DS Capstone 2021

Baker Boyz Sweet Products Forecast

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Overview

1. Objective

- Sales Data for 3 different Bakery Products
  - 1 Osterpinze
  - 2 sorts of Berliner
- Prediction of future sales (2022)
- Profit Optimization
  - Decrease days with discard rate
  - Increase potential future sales

[Current discard rate: 14%]

2. Data

- Data from 16.01.2012 - 14.04.2021 available
- Ratio Delivered / Sold is introduced

Sold On	Article	Amount Sold	Amount Delivered	**Ratio Delivered / Sold**	Comment
2012-01-16	Osterpinze	9	20	**2.22**	High Overdelivery
2012-01-18	Osterpinze	29	30	**1.03**	Low Overdelivery

3. Cost Assumptions

- Selling Prices

Osterpinze
1,40 €

Berliner 1
1,40 €

Berliner 2
1,40 €

- Costs

Selling Price	Personal Share	Production Share	Rental Share	Total Share	Total Cost [€]
1,40 €	20 %	17 %	8%	45 %	**0.63 €**

4. Evaluation Metric

- For model performance mean absolute error is used
- For profit evaluation a business accounting is created and [€ symbol] is used

Article_Number	1	2	3	Total	Unit
Amount_Sold	7109.00	2355.00	861.00	10325.00	[-]
Amount_Delivered	7753.00	2657.00	991.00	11401.00	[-]
Amount_Discarded	644.00	302.00	130.00	1076.00	[-]
Discard_Rate	1.09	1.13	1.15	1.12	[-]
Sell_Price	1.40	1.40	1.40	1.40	[€]
Prod_Cost	0.63	0.63	0.63	0.63	[€]
Discarded	405.72	190.26	81.90	677.88	[€]
Revenue	9952.60	3297.00	1205.40	14455.00	[€]
Cost	4884.39	1673.91	624.33	7182.63	[€]
Profit	5068.21	1623.09	581.07	7272.37	[€]

[Year 2021]

| Article_Number	1	2	3	Total	Unit
Amount_Sold	70568.00	39091.00	20393.00	130052.00	[-]
Amount_Delivered	76825.00	45063.00	23979.00	145867.00	[-]
Amount_Discarded	6257.00	5972.00	3586.00	15815.00	[-]
Discard_Rate	1.09	1.15	1.18	1.14	[-]
Sell_Price	1.40	1.40	1.40	1.40	[€]
Prod_Cost	0.63	0.63	0.63	0.63	[€]
Discarded	3941.91	3762.36	2259.18	9963.45	[€]
Revenue	98795.20	54727.40	28550.20	182072.80	[€]
Cost	48399.75	28389.69	15106.77	91896.21	[€]
Profit	50395.45	26337.71	13443.43	90176.59	[€]

[Years 2012-2021]

5. EDA

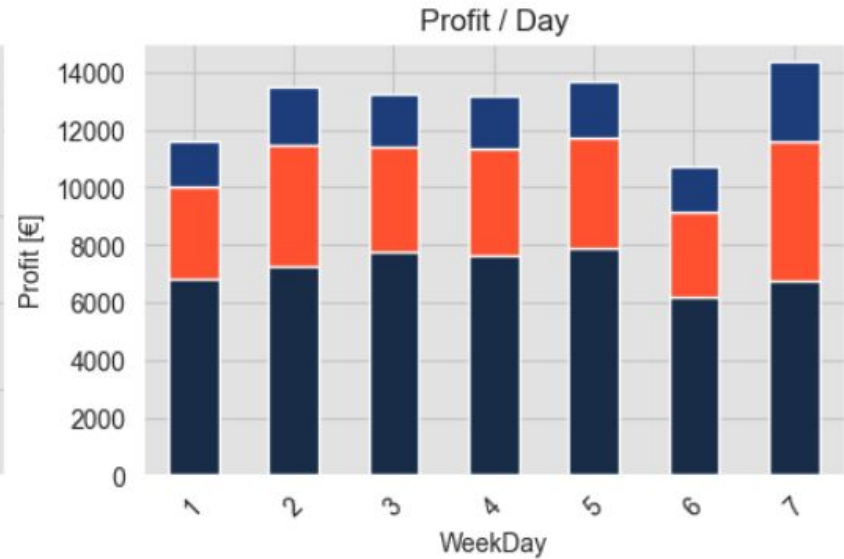- Yearly view, since 2019 decreasing amount of sales per year. Covid-Effect might be relevant
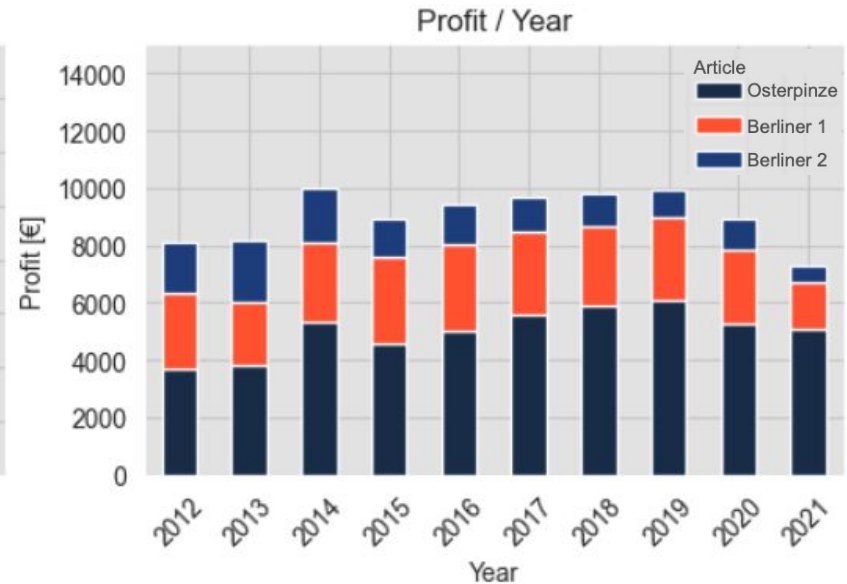
5. EDA
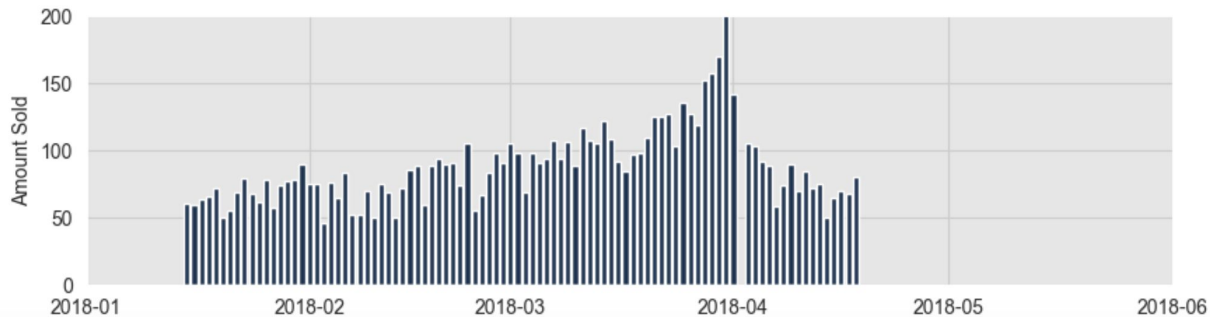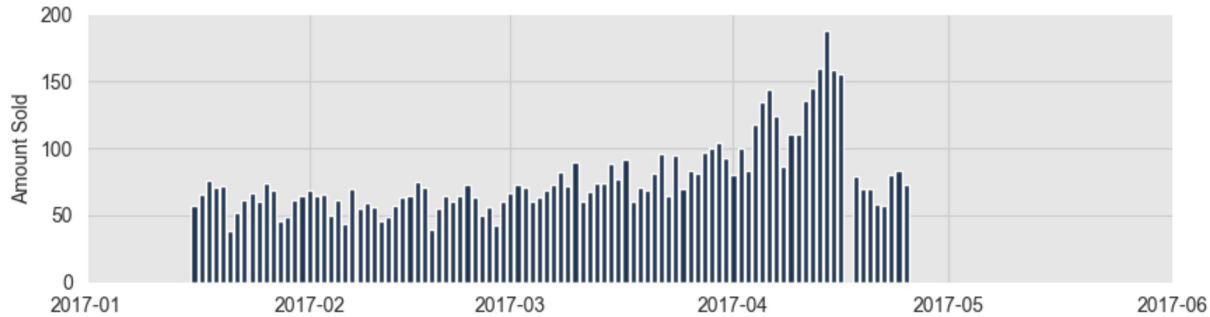
- Monthly View, seasonality for Osterpinze
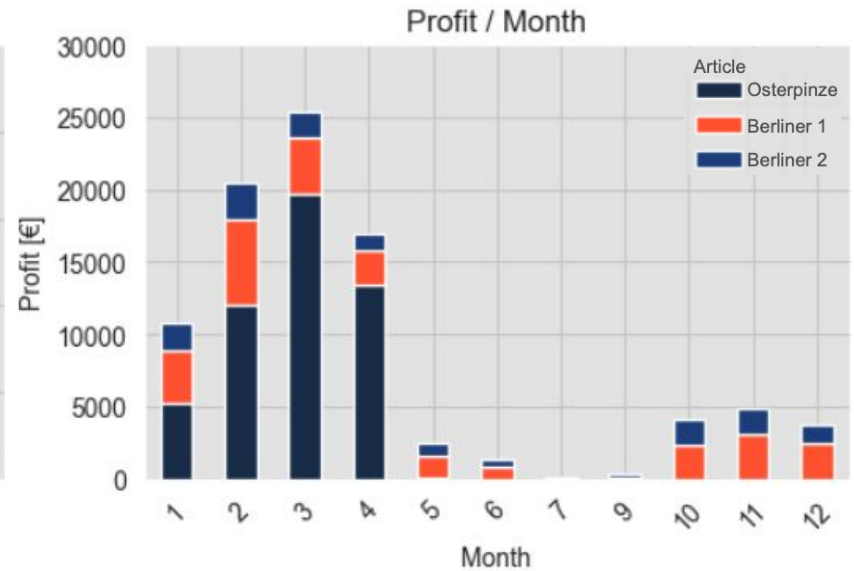
5. EDA

- Weekly view

5. EDA - Sales of Osterpinze

- Seasonal behaviour dependent on eastern

Eastern	Date
2017	April, 16
2018	April, 1

6.   Baseline Model Osterpinze

- Shift of eastern 2014-2019 and average "Amount Sold" in order to predict 2021

Baseline Prediction Model
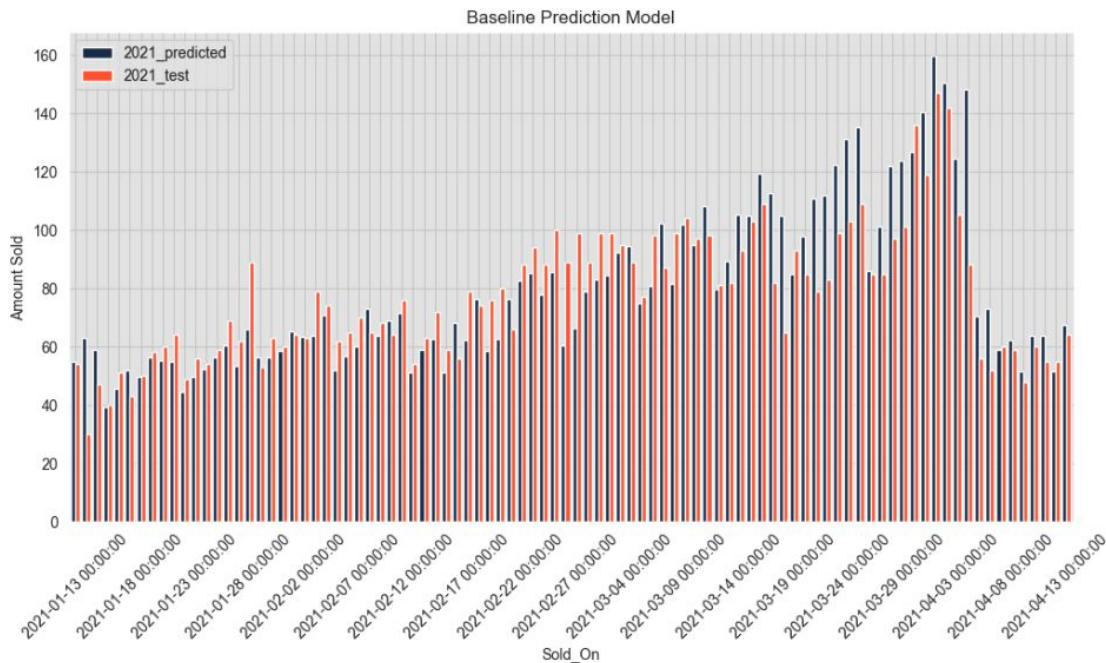
Eastern	Date
2021	April, 4

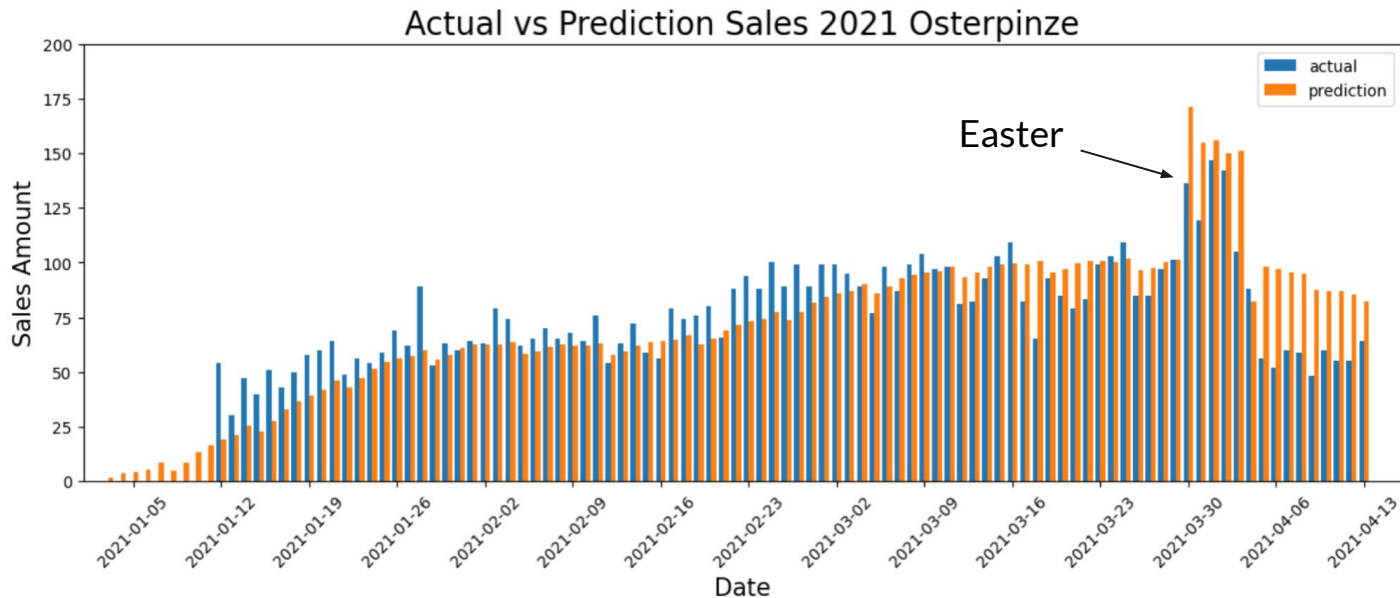| Mean Absolute Error |
|---------------------|
| 11.4 |

7. FB Prophet Prediction

- PROPHET → additive regression model for time series forecasting
- trends are fit with seasonality & holiday effects
- three main model components:

$$y = g + s + h + error$$

- g: represents trend

- s: periodic changes (e.g weekly/yearly)

- h: holiday effects

- error: accounts for unusual changes

7. FB Prophet - Sales Prediction 2021

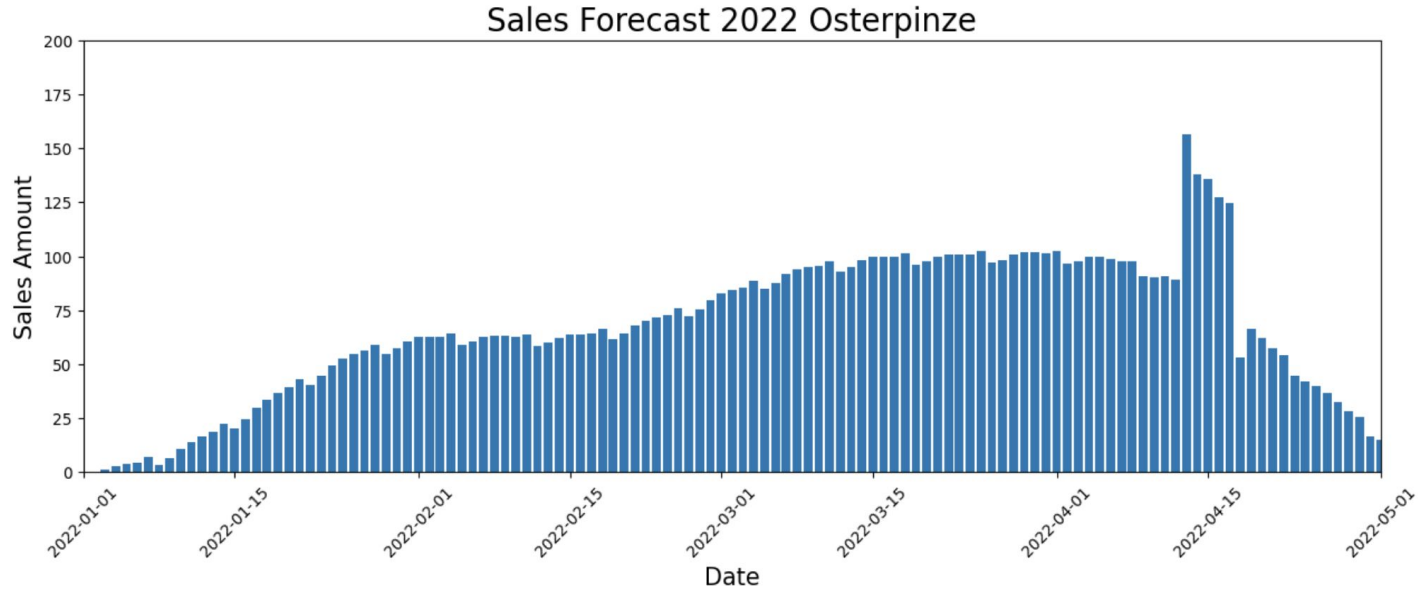- Prediction: Training data 2014-2019
- Actual: 2021

Actual vs Prediction Sales 2021 Osterpinze

Mean Absolute Error	
Base	11.4
PROPHET	12.7

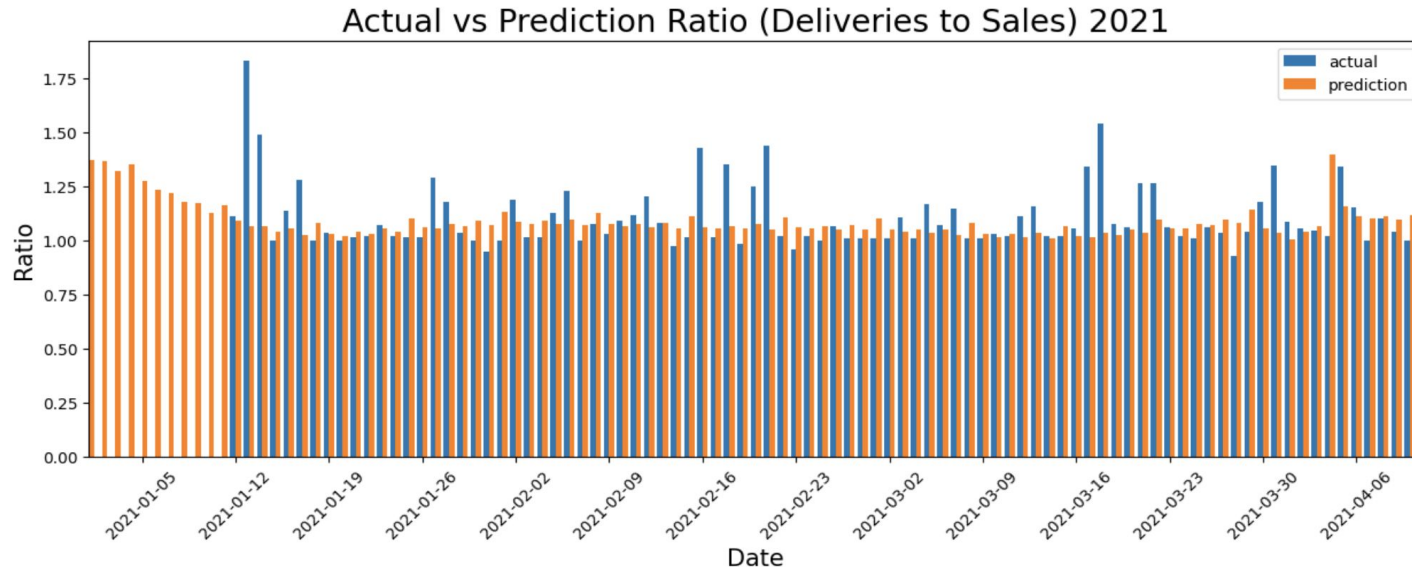# 7. FB Prophet - Sales Forecast 2022

- Model: Training data 2014-2019

Sales Forecast 2022 Osterpinze

7. FB Prophet - Ratio (Deliveries/Sales) Prediction 2021

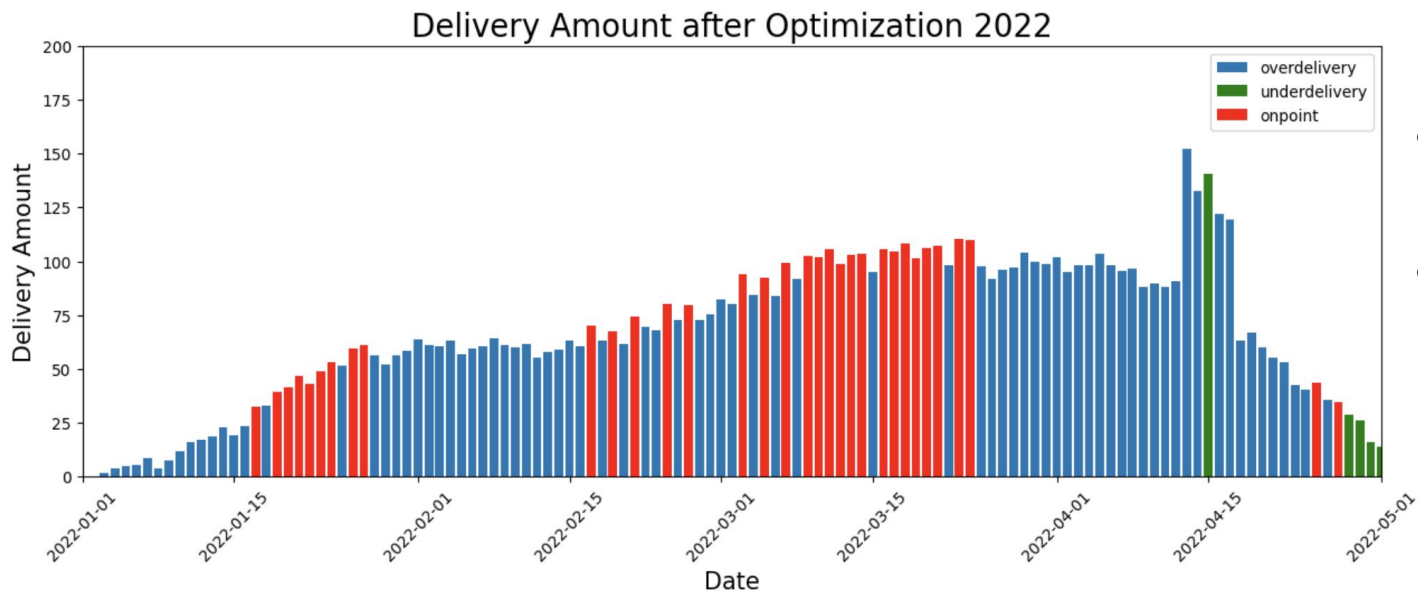- Training 2014-2019 / Test 2021
- Under / Overdelivery prediction

Actual vs Prediction Ratio (Deliveries to Sales) 2021

7. FB Prophet - Ratio Forecast 2022

- Boundaries chosen based on data of 2021

Ratio (Deliveries to Sales) Forecast 2022
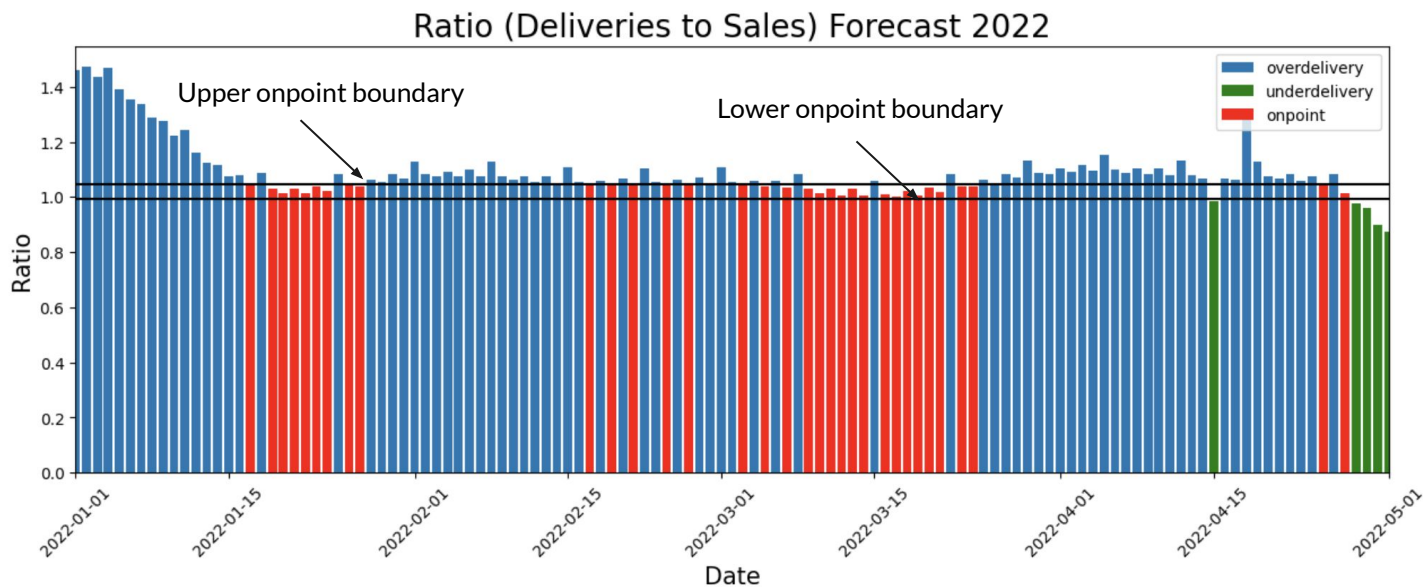
7. FB Prophet - Ratio Forecast 2022

● Recommended Delivery Amount after Optimization Process

Delivery Amount after Optimization 2022

● 10% decrease of overdelivery cases

● 5% increase of underdelivery/ onpoint cases

8. Prediction results & Conclusion

- Comparison of total profit without optimization vs Underdelivery Increase / Overdelivery Reduction
- Based on optimization the profit could be increased by 13% for 2021 and 11% for 2022

Total Profit	2021	2022	Unit
Without Optimization	7272	9048	[€]
With Optimization	8187	10099	[€]
Profit Increase	13	11	[%]

9. Future Work

- Deploy NeuralProphet on given data
- Deploy Hyperparameter-Tuning
- Integrate external data e.g. weather data, incidence values

Thank you for your attention!