MARKETING ANALYTICS IN R: CHOICE MODELING

Why choice modeling?

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Regression modeling relates predictors to numeric outcomes

A **linear regression model** is used to predict a **number**.

In marketing, we might use a **linear regression** to understand how how the sales at a store are related to the features of that store. Sales is a number.

Many events we want to understand and predict are choices

- Selecting a dress for a special occasion from an online retailer

- Choosing what to watch on a video streaming service

- Buying a car

Choices require their own special type of regression

Multinomial logistic regression or the **multinomial logit model** is used to predict a choice from a set of alternatives. The prediction is based on the features of each alternative. For instance, we can predict the likelihood of choosing a particular car based on the features of the available cars.

Logistic regression or the **logit model** is a special case of multinomial logistic regression used to predict binary "yes/no" such as the uptake on a promotional offer.

Marketing applications for choice models

Designing new products

- Understand how product features relate to what people will buy

Pricing

- Determine how price is related to market share

Merchandising

- Measure the effect of a "customer favorite" flag on which product a online shopper chooses

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What choices are you interested in analyzing?

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Inspecting choice data

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Data for linear regression

sales_2018	size	country	population
1249629	1259	US	10056
1350869	2055	US	12058
50456	1400	CN	5340
78451	1252	UK	22095
1509347	1739	DE	12756
99456	1850	CN	9453

Each row is an observation

Data for a choice model

Each observation is described by three rows: one for each option

ques	alt	choice	seat	trans	price
1	1	0	2	manual	35
1	2	0	5	auto	40
1	3	1	5	auto	30
2	1	1	5	manual	35
2	2	0	2	manual	30
2	3	0	4	auto	35

Summarizing choice data with choice counts

To count up the number of times a car is chosen at each price point:

```
xtabs(choice ~ price, data=sportscar)
```

Resulting in:

```
price
  30  35  40
1010 666 324
```

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Let's look at some choice data in R!

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Fitting and interpreting a choice model

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Fitting a linear model with lm()

To fit a linear regression model:

```
my_model <- lm(y ~ x1 + x2 + x3, data=lm_data)
summary(my_model)
```

lm_data data frame

y	x1	x2	x3
3	2	7	2
1	1	7	8
3	2	4	6

Fitting a choice model with mlogit()

To fit a choice model:

```r
library(mlogit)
mymodel <- mlogit(choice ~ feature1 + feature2 + feature3, data = choice_data)
```

choice_data

ques	alt	choice	feature1	feature2	feature3
1	1	1	low	high	low
1	2	0	low	high	high
1	3	0	high	high	low
2	1	0	high	low	high
2	2	1	high	high	low
2	3	0	low	low	low

Summary of mlogit() model object

```
summary(mymodel)

...

Coefficients :
              Estimate Std. Error  t-value  Pr(>|t|)
feature1low  -0.0322059  0.0740839  -0.4347    0.6638
feature2low   0.4546283  0.0727445   6.2497 4.114e-10 ***
feature3low  -1.2926911  0.0648649 -19.9290 < 2.2e-16 ***

Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

...
```

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Let's find out how people value the features of sports cars.

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Using choice models to make decisions

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Predicting choice shares

A choice model can be used to predict the market shares for a new set of products.

For example, the predicted shares for three sports cars cars might look like this:

```
     share seat   trans convert price
1 0.1767525    2 manual      no    35
2 0.5974280    2   auto      no    35
3 0.2258195    4   auto      no    40
```

If we change our design:

```
      share seat trans convert price
1 0.65314409    2  auto      no    30
2 0.25171218    2  auto      no    35
3 0.09514373    4  auto      no    40
```

predict_mnl() function

```
predict_mnl(model, products)
```

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Let's predict some shares!