predicting tcp/ip network traffic using time series forecasting

Final Presentation

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recap

goal: forecast TCP/IP traffic

- real-time and short-time

data set

- network traffic of three months

approaches

- classical time series prediction methods
- artificial neural networks

holt-winter approach

data set preparation

- split into training, and test set
- important to start at the beginning of a period

optimize parameter

- with grid search
- from 0.01 to 1.0 with 0.05 steps

parameter

- influence of the previous element
- weigth for the level (α)
- weigth for the trend (β)
- weigth for the seasonality (γ)

results

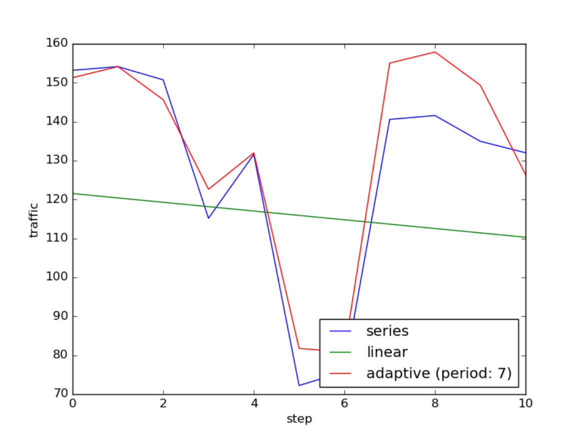
linear:

- α: 0.1
- β: 0.2
- mase: 1.17685709586

addaptive:

- α: 0.0
- β: 0.0
- γ: 1.0
- period: 7
- mase: 0.316808789116

forecast daily traffic



results

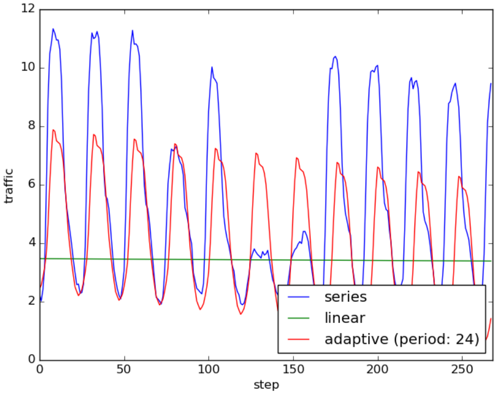
linear:

- α: 0.15
- β: 0.1
- mase: 4.34134852342

addaptive:

- α: 0.7
- β: 0.0
- γ: 1.0
- period: 24
- mase: 3.24448701448

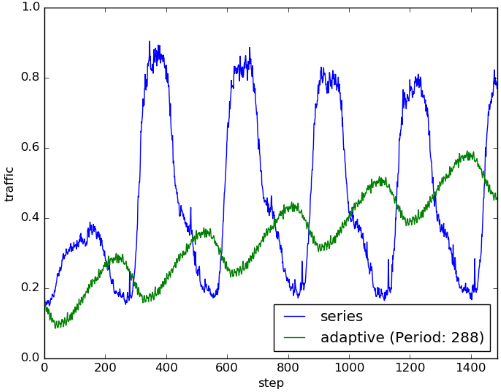
forecast hourly traffic



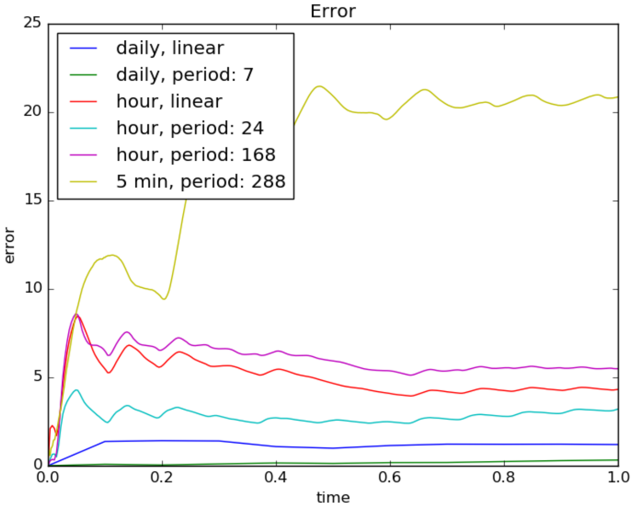
forecast 5 minute traffic

addaptive:

- α: 0.9
- β: 0.65
- γ: 0.9
- period: 288
- mase: 20.8613689301



Error-development over the complete test set



neural network approach

data set preparation

- generate sequences using sliding window
- split into training, validation, and test set

neural network library

- keras
- theano

hyper parameter search

- sliding window, number of neurons, number of layers,. . .
- hyperopt library
- tree-structured parzen estimator

MLP

- $N = 25$
- $W = \{1, 2, 4, 8\} \cup \{287, 288, 289\}$

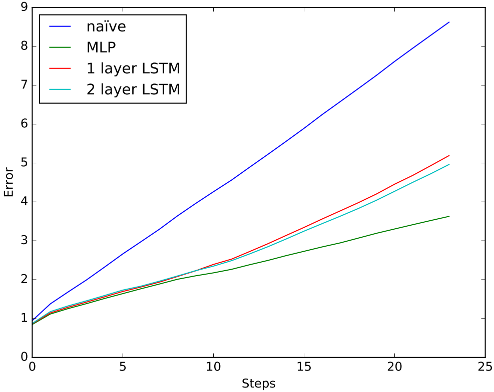
1 layer LSTM

- $N = 19$
- $W = \{1, 2, \ldots, 19\}$

2 layer LSTM

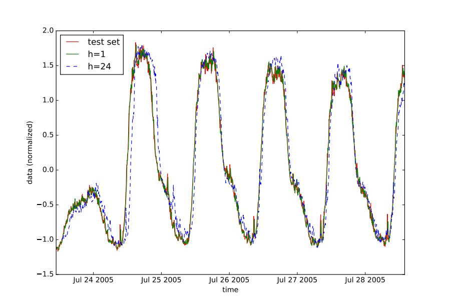
- $N_1 = 13$
- $N_2 = 5$
- $W = \{1, 2, \ldots, 14\}$

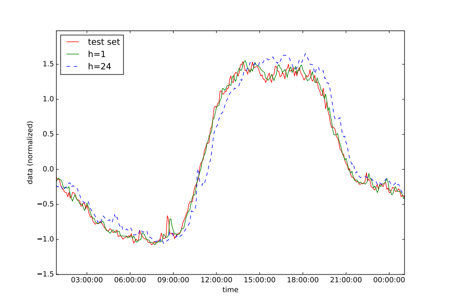
forecast error for different horizons



results

forecasting examples with $h = 1$ and $h = 24$ using MLP

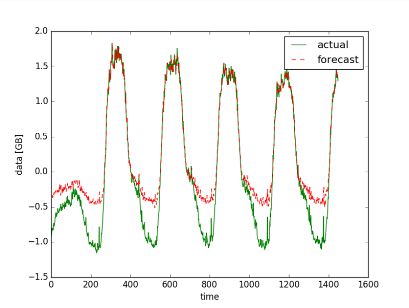




conclusion

forecast horizon

- one step ahead forecasting
- direct vs. iterative forecasting



training loss function

- MSLE
- penalizes underestimates
- numerical issues

conclusion

LSTM issues

- high expectations
- too few training samples
- slow

neural networks and time series

- used often for forecasting
- numerous different approaches
- problem solved?

Questions?