~ Seasonal time series ~

Forecast time series with multiple seasonalities

Neue Fische - Capstone project
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Structur

- Introduction
- EDA
- Models and forecast
- Conclusion & future work

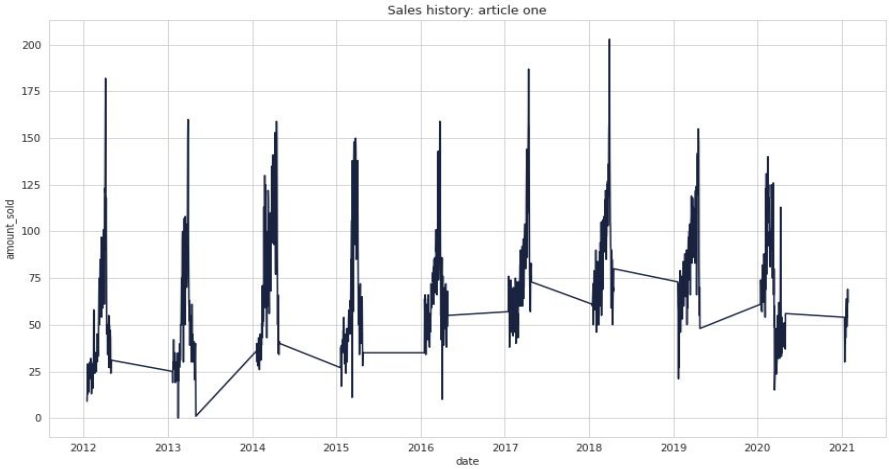
https://www.kochen-mit-diana.com/2020/04/osterpinze.html

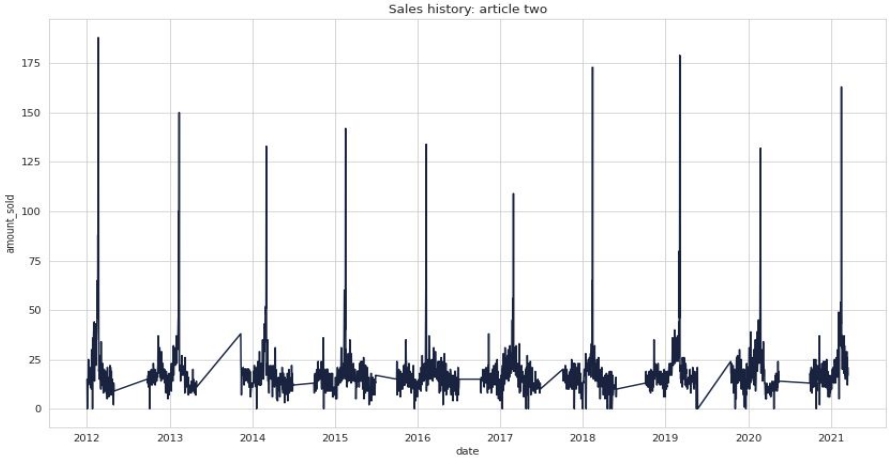

https://vom-achterhof.de/magazin/faschingskrapfen-rezept/

Introduction

- Daily sales data
- 3 seasonal bakery products
  - A1: Osterpinze, A2 & A3: Berliner
- 1 Bakery branch in Wien

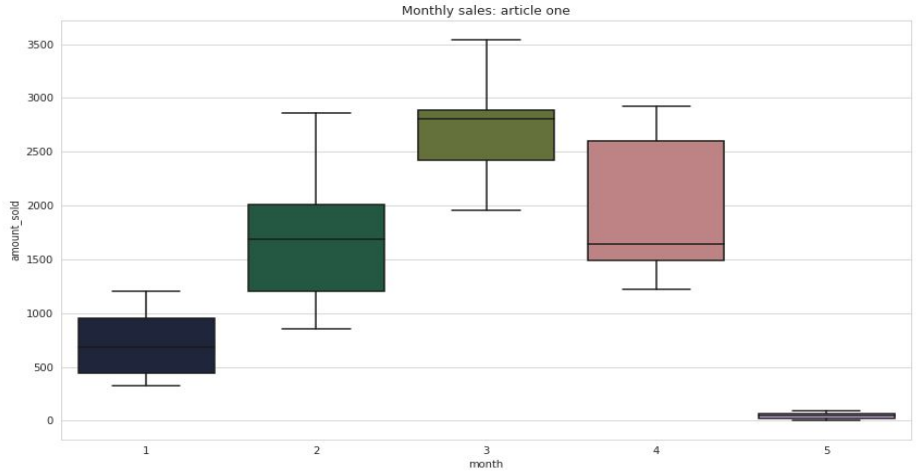
- Goal: Sales prediction for 2021
- No exogenous data

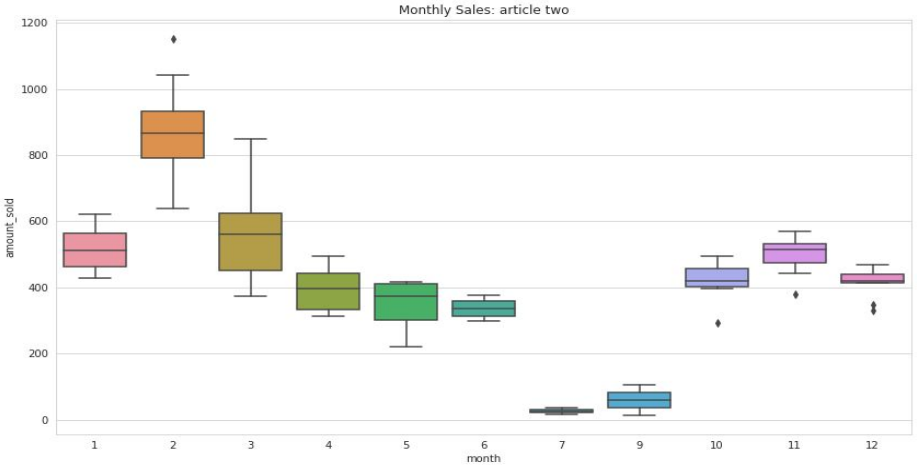




Course of the time series

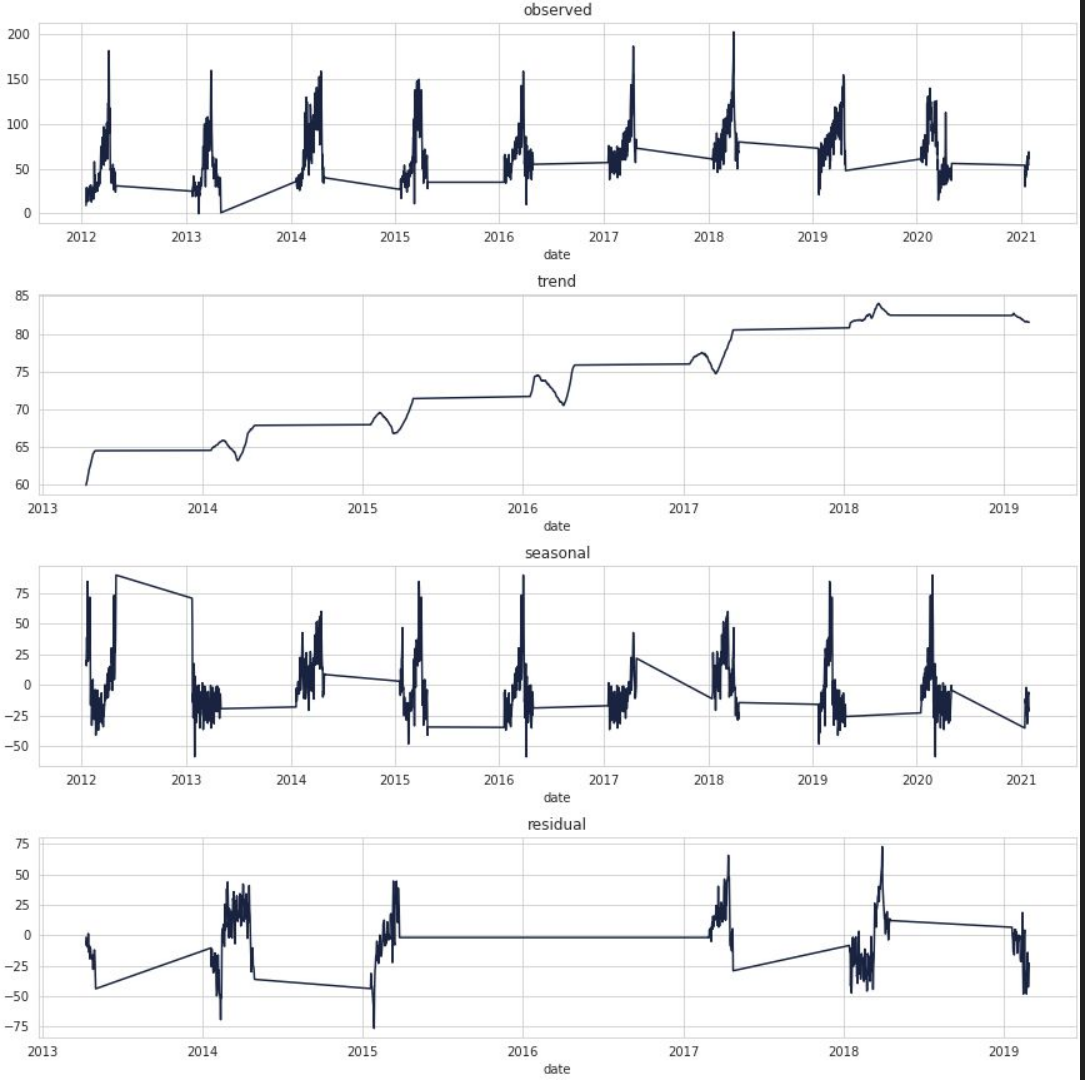
- A1: one season
  - beginning of the year
  - Seasonal frequency: 365
- A2 & A3: two seasons
  - beginning and end of the year
  - Seasonal frequency: 365





Monthly sales

- A1: January - April
  - Peak around easter
  - Seasonal frequency: 5 & 12
- A2 & A3: Oktober - March/April
  - Peaks February & November
  - Seasonal frequency: 12



Simple decompose

- frequency = 365
- correlated Residuen
- underlying seasonalities
- Periodogram
- f = 5 ,7, 12, 18, 43.5, 53, 77, 100, 365

Characteristics ts

Article one:

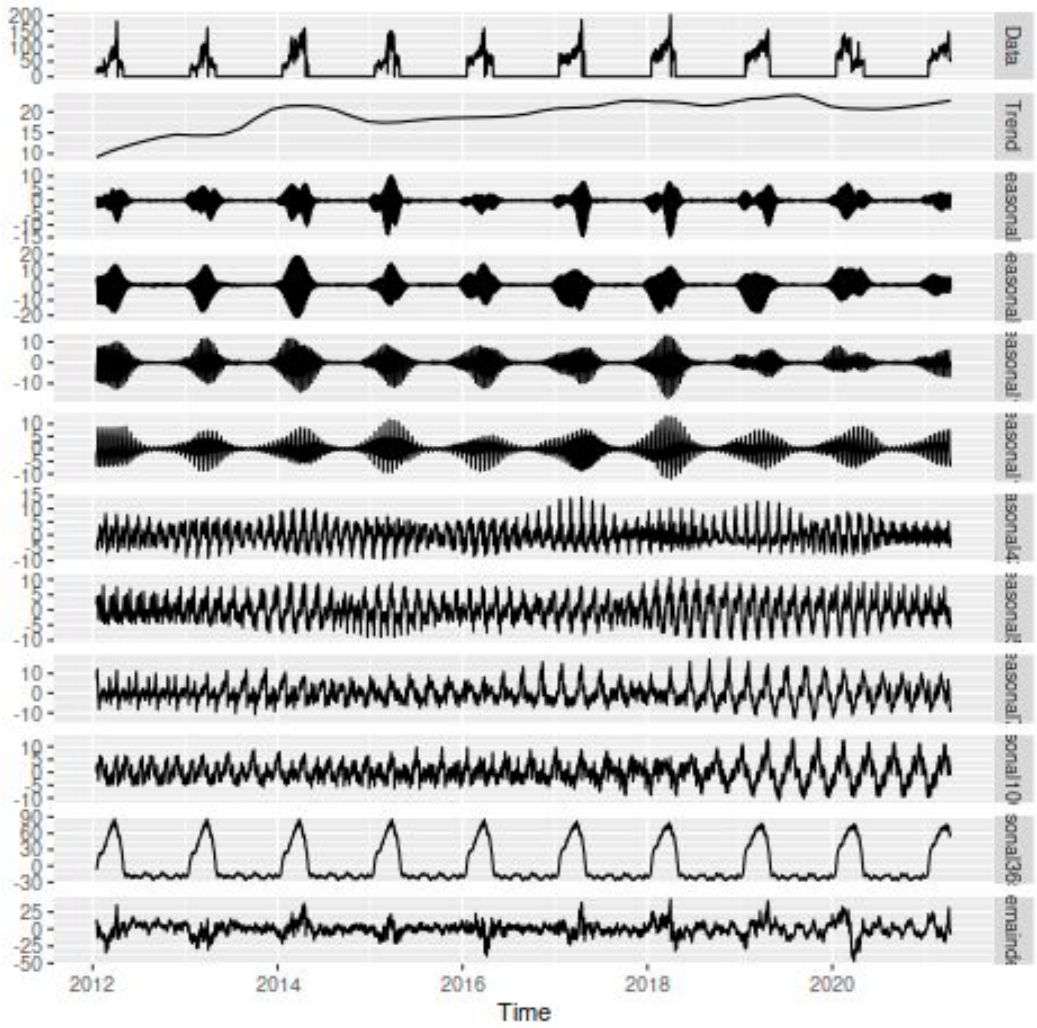
- Difference stationarity
- Normally distributed

all:

- Multiple seasonalities
- Gaps
- Univariate
- correlated residuen

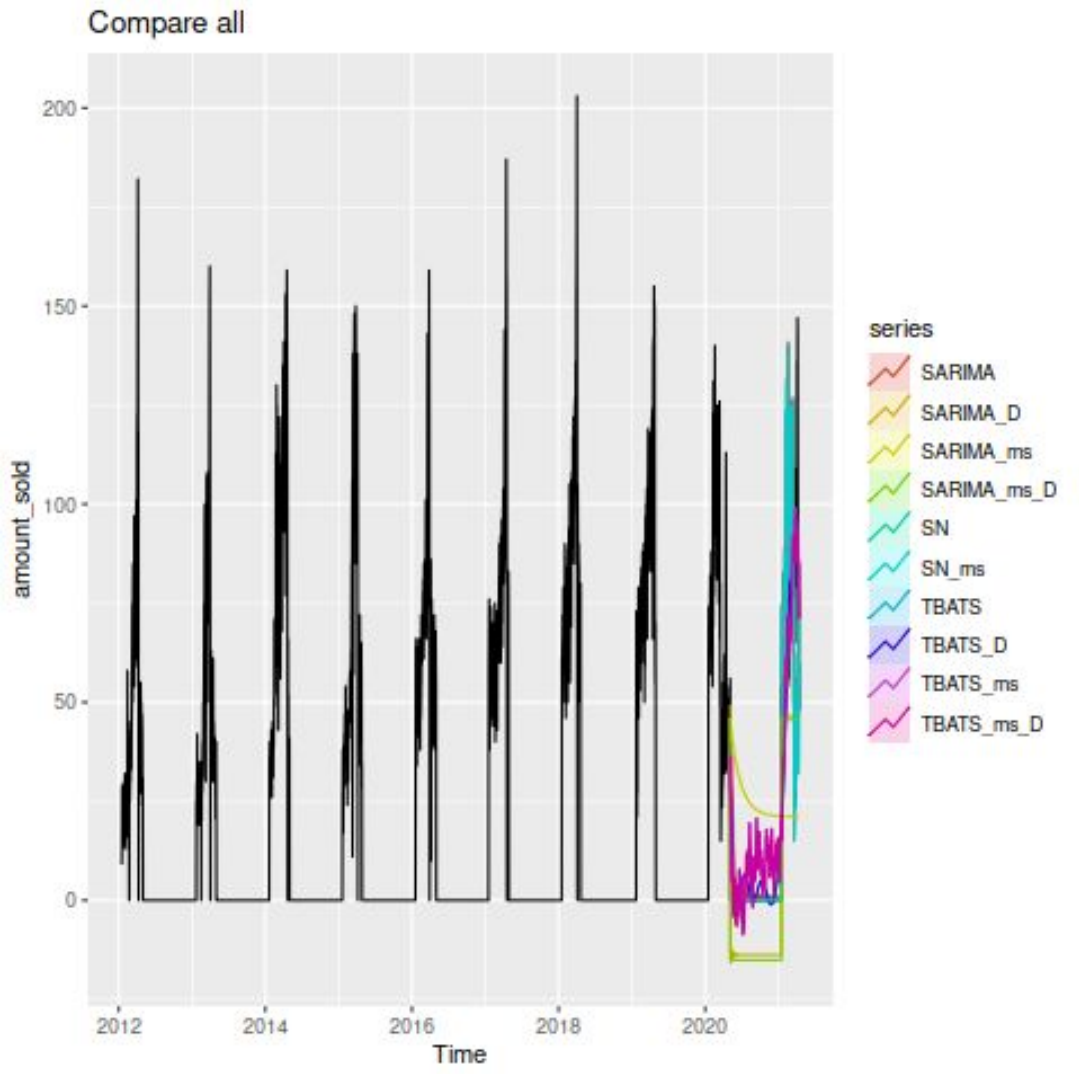
Article two & three:

- Stationarity
- right skewed



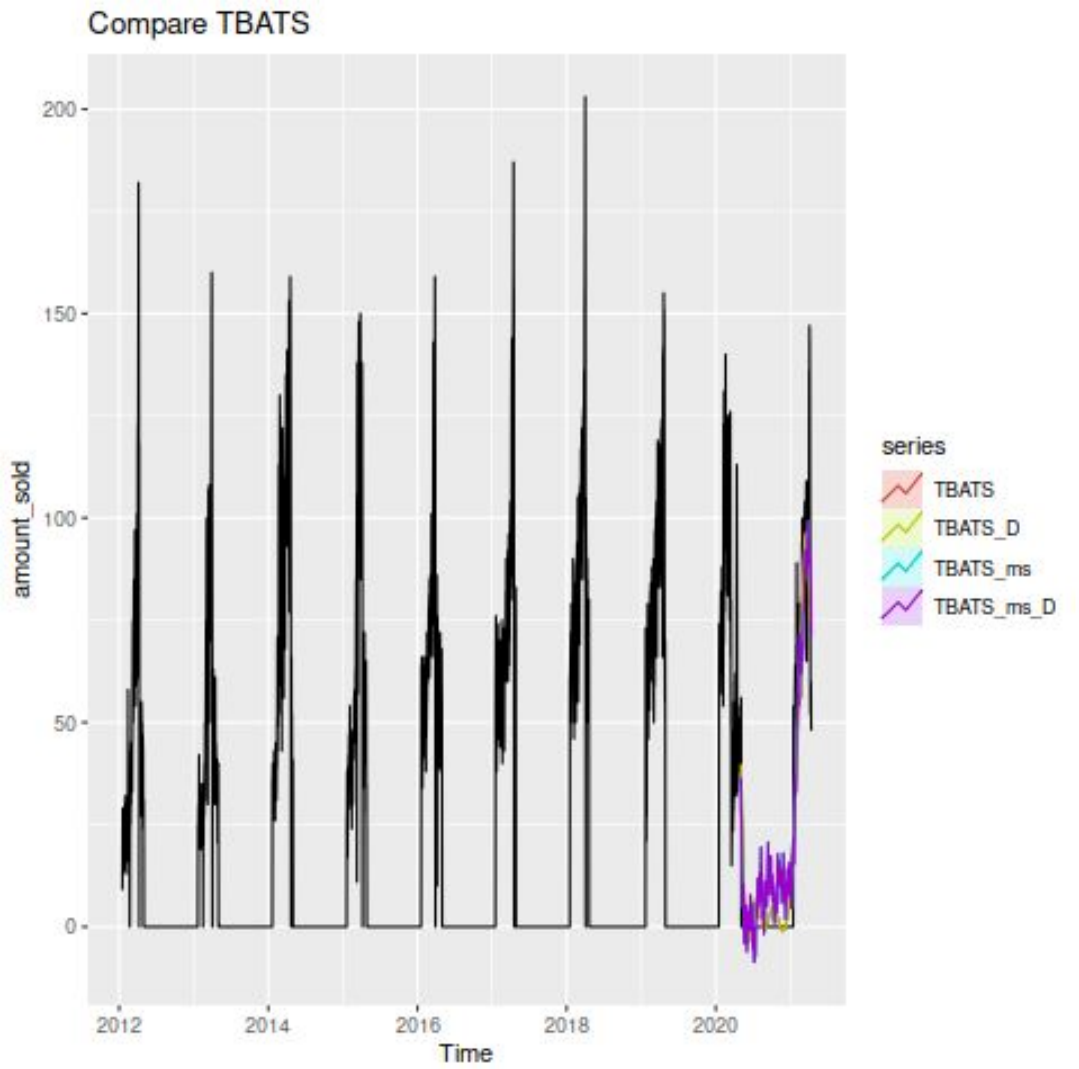
Decompose multiple seasonalities

- Testet:
  - Only one frequency: 365
    - ts - objects
  - Multiple seasonal periods
    - msts - objects
  - Sale time dummy variable



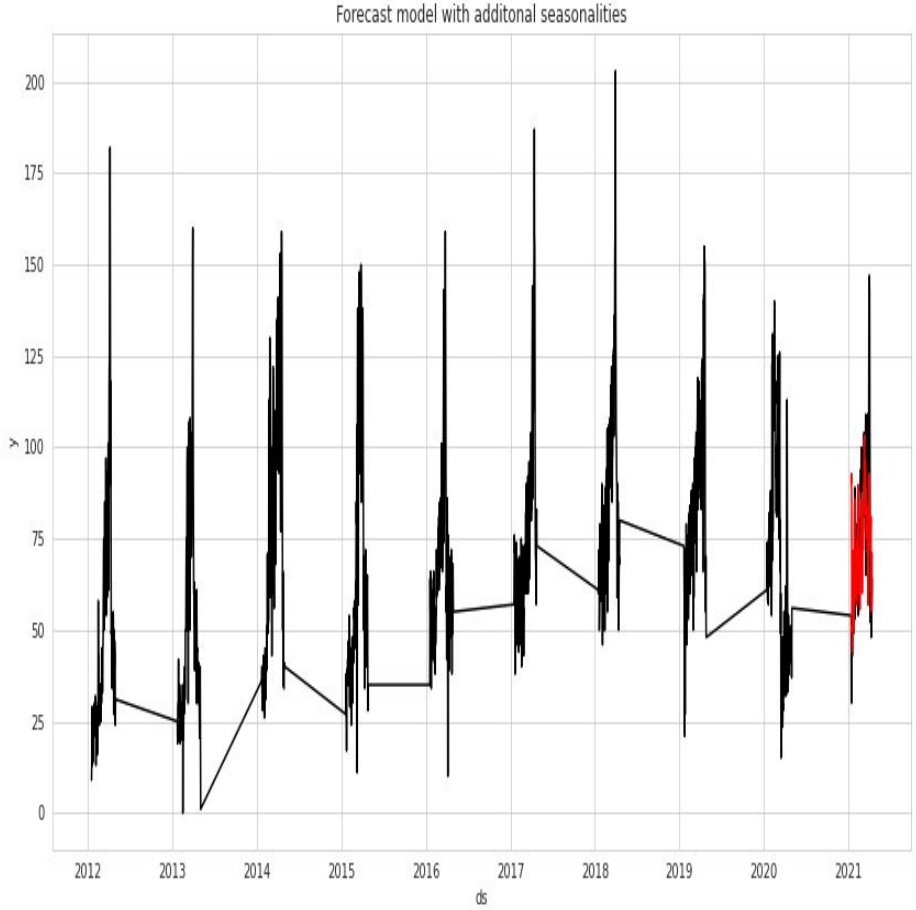
Comparison all R models

- Metric: RMSE
- ARIMA + ms ➡ bottom
- Seasonal naiv ➡ medium
  - No effect ms
- TBATS plain ➡ best



TBATS comparison

- Best: pure TBATS
  - RMSE: 11.61
- Dummies no influence
- ms marginally worse



fbProphet

- ‘Out of the box’ forecasting
  - RMSE: 22.70
- Adding seasonalities
- Adding holidays Austria
  - RMSE: 23.17

Conclusion & future work

- ms can be incorporated
  - In classic ML models
  - In fbProphet
- Dummies as regressors is not sufficient

- Try further models
- Repeat for the other articles
- Hyperparameter tuning

Thank you very much for your attention