

Advanced Mathematical Methods for Infrastructure and Transportation Planning

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Aims and Scopes

- ▶ To study the theory and the applications of “Discrete Choice Model (DCM, 離散選択モデル)”, which is one of the most popular method for travel demand forecasting.
 - ▶ Theoretical Basis: Microeconomics, Applied Statistics, Optimization Theory, Simulation
 - ▶ Applications: Predicting shares in travel demand or other market, Economic evaluation of transport infrastructures
- ▶ To learn about some practical issues of DCM through several exercises and assignments (Model estimation with some dataset).
 - ▶ “BIOGEME”: Free software for estimation and simulation of DCM
 - ▶ Computer Labs. with dataset from various research field such as “transportation”, “telecommunication”, “energy” and “marketing”.

Applications of DCM

- ▶ Most of early studies deal with individuals' "Mode choice".
 - ▶ McFadden (1974): Seminal paper
 - ▶ Domencich and McFadden (1975): Forecasting the passenger demand of Bay Area Rapid Transit (San Francisco)
- ▶ Other applications (mainly the works by the professors at TokyoTech)
 - ▶ Recreation demand (Hausman et al. 1995, Fukuda and Morichi 1999)
 - ▶ Telephone-service choice (Train et al. 1987)
 - ▶ Occupation (job) choice (Schmidt and Strauss 1975)
 - ▶ Trip destination choice (Yai 1985)
 - ▶ Railway route choice for Tokyo Network (Yai et al. 1997)
 - ▶ Choice of a daily activity pattern (Fujii 1997)
 - ▶ Car-parking choice (Muromachi 1993)
 - ▶ Analysis of illegal-bicycle-parking (Fukuda 2004)
 - ▶ Pedestrian behavior (Antonini et al. 2006)
- ▶ Other interesting applications: Facial expressions, Selection of supporting political party, etc.

References for Your Study

- ▶ Ben-Akiva, M. & Lerman, S. (1985) Discrete Choice Analysis: Theory and Applications to Travel Demand, MIT Press.
- ▶ Train, K. (2003) Discrete Choice Methods with Simulation, Cambridge University Press.
- ▶ 北村他 (2002) 交通行動の分析とモデリング, 技報堂出版.
- ▶ 土木学会 [編] (1996) 非集計行動モデルの理論と応用, 土木学会.
- ▶ Supplemental readings will be distributed at OCWi if necessary.

Class Schedule

1. (April 11) Choice Behavior and Binary Choice Models (BCM)
2. (April 18) Estimation of BCM
3. (April 25) *Computer Lab. (1)*: Estimation of BCM
4. (May 2) Multinomial Choice Models: Logit and Probit
5. (May 16) Specification and Estimation of Multinomial Logit Models (MNL)
6. (May 23) *Computer Lab. (2)*: Estimation of MNL
7. (May 30) Statistical Tests of Discrete Choice Models
8. (June 6) Independent from Irrelevant Alternatives, Forecasting and Microsimulation
9. (June 13) *Computer Lab. (3)*: Statistical Testing & Forecasting
10. (June 20) Nested Logit Model (NL)
11. (July 4) Issues on Sampling
12. (July 11) *Computer Lab. (4)*: NL & Sampling Issues
13. (July 18) Mixed Logit Model (MXL) & Simulation-based Estimation
14. (July 25) *Computer Lab. (5)*: Estimation of MXL

Course Evaluation and Advance Preparation

- ▶ Class participation
 - ▶ Five assignments (corresponding five exercises)
 - ▶ Estimation of DCM, programming and forecasting market shares
 - ▶ The “BIOGEME” will be used in all exercises and assignments. The website of BIOGEME: <http://biogeme.epfl.ch>
 - ▶ Interpretation, discussion & new suggestions with your estimation results
 - ▶ You may write assignments either in English or in Japanese.
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- ▶ Students are required to bring a laptop PC for those five exercises.
 - ▶ All lecture materials have already been uploaded on TITECH OCW-i (<https://secure.ocw.titech.ac.jp/ocwi/>). Students are required to print them out and bring them to each class.
 - ▶ Exercise materials have also been uploaded. Students are required to download and save them into your PC in advance.