

Multivariate statistics: Assignment 1

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1 Data trichotomization

To trichotomize the data, suitable cut-off points need to be found. The cutoff points are often chosen based on either expert knowledge or so as to optimize predictive power. An easy, often used method for dichotomization is a median-split since it assures that there are an equal amount of observation at either side of the cut-off value. Similarly, for trichotomization, we could aim for approximately 33.33% of the observations in each of the three categories. That would result in the following three categories: $[-12,4]$, $(4,11]$, $(11,70]$.

It is quite common in literature to dichotomize hearing loss into normal hearing (≤ 25 dB) and hearing loss (> 25 dB) (see Garinis et al. 2017; Gallagher et al. 2019; Ju et al. 2022, for example). However, thichotomization is less common and it should be noted that it is generally not advised to discretize continuous data since some information is inevitably lost (Nelson et al. 2017; MacCallum et al. 2002).

The Centers for Disease Control and Prevention distinguishes the following levels of hearing loss, based on Clark (1981):

- ≤ 25 dB: Normal hearing
- 26 - 40 dB: Mild hearing loss
- 41 - 55 dB: Moderate hearing loss
- 56 - 70 dB: Moderate / severe hearing loss
- 71 - 90 dB: Severe hearing loss
- ≥ 91 dB: Profound hearingloss

Table 1: Number of observations in each pre-defined categories from Clark (1981)

Category	Nb observations	Percentage	Cumulative percentage	Nb subjects	Avg age
$(-13,25]$	4148	93.87	93.87	536	56.12
$(25,40]$	239	5.41	99.28	91	71.85
$(40,55]$	22	0.50	99.77	14	75.70
$(56,70]$	10	0.23	100.00	1	70.18

Table 1 shows that, in this dataset, there is no one in the severe hearing loss categories and the large majority has normal hearing (93.867390812401). The median for all observation with normal hearing (≤ 25 dB) is 6dB. We therefor suggest to trichotomize the data into the following categories:

- ≤ 6 dB: Excellent hearing
- 7 - 25 dB: Normal hearing
- ≥ 25 dB: Hearing loss

2 Marginal model

Q2

3 Random-effects model

Q2

3.1 Empirical Bayes prediction

Q3

4 Transition model

Q4

5 Discussion

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