Contrasts

Peter von Rohr

2024-04-15

Contrasts

- Linear combination of parameters
- In R used to determine which estimable functions are shown as factor level effects

Example Dataset

Table 1: Body Weight and Breed of Beef Cattle Animals

Animal	Body Weight	Breed
1	471	Angus
2	463	Angus
4	470	Angus
7	518	Limousin
8	511	Limousin
9	510	Limousin
10	541	Limousin
3	481	Simmental
5	496	Simmental
6	491	Simmental

Contrasts in R

```
(mat_ctr <- contrasts(as.factor(tbl_flem_bw_breed$Breed)))
```

```
##           Limousin Simmental
## Angus            0         0
## Limousin         1         0
## Simmental        0         1
```

Model Matrix

```r
model.matrix(lm(`Body Weight` ~ Breed,
                data = tbl_flem_bw_breed))
```

```
##    (Intercept) BreedLimousin BreedSimmental
## 1            1             0              0
## 2            1             0              0
## 3            1             0              0
## 4            1             1              0
## 5            1             1              0
## 6            1             1              0
## 7            1             1              0
## 8            1             0              1
## 9            1             0              1
## 10           1             0              1
## attr(,"assign")
## [1] 0 1 1
## attr(,"contrasts")
## attr(,"contrasts")$Breed
```

Estimable Functions

- extend contrasts matrix by one row of all ones for the intercept

```
##           (Intercept) Limousin Simmental
## Angus              1        0         0
## Limousin           1        1         0
## Simmental          1        0         1
```

Estimable Functions II

▶ Inverse of extended contrasts matrix

```
##             Angus Limousin Simmental
## (Intercept)     1        0         0
## Limousin       -1        1         0
## Simmental      -1        0         1
```

▶ First row: which group means are used for intercept
▶ Other rows: vectors q^T representing estimable functions

Validation

- Compute a solution of least squares normal equation
- Use matrix of estimable functions to validate effects estimates

Default Contrasts

- Per default: `treatment` contrasts
- Factor levels in alphabetical order
- First level corresponds to control, other levels are treatments
- Intercept estimate as mean observation for control group
- Effects estimates as difference between treatment and control
  solutions of normal equations

Other Contasts

- Helmert
- sum
- poly

Custom Contrasts

- ▶ Construct own matrix of estimable functions
- ▶ Invert that matrix
- ▶ Ignore first column
- ▶ Use remaining matrix of contrasts as argument in `lm()`