Trip Recommendation System

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Supply Chain Intelligence

2023-01

Model Framework

Planning Stage

Input Preparation	Initial Planning	Final Planning	Driver Assignment	Simulation
1. Parcel Number 2. Inventory constraint 3. Vehicle capacity 4. Travel time 5. …..	Generate initial trip schedules with **MIP** (mix integer programing) model	Mimic SOP to execute initial plan and the result of execution is final plan	Fix trip schedules, search best batch options to minimize driver number	1. Use true parcel number 2. Execute the final plan based on SOP 3. Calculate evaluation metrics based on execution result

Input preparation (Parcel number forecast- Model)

1. Time Series feature
   a. Last 5*24 hour parcel number

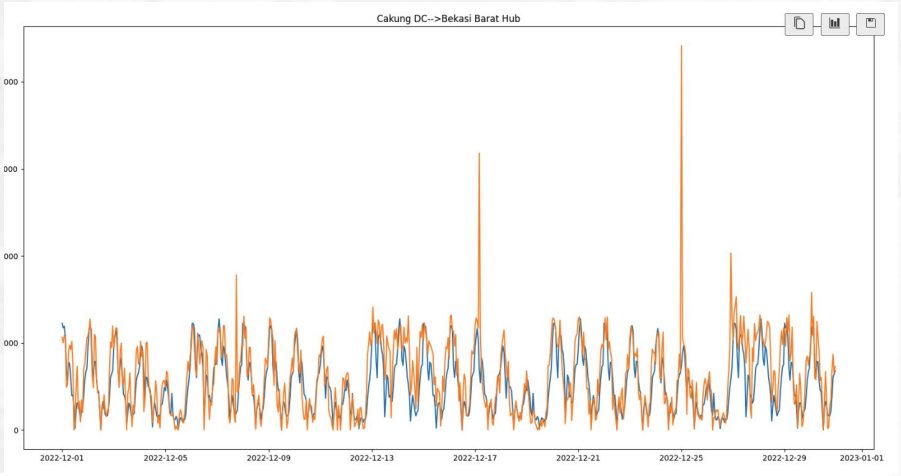
1. Event feature
   a. isHoliday
   b. isPayday
   c. isEventDay(double double day)

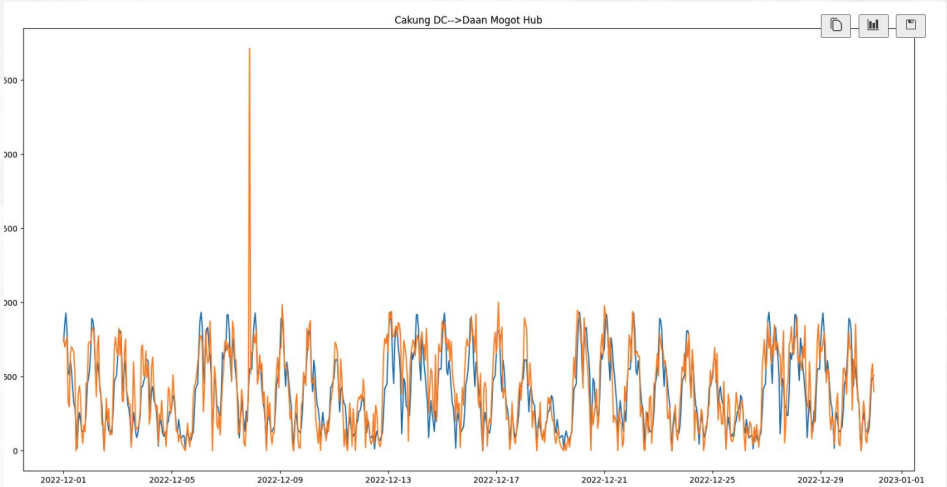
1. Periodic feature
   a. dayofweek*hour (7*24 features)
   b. dayofMonth (31 features)
   c. Dayofweek (7 features)

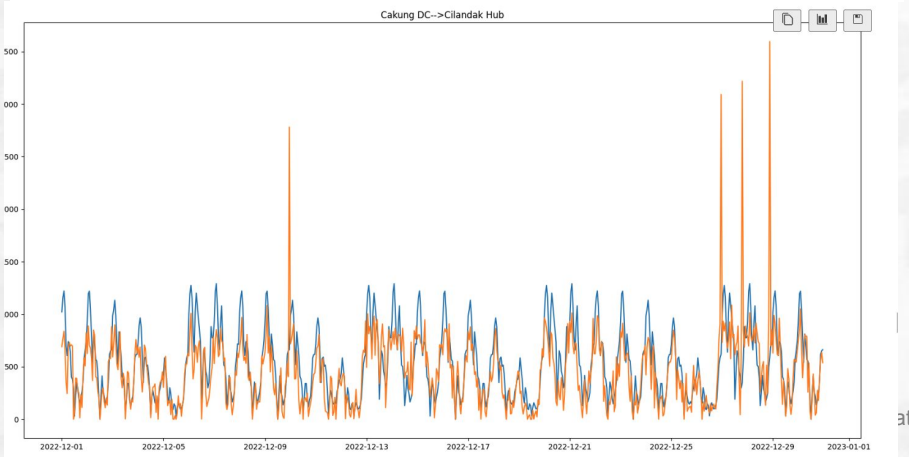
Linear regression model
Tree based model
Mutiple layer perception

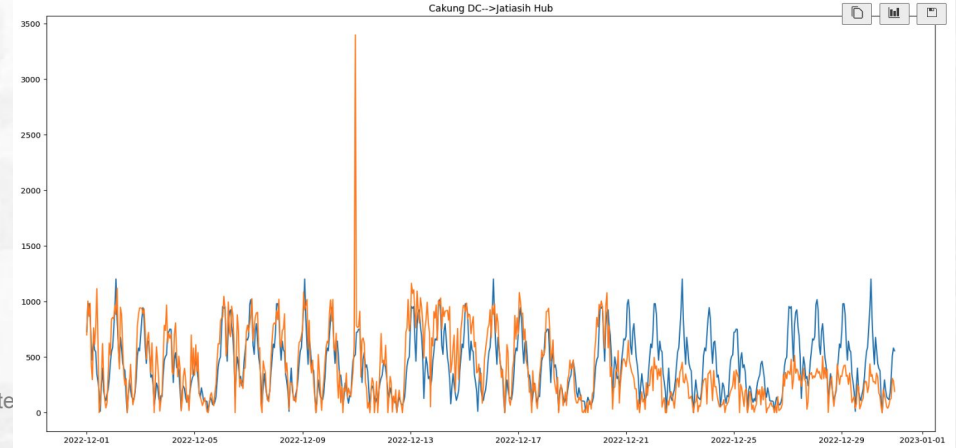
Forecasted parcel

Input preparation (Parcel number forecast - graph)









Input preparation (Parcel number forecast - metric)

Forecast accuracy

		Forecast for 30 days (2022-DEC)			
		Total ADO for 21 hubs(Daily)	ADO for each hub(Daily)	Total ADO for 21 hubs(hourly)	ADO for each hub(hourly)
	<= -20%	0.0%	10.3%	20.0%	27.8%
	-20% ~ -10%	3.3%	7.5%	10.0%	7.6%
Under Forecast	-10%~0%	20.0%	10%	15%	9.3%
	0%~10%	43.3%	21.6%	11.2%	9.5%
	10% ~ 20%	9.9%	20.8%	8.2%	8.7%
Over Forecast	>= 20%	23.3%	29.8%	35.8%	36.6%
WMAPE		10.6%	18.5%	23.5%	30.5%
MAPE1		11.5%	20.1%	37.20%	NA
MAPE2		9.8%	19.80%	NA	NA
WMAPE formula		abs(p-y).sum()/ y.sum()			
MAPE1 formula		(abs(p-y)/p).mean()			
MAPE2 formula		(abs(p-y)/y).mean()			

Input preparation (Parcel number forecast)

Business Impact (last version)

Case Number	Hourly Error (WMAPE)	Vehicle Number	Optimized percentage	Ad-hoc Trip Percentage
0	0%	47	39%	0%
1	10%	50	37%	5%
2	20%	51	35%	11%
3	30%	53	32%	14%
4	40%	53	33%	16%
5	50%	53	33%	18%
6	60%	53	32%	20%
7	70%	54	31%	22%
8	80%	53	32%	24%
9	90%	51	35%	25%
10	100%	54	31%	27%

All result is based on simulation:

Input preparation (Parcel number forecast)

Business Impact (current version)

stage	Vehicle number(average for 30 days)	Cancel rate	Ad-hoc rate
planning	27	0	0
simulation result	36	2.6%	17.57%

Initial Planning

Given

1. Constraints
2. Parameters
3. Optimization target
4. Decision variables

Use MIP model to search solutions (defined by decision variables) to optimize target while obey constraints

Details :
https://confluence.shopee.io/display/SPSC/Business+Assumption+for+Model
Case study:
https://confluence.shopee.io/display/SPSC/2023-01-06

Simulation

1. Use true parcel number
2. Use SOP
3. Use final plan

Driver Assignment

Short term solution

1. Fix trip schedules and batch schedules;

2. Search for best batch schedules
   a. Assign (v_id, batch_id) a driver

Long term solution:

1. Combine initial plan to optimize vehicle number and driver number together

Q&A | Thanks