# Predicting TCP/IP network traffic using time series forecasting

## Interim Presentation

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# RECAP

## goal: forecast TCP/IP traffic

- real-time and short-time

## data set

- network traffic of three months
- three different resolutions

## approaches

- classical time series prediction methods
- artificial neural networks

## single exponential smoothing

- weighted moving average
- $\hat{y}_{t+1,t} = \alpha y_t + (1 - \alpha)\hat{y}_{t-1}$

## double exponential smoothing

- Holt's linear trend method
- ability to model trends in the data set
- two smoothing equations (level and trend)

## triple exponential smoothing

- Holt's exponential trend method
- ability to model trends and seasonal effects
- three smoothing equations
- two season variant of the method

## expectations

- time series is highly seasonal
- data set suits the method

## neural networks

- non-linear learning
- flexible, powerful
- less well-behaved

## feed-forward network

- multilayer perceptron (MLP)
- most commonly used for forecasting
- sliding window over input series (i.e. set of lags)
- one hidden layer with $n$ neurons

## recurrent network

- allows cycles
- long short-term memory (LSTM)
- influence of past values decays quickly → memory cells
- well-suited for time series forecasting

## problems and expectations

- LSTM is not straightforward
- LSTM should outperform MLP

## accuracy measures

- sum squared error (SSE)
- symmetric mean absolute percentage error (sMAPE)
- ...

## scale-free errors

- compare forecasts on series of different scales
- mean absolute scaled error (MASE)
- compare forecast with naïve method
- seasonal version: $\hat{y}_{t+h,t} = y_{t+h-K}$

# Questions?