Chair of Network Architectures and Services
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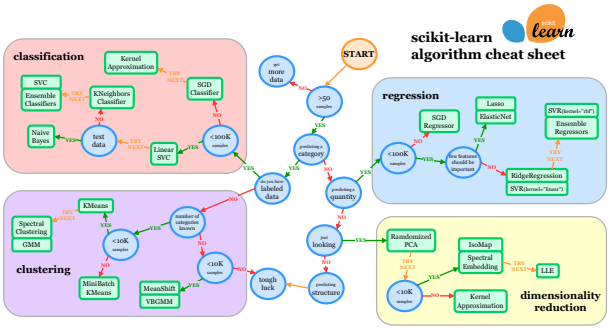
Thesis M.Sc.

IDP

ML-Based ISP Network Management

Motivation

Modern computer networks are growing in complexity, requiring advanced techniques for effective monitoring, troubleshooting, and optimization. Conventional network management often depends on manual intervention, which is both time-intensive and error-prone.
Machine Learning (ML) offers promising approaches to assist with automating these tasks, being a key enabler for self-managing networks. However, applying ML in networking typically requires significant domain expertise, both in ML techniques and network operations. For example, refer to the Figure showing the `scikit-learn` algorithm cheat sheet, which highlights some of the key considerations when selecting an appropriate ML approach. This overview is not even exhaustive, as other machine learning paradigms – such as deep learning and neural networks – are not included.
Navigating this ”ML jungle” and applying the correct techniques to certain networking problems is a non-trivial task. Approaches like AutoML [2] can help in the process, but jobs like data preprocessing and feature selection still remain.
The goal of this thesis is to explore the use of different ML techniques for common network challenges in ISP-grade environments, such as link aggregation (LAG) inconsistencies, routing anomalies, and failure recovery.



`scikit-learn` algorithm cheat sheet [1].

Your Task

- Get to know typical data that is generated by ISP-grade networks (cf. NETCONF [3] and YANG [4] as two typical techniques in that regard)
- Select suitable ML techniques for typical failure scenarios and apply them to datasets obtained from a virtualized ISP-grade network (provided by us)
- Evaluate your approaches and develop a decision scheme for ML applied to computer networks

Requirements

- Machine learning background
- Basic computer networking knowledge
- Motivation to work with realistic datasets (including inconsistencies, noise, ...)

References

[1] https://scikit-learn.org/stable/machine_learning_map.html
[2] X. He, K. Zhao, X. Chu, AutoML: A survey of the state-of-the-art, Knowledge-Based Systems 212 (2021) 106622.
[3] RFC 6241 [4] RFC 6020

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