Week 10

Conjoint Analysis

analysis of features considered jointly

Forms of conjoint analysis

- **Choice-based**
- **Adaptive:** Each customer is asked a different set of questions which are decided dynamically based on their responses
- **Full-profile:** a full suite of options is presented to the consumer
- **Menu-based:** consumer is shown a list of attributes with associated prices and they choose their ideal product

Process

- Define products as a collection of attributes
- Consumers react to a number of alternatives
- Infer attributes'
    - importance
    - most desired level of each consumer

Optimization Method (Linear Programming)

💡 used when consumer choice data is pairwise data and attribute values are continuous

- Set of options on which the preference judgement is made: $j = \{1, 2, .., n\}$
- The n options are described in terms of t dimensions: $P = \{1, 2, .., t\}$
- The pre-specified location of the j^{th} option in the t-dimensional space is denoted by Y_j i.e. $Y_j = \{Y_{j,p}\}p \in P$
- The ideal point of the subject is $X = \{x_p\}p \in P$ i.e. the product location most preferred by the individual.
- Unweighted distance $d_j^u = [\sum_{p \in P}(y_{j,p} - x_p)^2]^{1/2}, \forall j \in J$
- Weighted distance $d_j^w = [\sum_{p \in P} w_p(y_{j,p} - x_p)^2]^{1/2}, \forall j \in J$
- **The objective function is a minimization function and can be defined as poorness of fit.**
  $B = \text{poorness of fit} = \sum_{(j,k) \in \Omega}(s_j - s_k)^+$
- $a_{jkp} = y_{kp}^2 - y_{jp}^2 \in \Omega \text{ and } p \in P$
- $b_{jkp} = -2(y_{kp} - y_{jp}), \forall (j,k) \in \Omega \text{ and } p \in P$
- $V = v_p = \{w_p x_p\}, p \in P$
- $z_{jk} = max[0, -[\sum_{p \in P} w_p a_{jkp} + \sum_{p \in P} v_p b_{jkp}]]$

Final Formulation:

- $A_p = \sum_{(j,k) \in \Omega} a_{jkp} \text{ for } p \in P$
- $D_p = \sum_{(j,k) \in \Omega} b_{jkp} \text{ for } p \in P$

Linear Program:

$$\text{Min} \sum_{(j,k)\in\Omega} z_{jk}$$
Subject to:
$$\sum_{p\in P} w_p a_{jkp} + \sum_{p\in P} v_p b_{jkp} + z_{jk} \geq 0 \text{ for } (j,k) \in \Omega$$
$$\sum_{p\in P} w_p A_p + \sum_{p\in P} v_p D_p = 1$$

Statistical method (Linear Regression)

> 💡 used when consumer choice data is ratings and product attributes are categorical

- **dependent variable:** respondent's ratings
- **independent variables:** product attributes
- **Utilities for the levels/Partworths:** estimated betas associated with the independent variable