Traffic Matrix Prediction based on Bidirectional Recurrent Neural Network and Long Short-Term Memory

Abstract:

Accurate prediction of the future network traffic plays an important role in various network problems (e.g. traffic engineering, capacity planning, quality of service provisioning, etc.). Measuring all the network traffic is impossible or impractical due to the monitoring resources constraints as well as the dynamic of temporal/spatial fluctuations of the traffic. To this end, a common approach is to solve the traffic matrix interpolation using compress sensing and matrices completion. Besides that, there are some studies exploiting Deep Learning techniques such as Restricted Boltzmann Machine or Recurrent Neural Network to estimate the traffic volume. However, their proposals reveal a poor performance regarding the traffic inference when the measurement data has a high missing rate.

In this paper, we propose a high accurate traffic prediction algorithm by leveraging the advantages of Long Short-Term Memory (LSTM) in the time series estimation and modifying the Bidirectional Recurrent Neural Networks (BiRNN) in tuning the samples. We evaluate our model based on the Abilene and GEANT dataset which contain the real traffic matrices. The experiment results show that the proposed approach can achieve significantly better prediction accuracy in terms of several metrics such as error ratio, normal mean absolute error, root mean square error and R2-score, even when only 30% of the traffic flows in the network are measured.

Introduction