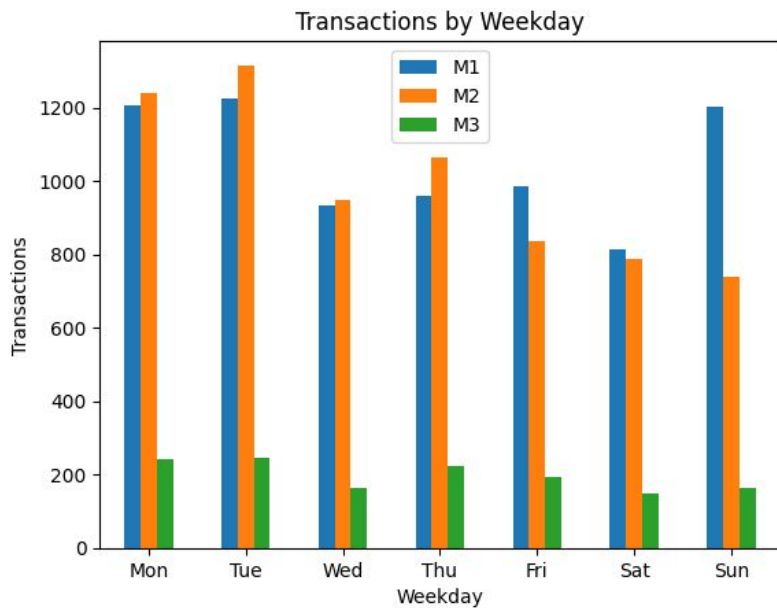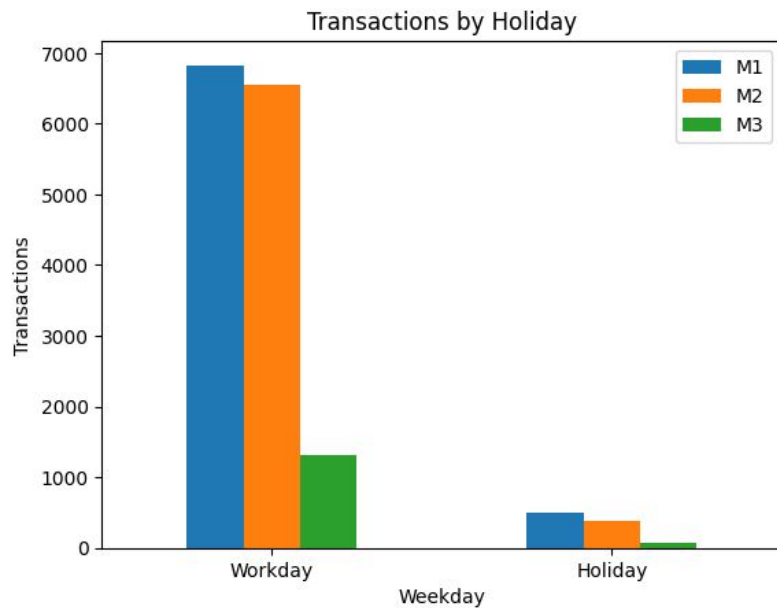Rolling Mean for M2 normal operated Hospital
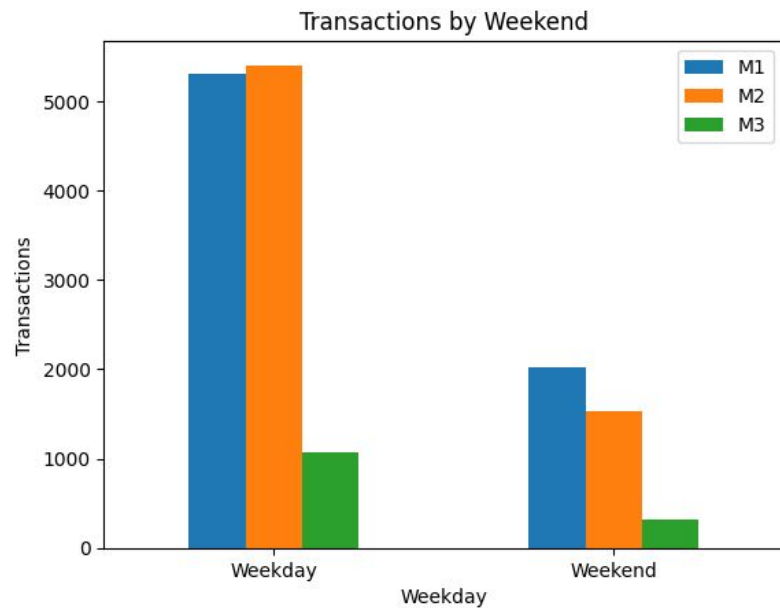
Feature Engineering

After resampling into Hourly

We create weekday, weekend, and holiday features into dataset
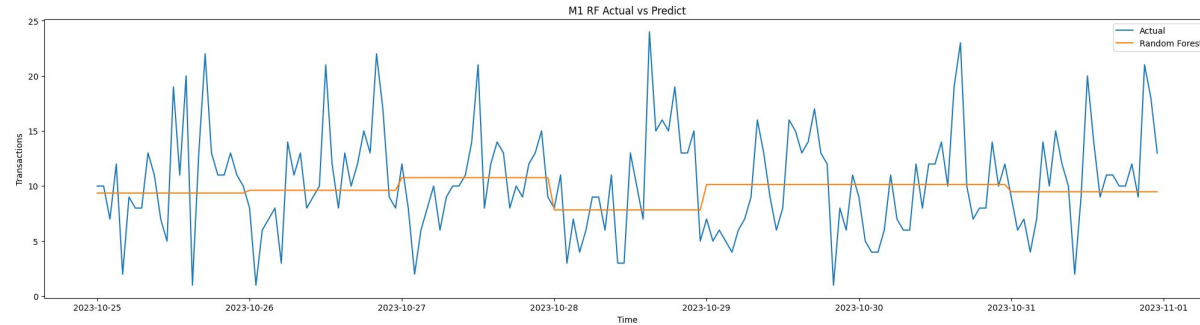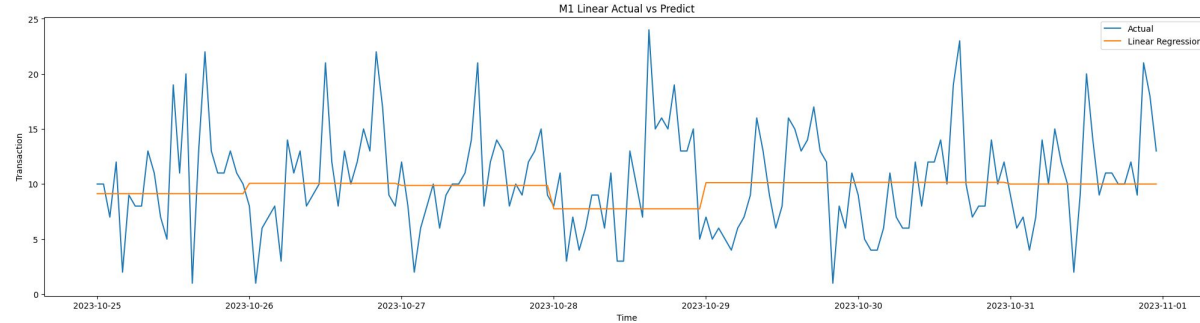
Feature Engineering

Feature Engineering
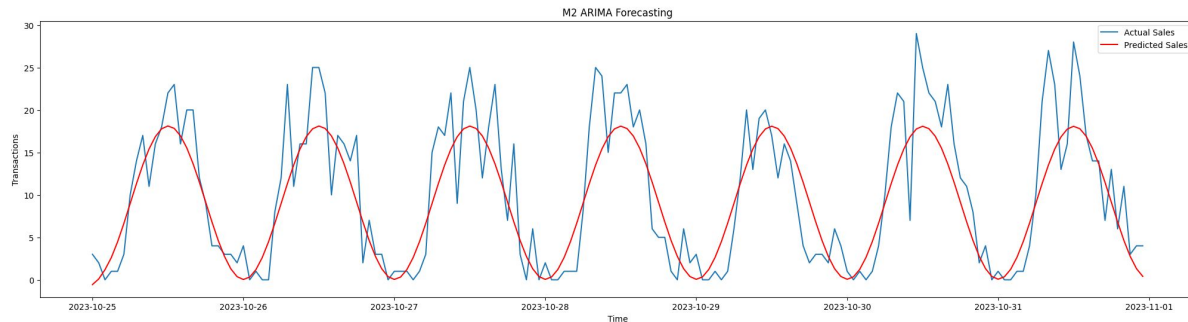
Modeling - Linear Regression

After we try Linear Regression

we found that `predict` is didn't quite accurate enough for both

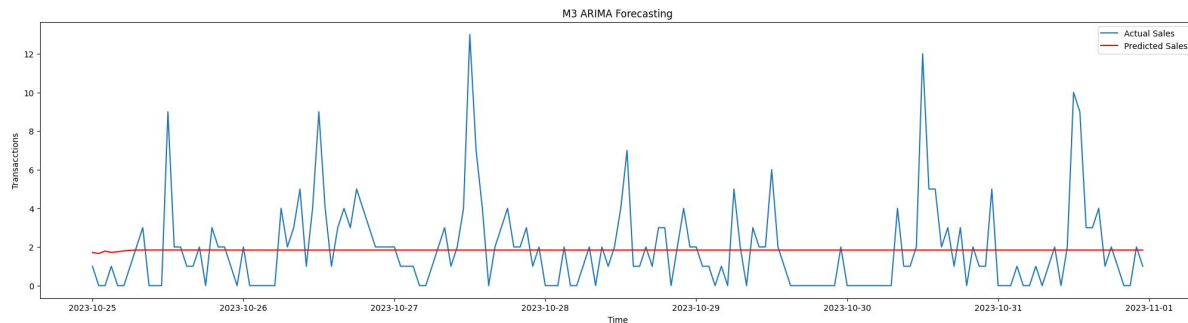**Linear regression** and **RandomForrest**

Modeling - ARIMA

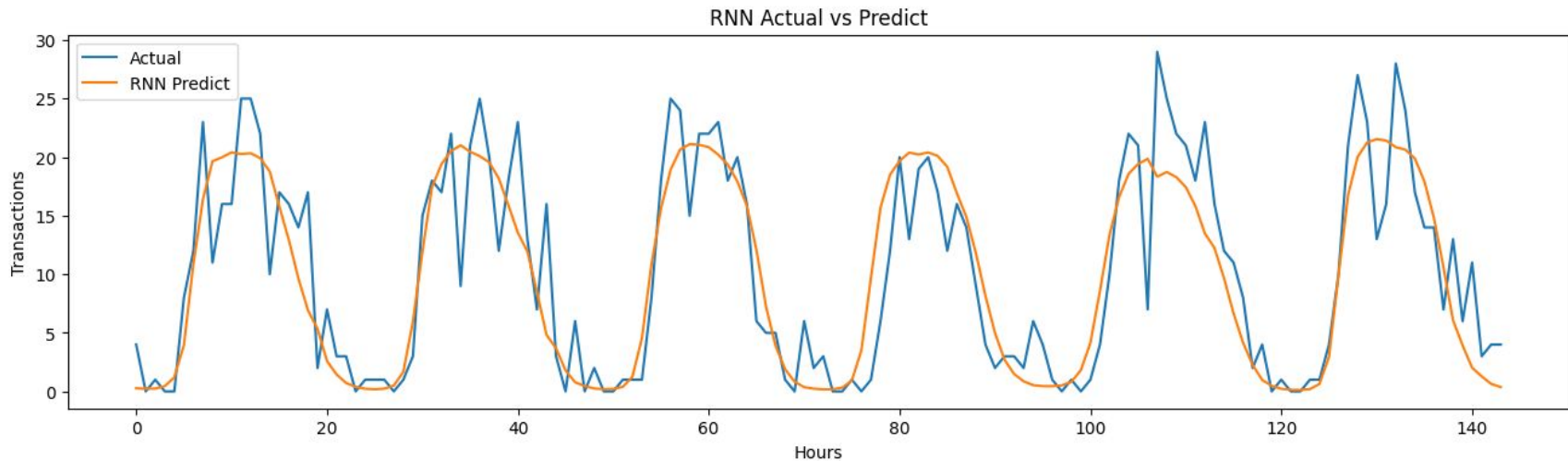For ARIMA best score seem able to capture trend for Machine that have period pattern

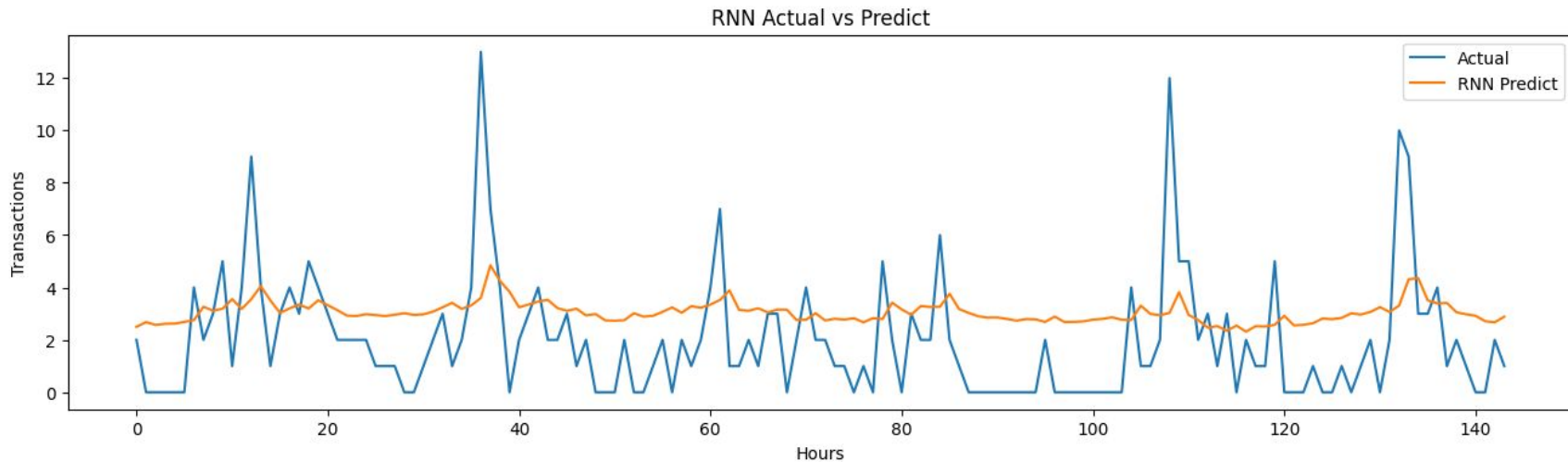But for machine that various dynamic ARIMA seem can't capture trend

Modeling - RNN

RNN with LSTM model is better than ARIMA to follow trends for **M2** machine
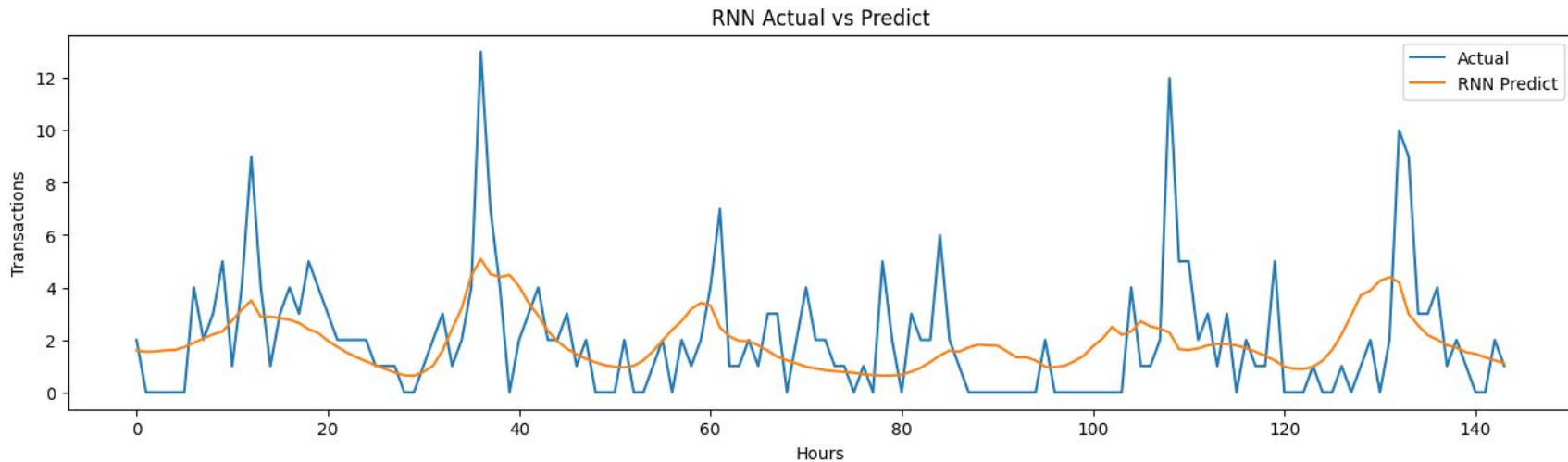

RNN Actual vs Predict

Modeling - RNN

But we still struggle at **M3** dataset

Modeling - RNN

After add feature to RNN and adjust LSTM to support multi features **M3** predict better

RNN Actual vs Predict

Usage

After Training with each machine (or grouping machine type, place, building population)

We can predict next 48 hours to check when we should refill machine by setup cups sell threshold

RNN Predict Sale for next 48 Hours

Legend:
- predict transactions
- cumulative transactions
- 360 transactions refill point
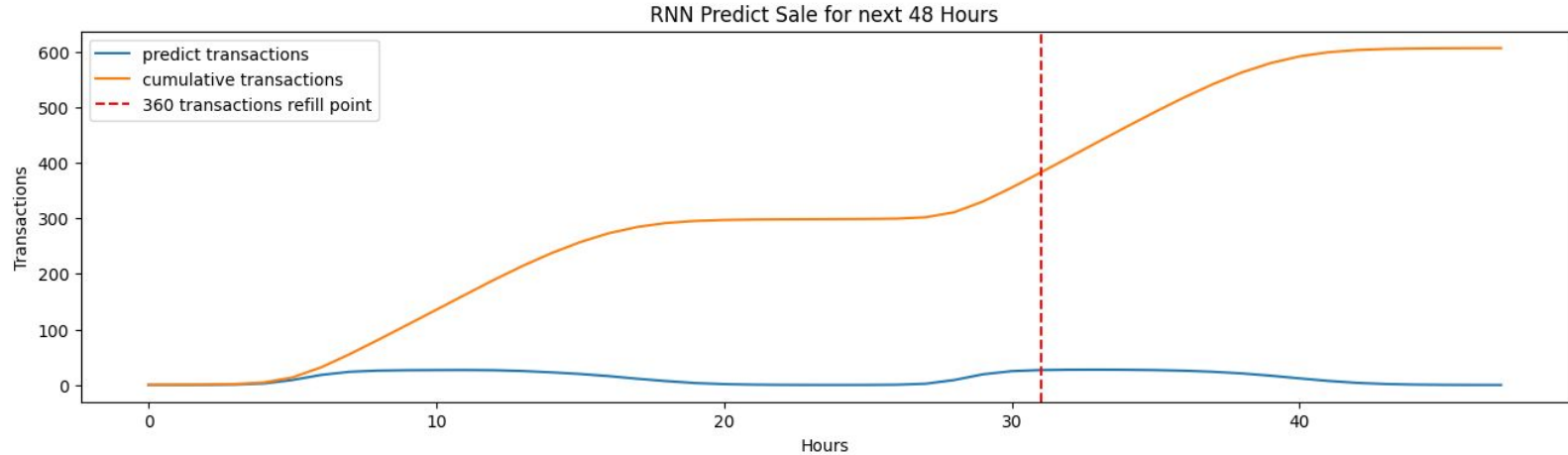
Challenge

1. More different machine type and place (as of current 6,567 machines)

2. Change from **Machine** availability to **Drinking's Menu** availability Lack of menu recipe and machine capacity for each ingredients

3. When use this model predict next refill should assume that machine already full at the time model run prediction

Future Work

1. Limit on Time series information to 1 month OCT if we can gather more so we can analysis trends and seasonal

2. Add more surrounding data to make more features eg. Weather, Building populations, Campaign and promotion

3. Finish this Proof of concept and pack into Application to use internal with MLOps

Q&A