Thesis
M.Sc.

Neural Net Confidence Score Estimation in Cognitive Network Management

Motivation

With the current advancement in machine learning and deep learning, network management is shifting towards a more cognitive system from the current rule-based systems. In cognitive network management, different functionalities are managed by different cognitive functions [1]. These cognitive functions learn from the network through processing network data in real time, and perform actions based on their learning. Most of the current cognitive network functions are implemented using complex neural nets (NNs), realizing deep learning.

The accuracy of inference of a NN can be affected by several reasons, for example, missing data points, errors in the dataset, or even malicious data-poisoning. To counteract such cases, the network management could utilize an estimation of trustworthiness of the NN's output. In this context, the confidence score is exactly this, representing how reliable an NN output is. Calculation of the confidence score is equivalent to sensitivity analysis of an NN, for which different methods are already available [2], [3]. However, those existing methods probably need to be adjusted for the use in a cognitive network function.

Note

This thesis is in cooperation with Nokia (Munich)
You will have to work there for the duration of the thesis!

Your Task

- Get an overview on existing sensitivity analysis methods through literature research.
- Select a few sensitivity analysis methods and implement them.
- Evaluate the selected methods using a NN-based cognitive function in a network simulator.

Literature

[1] A. Banerjee, S. S. Mwanje and G. Carle, "Towards Control and Coordination in Cognitive Autonomous Networks", in IEEE Transactions on Network and Service Management (TNSM), doi: 10.1109/TNSM.2021.3116308.
[2] M. W. Beck, "NeuralNetTools: Visualization and Analysis Tools for Neural Networks" in Journal of Statistical Software, 85(11), pp1–20. Foundation for Open Access Statistics, 2018
[3] J. Pizarroso, J. Portela and A. Muñoz. "NeuralSens: Sensitivity Analysis of Neural Networks", arXiv preprint arXiv:2002.11423, (2020)

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