

Mathematical Models in Marketing

Fall 2017

Fridays, 1:00 – 4:00 pm

Room: 306 Uris Hall

Instructor: Rajeev Kohli

Overview

The purpose of the course is to provide an introduction to mathematical models in marketing. It covers a mix of standard topics (e.g., preference models, segmentation, marketing mix) and more recent topics (e.g., social networks, recommendation systems, web search, advertising auctions). The emphasis of the course is on developing skills that are useful for evaluating and conducting research in marketing using mathematical methods.

Classes are a combination of lectures and discussions of assigned articles. You are expected to actively contribute to class discussions and think critically about the concepts and issues discussed in the course. Reading and analyzing the required papers for each class is the best way to prepare for class participation. You are expected to prepare a short critique (2-3 pages) and lead the class discussion for selected papers. Both your critique and class discussion should focus on providing:

1. A succinct summary of the objective and contribution of the research.
2. A careful critique of the research, including a discussion of the paper's major strengths and weaknesses (spend most of the time here).
3. Future research issues in the problem area.

Grading

25% homework; 25% research proposal; 25% final exam; 25% class preparation and presentations.

You should identify a topic for the research proposal by the third week of class, so that you have sufficient time to acquire the relevant background and develop your

analysis. You should describe the problem, briefly review the relevant literature, explicitly state the proposed contribution, develop a model, describe the required data, and outline the analysis and expected results. But the entire paper need not be completed. For example, you do not have to collect data, or write it as a paper ready for submission to a journal. High quality work is expected. Using canned computer programs to analyze a data set is not an appropriate project for the course.

Readings

Readings for the sessions are given below. All the major journals in marketing are available online through Columbia University libraries. A pdf copy of the Easley and Kleinberg book *Networks, Crowds, and Markets: Reasoning About a Highly Connected World* is available from Jon Kleinberg's website.

Sessions 1, 2 and 3. Conjoint analysis, compensatory and non-compensatory models.

1. Green, P. E., and V. Srinivasan (1978), "Conjoint Analysis in Consumer Research: Issues and Outlook," *Journal of Consumer Research*, 5 (3), 103–123.
2. Srinivasan, V. and A.D. Shocker (1973), "Linear Programming Techniques for Multidimensional Analysis of Preferences," *Psychometrika*, 38 (3), 337–369.
3. Louviere, J.J. and G. Woodworth (1983), "Design and Analysis of Simulated Consumer Choice or Allocated Experiments: An Approach Based on Aggregate Data," *Journal of Marketing Research*, 20 (4), 350–367.
4. Toubia, O., D.I. Simester, J.R. Hauser and E. Dahan (2003), "Fast Polyhedral Adaptive Conjoint Estimation," *Marketing Science*, 22 (3), 273–303.
5. Kohli, R. and R. Krishnamurti (1987), "A Heuristic Approach to Product Design," *Management Science*, 33 (12), 1523–1533.
6. Green, P.E. and A.M. Krieger (1985), "Models and Heuristics for Product Line Selection," *Marketing Science*, 4 (1), 1–19.
7. Bertsimas., D. and V.V. Mišić (2016), "Robust Product Line Design," *Opera-*

tions Research, 65 (1), 19–37.

8. Yee, M., E. Dahan, J. R. Hauser, and J. Orlin (2007), “Greedoid-Based Non-Compensatory Consideration-Then-Choice Inference,” *Marketing Science*, 26 (4), 532–549.
9. Kohli, R., K. Boughanmi and V. Kohli (2017), “Randomized Algorithms for Lexicographic Inference,” working paper, Columbia Business School.
10. Kohli, R. and K. Jedidi (2015), “Error Theory for Elimination by Aspects,” *Operations Research*, 63 (3), 512–526.

Sessions 4 and 5. Segmentation, Targeting, Personalization.

1. Cluster Analysis: Basic Concepts and Algorithms.
2. Green, P. E. and A.M. Krieger (1991), “Segmenting Markets With Conjoint Analysis,” *Journal of Marketing*, 20–31.
3. Kamakura, W. A. and G. J. Russell (1989), “A Probabilistic Choice Model for Market Segmentation and Elasticity Structure,” *Journal of Marketing Research*, 26 (November), 379–390.
4. Das, A., M. Datar and A. Garg (2007), “Google News Personalization: Scalable Online Collaborative Filtering,” In *Proceedings of the 16th international conference on World Wide Web*, pp. 271–280, ACM.
5. Linden, G., B. Smith and J. York (2003), “Amazon.com Recommendations: Item-to-Item Collaborative Filtering,” *IEEE Internet Computing*, 7 (1), 76–80.
6. Ansari, A., S. Essegiaier and R. Kohli (2000), “Internet Recommendation Systems,” *Journal of Marketing Research*, 37 Aug.), 364–375.
7. Pazzani, M.J. and D. Billsus (2007), “Content-Based Recommendation Systems,” in *The Adaptive Web*, pp. 325–341, Springer, Berlin, Heidelberg.
8. Leskovec, J., L.A. Adamic and B.A. Huberman (2007), “The Dynamics of Viral Marketing,” *ACM Transactions on the Web*, 1 (1), 5.

9. Lambrecht, A. and C. Tucker (2013), “When Does Retargeting Work? Information Specificity in Online Advertising,” *Journal of Marketing Research*, 50 (5), 561–576.

Sessions 6 and 7. Diffusion, information, cascades, networks and social media.

1. Mahajan, V., E. Muller and F. M. Bass (1990), “New Product Diffusion Models in Marketing: A Review and Directions for Research,” *Journal of Marketing*, 1–26.
2. Godes, D. and D. Mayzlin (2004), “Using Online Conversations to Study Word-of-Mouth Communication,” *Marketing Science*, 23 (4), 545–60.
3. Kumar, V., V. Bhaskaran, R. Mirchandani and M. Shah (2013), “Creating a Measurable Social Media Marketing Strategy: Increasing the Value and ROI of Intangibles and Tangibles for Hokey Pokey,” *Marketing Science*, 32 (2), 194–212.
4. Borgatti, S.P., A. Mehra, D. J. Brass and G. Labianca (2009), “Network Analysis in the Social Sciences,” *Science*, 323, 892–895.
5. Watts, D. J. and P. S. Dodds (2007), “Influentials, networks, and public opinion formation,” *Journal of Consumer Research*, 34 (4), 441–58.
6. Easley, D. and J. Kleinberg (2010), “Information Cascades,” Chapter 16 in *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*.
7. Easley, D. and J. Kleinberg (2010), “Cascading Behavior in Networks,” Chapter 19 in *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*.
8. Easley, D. and J. Kleinberg (2010), “Markets and Information,” Chapter 22 in *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*.
9. Easley, D. and J. Kleinberg (2010), “Graph Theory and Social Networks,” Chapter 2 in *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*.

10. Easley, D. and J. Kleinberg (2010), “Strong and Weak Ties,” Chapter 3 in *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*.
11. Easley, D. and J. Kleinberg (2010), “Networks in Their Surrounding Contexts,” Chapter 4 in *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*.
12. Easley, D. and J. Kleinberg (2010), “The Small Worlds Phenomenon,” Chapter 20 in *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*.

Session 8 and 9. Marketing mix - pricing and promotions.

1. Easley, D. and J. Kleinberg (2010), “Auctions,” Chapter 9 in *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*.
2. Easley, D. and J. Kleinberg (2010), “Link Analysis and Web Search,” Chapter 14 in *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*.
3. Easley, D. and J. Kleinberg (2010), “Sponsored Search Markets,” Chapter 15 in *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*.
4. Bijmolt, T.H.A., H.J. Van Heerde, R.G.M. Pieters (2005), “New Empirical Generalizations on the Determinants of Price Elasticity,” *Journal of Marketing Research*, 42 (2), 141-156.
5. Iyengar, R., K. Jedidi and R. Kohli (2008), “A Conjoint Approach to Multi-Part Pricing,” *Journal of Marketing Research*, 45 (2), 195–210.
6. H.J. van Heerde, S. Gupta and D.R. Wittink (2003) Is 75% of the Sales Promotion Bump Due to Brand Switching? No, Only 33% Is,” *Journal of Marketing Research*, 40 (4) 481–491.
7. van Ryzin, G.J. and K.T. Talluri (2005), “An Introduction to Revenue Management,” *Tutorials in Operations Research*, INFORMS, 142–194.

Session 10 and 11. Marketing mix - new products, advertising, distribution, retailing and salesforce.

1. Silk, A.J. and G.L. Urban (1978), “Pre-Test-Market Evaluation of New Packaged Goods: A Model and Measurement Methodology,” *Journal of Marketing Research*.
2. Anderson, E., S. Lin, D. Simester and C. Tucker (2015), “Harbingers of Failure,” *Journal of Marketing Research*, 52 (5), 580–592.
3. Brynjolfsson, Erik, Yu Hu, and Duncan Simester (2011), “Goodbye Pareto Principle, Hello Long Tail: The Effect of Search Costs on the Concentration of Product Sales,” *Management Science*, 57 (8), 1373–1386.
4. Simester, D.I., P. Sun and J.N. Tsitsiklis (2006), “Dynamic Catalog Mailing Policies,” *Management Science*, 52 (5), 683–696.
5. Little, J.D.C. (1979), “Aggregate Advertising Models: The State of the Art,” *Operations Research*, 27 (4), 629–667.
6. Mela, C., S. Gupta, and D. R. Lehmann (1997), “The Long-Term Impact of Promotion and Advertising on Consumer Brand Choice,” *Journal of Marketing Research*, 34(2), 248-261.
7. Naik, P.A., M.K. Mantrala and A.G. Sawyer (1998), “Planning Media Schedules in the Presence of Dynamic Advertising Quality,” *Marketing Science*
8. Feldman, J. and S. Muthukrishnan (2008), “Algorithmic Methods for Sponsored Search Advertising,” *Performance Modeling and Engineering*, 1, 91–122.
9. Zoltners, A. A. and P. Sinha (2005), “Sales Territory Design: Thirty Years of Modeling and Implementation,” *Marketing Science*, 24 (3), 313–331.
10. Basu, A., R. Lal, V. Srinivasan and R. Staelin (1985), “Salesforce Compensation Plans: An Agency Theoretic Perspective,” *Marketing Science*, 4 (4), 267–291.

Session 12. Presentations.