

Course Summary and Further Resources

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Summary



Multivariate time series datasets

- Endogenous and exogenous variables

Module Prophet by Facebook

- Seasonal decomposition model

Resources for further studies in time series analysis

Course summary



Multivariate Datasets



Variable Types of Multivariate Datasets

Exogenous variable

Endogenous variable





Exogenous Variable

External regressor with unidirectional effect on the model and the forecast variable

Number of cocktails sold \leftarrow outside temperature

Endogenous Variables

Mutual influence among the variables of the dataset

- 'True multivariate time series'

Vector autoregressive models:

- Each variable is a linear function of past lags of itself and past lags of other variables

Function VAR from module `statsmodels.tsa.vector_ar`

- Variables need to be stationary



Variable Types of Multivariate Datasets

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External regressor with
unidirectional effect on the
model and forecast variables

Endogenous Variable

Mutual influence among the
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Automated Forecasts with Prophet





Data analytics at a company level

- Team of data scientists
- Analytical tool development

Module fbprophet: Open source toolbox for time series analysis in Python and R



Additive Decomposition with Prophet

$$Y_t = g_t + s_t + h_t + e_t$$

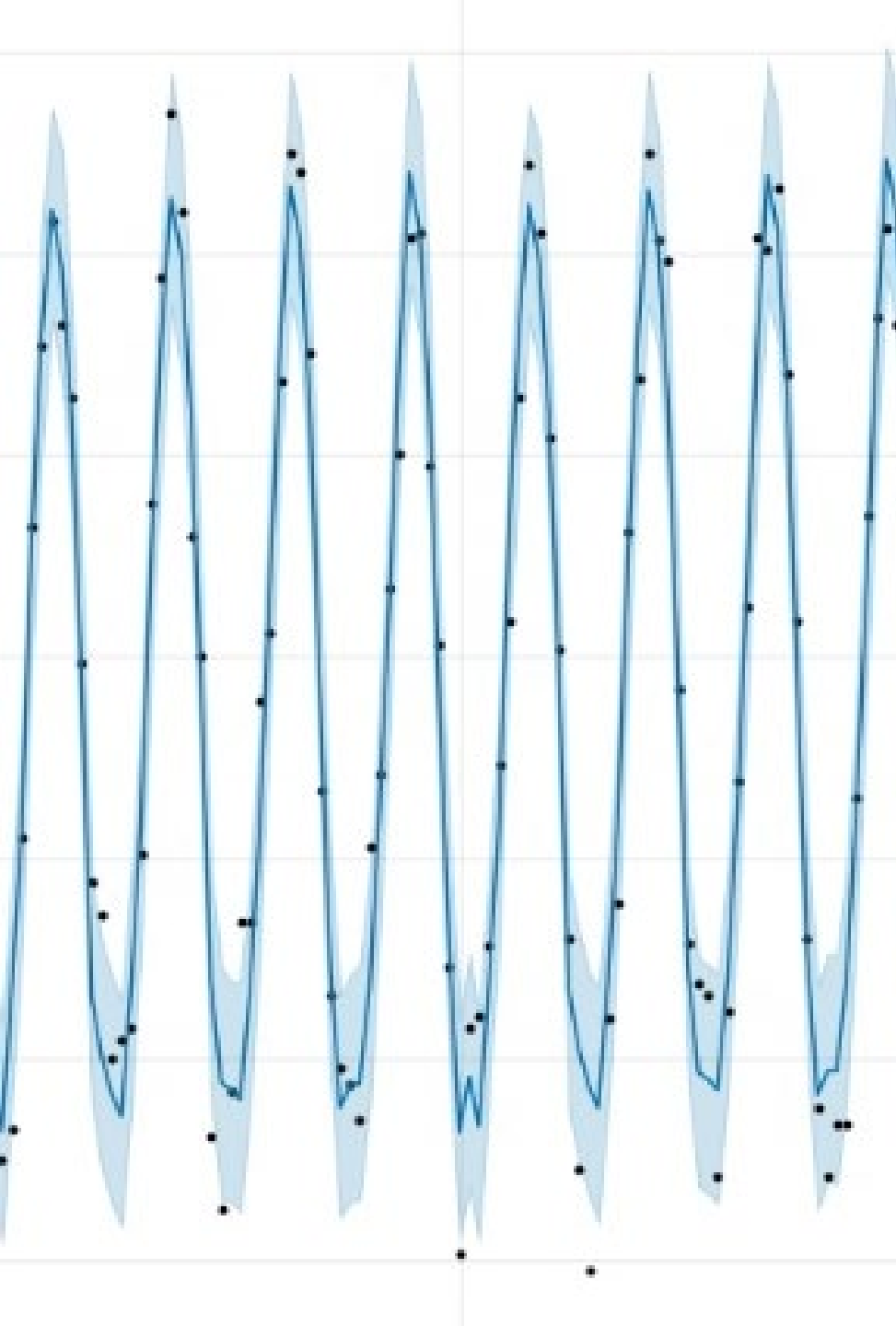
Trend
(g)

Seasonality
(s)

Holidays
(h)

White noise
(e)





Fits a regression for each component with time as the independent variable

Trend: Piece-wise linear curve

- Change points are automatically detected or can be set manually

Seasonality: Fourier order for flexible modeling

- Daily, weekly, monthly, yearly cycles

Holidays: Optional list of special events

- Scale of significance and time window



Change point

An instance in time where the underlying environment changes and patterns are no longer valid or significantly altered.



The Input Data

Naming Conventions

Time stamp ('ds') and
observational values ('y')

Object Class

`pd.DataFrame` where the time
stamp is not used for the
index



The Strengths of Prophet



**Fast to model and
create forecasts**



**Versatile but still easy
to use**



Easy to communicate



Prophet Setup

Adjusting the nottem dataset to fit the requirements of object class and header

Module 'fbprophet'

- \$ pip install fbprophet
- Dependency: PyStan



Further Resources





Documentation of the TSA module of StatsModels

Scientific resources available in R

- Forecasting: Principles and Practice by Rob Hyndman
- Applied Time Series Analysis by Megan Romer (PSU)
- CRAN task view on time series analysis
- PDF documentation, research papers, applied methods

Python community at Stack Overflow



Time Series Courses at Pluralsight

**Beginning Time Series
Analysis and Forecasting
with R**

**Applied Time Series
Analysis and Forecasting
with R**



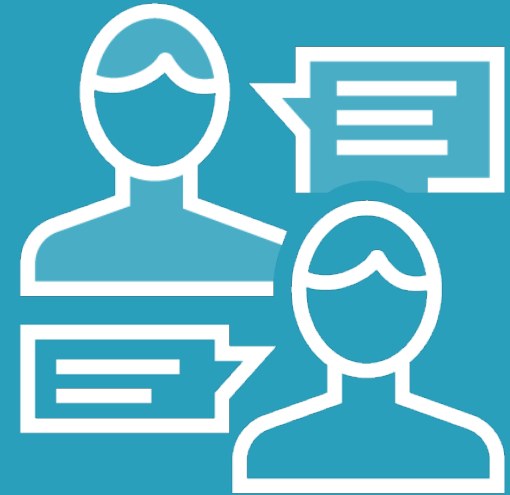
Main Resources to Learn More



**Courses at
Pluralsight**



**Free ebook by
Rob Hyndman**



**Community at
Stack Overflow**



Summary



Main module: StatsModels/ TSA

Statistical underpinnings: Stationarity, autocorrelation, visualizations

ARIMA(p, d, q) model

Seasonal ARIMA(p, d, q)(P, D, Q)[m] and seasonal decomposition

Exponential smoothing ($\alpha, \beta, \gamma + \varphi$)

Additive decomposition with Prophet

