

Master thesis No. 1050

## Network Traffic Prediction with Machine Learning using Gaussian Processes



### Methods

Machine learning  
Gaussian processes  
Bayesian statistics

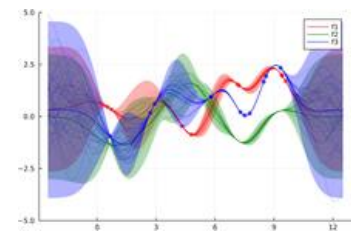
### Topics

Traffic modeling  
Traffic prediction

### Background

In today's demanding networking landscape, network operators face the dual challenge of upholding stringent QoS (Quality of Service) standards while managing costs effectively. Balancing OpEx (Operational Expenses) reduction with efficient equipment utilization is crucial, and accurate traffic predictions play a pivotal role in achieving this optimization. The ability to anticipate future traffic patterns empowers network operators to design and implement strategies that maximize network utilization and minimize unnecessary investments in new hardware.

Gaussian Processes (GPs) have emerged as a prominent ML (Machine Learning) technique, employing multivariate normal distributions to effectively model stochastic processes under the Bayesian paradigm. Their remarkable ability to quantify uncertainty across a wide range of disciplines has cemented their position as a powerful tool.



### Problem Description

In the context of this thesis, you are called to use GPs to model network traffic demands. More specifically, the thesis consists of the following steps:

- getting familiar with GPs and related Julia packages
- investigation of network traffic patterns
- implementing GPs for modeling the backbone network traffic
- evaluation of the models

### Acquired Knowledge and Skills

In this thesis, you will enrich your knowledge of GPs and probabilistic inference, a methodology gaining growing focus. You will also experiment with the scientific programming language Julia. Finally, you will get a great insight into networking and network services.

### Requirements

Communication Networks Architecture and Design  
Programming Experience

### Desirable knowledge

Programming Experience in Julia

### Contact

Dipl.-Ing. Filippou Christou  
room 1.319 (ETI II), phone 685-67968, E-Mail [filippou.christou@ikr.uni-stuttgart.de](mailto:filippou.christou@ikr.uni-stuttgart.de)