Saturday Plenary Session

May 7, 2016, 11:30 AM – 12:20 PM; Venue: Salon IV & V

Dr. David Simchi-Levi, Professor of Engineering Systems, MIT

Abstract Title: Data-Driven Research in Revenue Management

Abstract: In a dynamic pricing problem where the demand function is unknown *a priori*, price experimentation or product bundling can be used for demand learning. In practice, however, online sellers are faced with a few business constraints, including the inability to conduct extensive experimentation, limited inventory and high demand uncertainty.

In this talk, we show how data-driven research fosters the development of new engineering and scientific methods that explain, predict, and change behavior.

Collaborating with Groupon, we developed a dynamic pricing model where the demand function is unknown but belongs to a known finite set. The data suggested that we can approximate the true demand function by a collection of linear demand functions. Groupon allows for a limited number of price changes during the selling season and the objective is to minimize the regret, i.e. the expected total revenue loss compared to a clairvoyant who knows the demand distribution in advance. We demonstrate a pricing policy that incurs the smallest possible regret, up to a constant factor. Implementation of our algorithm at Groupon shows significant impact on revenue and market share.

In the second part of the presentation, we extend the model to a network revenue management problem where an online retailer aims to maximize revenue from multiple products with limited inventory. This model is motivated by collaboration with retailer Rue La La, where the retailer does not know the expected demand at each price point and must learn the demand information from sales data. We propose an efficient and effective dynamic pricing algorithm, which builds upon the Thompson sampling algorithm used for multi-armed bandit problems by incorporating inventory constraints into the pricing decisions. The algorithm proves to have both strong theoretical performance guarantees as well as promising numerical performance results when compared to other algorithms developed for the same setting.

In the last part, we report on implementation of our methods and algorithms at B2W Digital, a large Latin American retailer. An important opportunity at B2W is product bundling. We show that bundling can be used as a form of price experimentation, that is, a mixed bundling scheme allows the firm to quickly learn the customer valuation distributions without having to change any prices. We then introduce a simple price bundling scheme that takes into account customer valuations and product cost.

Throughout the presentation, I will spend time characterizing exactly what I mean by data driven research, why it is relevant today more than ever before, and why it provides new opportunities for more creativity and a bigger and sometimes surprising impact on the organization. As you will see, this line of research can be quite different from what some in our profession refer to as empirical research.

Dr. David Simchi-Levi Biography:

Dr. David Simchi-Levi is a Professor of Engineering Systems at MIT and Chairman of OPS Rules, an operations analytics consulting company and Opalytics, a cloud analytics platform. He is considered one of the premier thought leaders in supply chain management and business analytics. His research focuses on developing and implementing robust and efficient techniques for operations management. He has published widely in professional journals on both practical and theoretical aspects of supply chain and revenue management. His Ph.D. students have accepted faculty positions in leading academic institutes including U. of California Berkeley, Columbia U., Cornell U., Duke U., Georgia Tech, Harvard U., U. of Illinois Urbana-Champaign, U. of Michigan, Purdue U. and Virginia Tech. Professor Simchi-Levi co-authored the books M*anaging the Supply Chain* (McGraw-Hill, 2004)*,* the award winning *Designing and Managing the Supply Chain* (McGraw-Hill, 2007) and *The Logic of Logistics* (3rd edition, Springer 2013). He also published *Operations Rules: Delivering Customer Value through Flexible Operations (*MIT Press, 2011). He served as the Editor-in-Chief for Operations Research (2006-2012), the flagship journal of INFORMS and for Naval Research Logistics (2003-2005). He is an INFORMS Fellow, MSOM Distinguished Fellow and the recipient of the 2014 INFORMS Daniel H. Wagner Prize for Excellence in Operations Research Practice; 2014 INFORMS Revenue Management and Pricing Section Practice Award; 2009 INFORMS Revenue Management and Pricing Section Prize and Ford 2015 Engineering Excellence Award.Professor Simchi-Levi has consulted and collaborated extensively with private and public organizations. He was the founder of LogicTools which provided software solutions and professional services for supply chain optimization. LogicTools became part of IBM in 2009.