Master’s Thesis Proposal

Learning Dynamic Pricing Strategies

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Introduction

Several e-commerce providers, including plane ticketing and hotel booking websites, present significantly varying prices for the same product. These providers follow dynamic pricing strategies that typically depend on various factors, such as a user’s geographic location (higher prices in richer countries), a user’s IP address (lower prices for comparison websites), or even a user’s cookies (higher prices for users that already checked the price in the past).

The goal of these strategies is to maximize profits by always charging the highest price the customer is willing or able to pay. Since different customers might not all be willing to pay the same price, the website providers aim to determine the optimal price for each customer, based on the available information. As a result, rich or loyal customers potentially pay significantly higher prices, while new customers or customers that intensively look for low prices find a lower price for exactly the same product.

Assignment

Objectives

The objective of this project is twofold. First, a framework shall be developed for measuring different prices with various traffic features. Second, measurements shall be conducted with this developed framework, and from these measurements a model of the pricing strategy shall be learnt.

The first part of the objective is the development of a framework that performs measurements with various traffic features, such as different HTTP headers, IP addresses, modified cookies and browser histories, different sets of browser plug-ins or hardware acceleration fingerprints (e.g., for canvas elements), and several times and dates could be considered. Browser and traffic fingerprinting attacks from the literature should be explored and discussed. For changing a user’s IP addresses different techniques shall be evaluated: VPN servers, the anonymity service Tor, and cloud services with guaranteed locations (such as offered by Amazon Web Services) shall be used to be compared in the second part’s evaluation. For changing other features, a framework for automating modified browser requests, such as the Selenium Browser Automation project, could be used. Moreover, it should be evaluated whether the AdFisher framework (for automated experiments on personalized ad settings) can be in parts reused or even extended.

The second part of the objective is to learn a provider’s pricing strategy. Using the developed framework, thorough measurements shall be conducted, and a method shall be developed for learning a provider’s pricing strategy from these measurement data. For learning the pricing strategy standard statistical methods can be used, such as linear regression. The learnt model should predict future price evolution; thus, if time permits, the accuracy of the learnt model shall be experimentally evaluated with the provided framework.

This project and the project “Counteracting Dynamic Pricing Strategies” would be suitable for two students that work in close collaboration.
Tasks

1. Research related work on browser fingerprinting and on other relevant related work.
2. Propose a set of target websites.
3. Identify via manual inspection pricing-relevant candidate traffic features (e.g. time, browser, location).
4. Develop a framework for making measurements for a set of target websites.
5. Conduct representative measurements by using this developed framework.
6. Implement a method for learning from the set of measurements a models of dynamic pricing strategy.
7. Optional: Experimentally evaluate whether the model accurately predicts price evolution

Deliverables

Final report  The final report may be written in English or German. It must contain an abstract written in both English and German, this assignment and the schedule. It should include an introduction, an analysis of related work, and a complete documentation of all used software tools. Three copies of the final report must be delivered to the supervisor.

Measurement and Learning framework  Software and configuration scripts developed during the thesis must be delivered in electronic form.

Presentation  At the end of the thesis a presentation of 30 minutes must be given during an Infsec group seminar. It should give an overview as well as the most important details of the work.