Wave Function Collapse for Procedural Network Traffic Synthesis [BSc or MSc]

1 Topic

Generating synthetic network traffic is often required in order to evaluate network systems and how they handle the traffic. Traffic synthesis is usually achieved by either replaying some collected traffic traces, generating real traffic using real applications, or some form of statistical or machine-learning based traffic synthesizer. We would like to study how well the wave-function-collapse (WFC) algorithm can be applied to traffic synthesis.

2 Task

The WFC is a fairly generic algorithm for procedural content generation, typically used in 2d or 3d spatial synthesis in for example video-games. It is at its core an auto-regressive statistical synthesis method that procedurally generates data that looks similar to a set of initial samples you give the algorithm. What sets it apart from state of the art GAN-based traffic synthesizers is that it can procedurally generate patterns based on a template (i.e., an example traffic trace) and that it requires no particular training.

We want to see how well this paradigm translates into procedural traffic generation: What are its pros and cons? How expensive is it? How authentic is the generated traffic?

3 Methods

The goal is to develop a concrete algorithm that synthesizes network traffic based on the WFC paradigm, and to analyze its performance. Computational performance is fairly straightforward to determine, what is a bit more challenging is to quantify the wellness of the synthesized traffic. To that end we would make use of statistical tests as well as machine learning based classifiers in order to see to what degree it is possible to distinguish between synthesized and real traffic.

Depending on whether its a Bachelor or Master project/thesis we adjust the scope and difficulty.

4 Prerequisites

Required: **Algorithms**, **Statistics**, **Probability Theory**

5 Contact

If you are interested, write to francesco.dadalt@inf.ethz.ch. Please attach your CV, transcript of records, and a brief reasoning for why you would like this project.