Paper Summary and Critique

Computers Can Learn from the Heuristic Designs and Master Internet Congestion Control

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Summary

The authors propose a novel CC algorithm that is an offline reinforcement learning model, trained on heuristics from classical CC algorithms. In other words, it is trained on the outputs of various CC algorithms for some given network data, and learns to approximate these actions in a generalized way.

Strengths

- Learns from specialized, manually curated CC policies in a general way.
  - All data is exploited prior to the training phase.
- The decoupling of the data collection and policy learning allows Sage to learn from virtually any CC policy.
- Improves upon previous state of the art - Orca (Classic Meets Modern - a Pragmatic Learning-Based Congestion Control for the Internet) - by managing 1.4x the throughput, while maintaining a similar delay performance.
- Outperforms current state-of-the-art policies (including Orca) in various complex network scenarios.

Weaknesses

- The RL model provides a non-negligible amount of CPU overhead.
  - A caveat here is that the authors have stated that the overhead is *much smaller* than most existing ML-based and even heuristic (classical) CCs.
- Sage also relies on the creators of policy models to provide access APIs so that Sage may use the model to collect policy information. While kernel implemented policies have such APIs, most academical ML-based

policies are developed in and for the user-space, which means they would have to develop and provide their own access APIs, which most do not.

Applicability to practice

- If CPU overhead is within satisfactory constraints, Sage's CC techniques could hold promise for real-world applications.
- Sage's adaptability makes it versatile for use in a diverse choice of network environments.

Comments for improvement

- If the overhead could be reduced further, it may remove one of the core limitations of this approach.

Extra Notes

- Written by the same authors as Classic Meets Modern- a Pragmatic Learning-Based Congestion Control for the Internet.pdf.