

Team Name:
Pricing and Price Testing using Statistics, Data Mining and Optimization

Team Directors: Wedad Elmagraby (Wedad_Elmaghraby@rhsmith.umd.edu)
Itir Karaesmen (ikaraes@rhsmith.umd.edu)
Wolfgang Jank (wjank@rhsmith.umd.edu)

Meeting time & day: TBD

Research Focus:

Online merchants are discovering that by leveraging the Internet, real-time data can be collected and used to make accurate decisions regarding inventory control and supply chains. However, one component of the retail model has remained largely untapped by most e-retailers - price. What most e-retailers have yet to uncover is that by adjusting price levels based on real-time market data, dramatic increases in gross margins can occur. In fact, according to Arthur Andersen, a 1% increase in price can lead to operating profit improvements of 11% or greater.

To achieve the goal of 'charging the right price', retailers must first understand the nature of the demand that they face (is demand highly inelastic, is it very time-sensitive, is it subject to dramatic shifts due to exogenous forces, etc.). Equipped with this knowledge, they then must understand how to optimize prices in the presence of their supply chain constraints. On the other hand, they have to understand how pricing decisions affect their bottomline and what demand- or pricing-related parameters are crucial for optimal decision-making.

While the academic literature in operations management and management science for optimal decision-making in pricing and revenue management has been growing, the demand models that are proposed/used in that literature rely on several restrictive assumptions and rarely rely on “field data.” In fact, demand-modeling is considered to be one of the “greatest unsolved problems” in revenue management and pricing.¹ On the other hand, empirical and computational work – as in marketing or data mining – to characterize demand through field data rarely consider the role or affect of optimal decision-making. Research on use of statistics and data mining to characterize demand/pricing-related information in order to optimize pricing decisions will not only fill a void in the academic literature, but will have significant practical value.

The objective of this course is to explore and develop methodology in price testing in order to optimize prices.

To make an effective adjustment in price levels, accurate, concise information is imperative. Historically, data mining (amassing mounds of information then

¹ G. van Ryzin (2006). “Greatest unsolved problems in revenue management,” presented at the INFORMS Annual Meeting, Pittsburgh.

painstakingly extracting useful and relevant nuggets) has served as the time-honored way of utilizing data. Unfortunately, this passive-based approach creates a detrimental lag-time; online retailers are powerless in responding to fickle market demands. Additionally, making future assumptions based on data from a year ago can lead to disastrous pricing decisions.

In light of the Internet, merchants can now capture real-time information about their marketplace by performing "live testing" on the Internet. Live testing allows online retailers to get a holistic sense of what is driving the market. Everything from customer demand to competitor influence is available immediately. Instead of purchasing X amount of goods based on last year's numbers then dramatically slashing prices to get rid of surplus inventory, online retailers can measure demand in real time and adjust prices accordingly, saving money by finding out the "right" price for products early in the season.

In this RIT, we will investigate both statistical and optimization models and methods to

- (i) analyze pricing data in real time,
- (ii) develop statistically significant beliefs over the dynamics of demand,
- (iii) investigate methods suitable to anticipate changes in demand,
- (iv) optimize prices given the beliefs on demand.

The course will include reading of subject-specific articles from the pricing and operations management literature; it will also include reading of articles from statistics and data mining. While some parts of the course will focus more on a theoretical understanding of the issues surrounding data-driven pricing, much of it will focus on hand-on research via analysis of pricing data using modern statistical methods and models, and simulation of real-world scenarios. To that end, the student will need a good knowledge of statistical software packages (e.g. R, SAS) as well as other programming languages (e.g. Matlab, C++)

General Prerequisites:

- Experience and familiarity with MS Excel and MS Access.
- Excellent knowledge of a programming language (e.g. C++, Perl, JAVA, Matlab).
- Good knowledge of a statistics package (e.g. SAS, Splus, R).
- Desire and willingness to work in a team and present research papers.
- And permission of the instructors.

Graduate Prerequisites: STAT 740,741, CMSC 660,726 ²

Undergraduate Prerequisites: BMGT 230, 430, STAT 420, 450, CMSC 460

Work Schedule:

Meetings will be held *bi-weekly* at the *eCommerce lab* (3509 Van Munching Hall) in the business school. During the initial meetings, the instructors will introduce the general

² Or equivalent with the permission of the instructors.

framework and assign relevant reading material. After that, students (in teams) will select a specific topic for their own research. During subsequent meetings, students will present their findings to the whole research group in an informal setting. The group will discuss the work, assist with questions, and give feedback. Active participation during each meeting is required from all students! At the end of the semester, each team will submit a short research report & and give a final presentation highlighting their results.