

STATISTICAL RETHINKING 2023

WEEK 2

1. From the `Howell1` dataset, consider only the people younger than 13 years old. Estimate the causal association between age and weight. Assume that age influences weight through two paths. First, age influences height, and height influences weight. Second, age directly influences weight through age-related changes in muscle growth and body proportions.

Draw the DAG that represents these causal relationships. And then write a generative simulation that takes age as an input and simulates height and weight, obeying the relationships in the DAG.

2. Use a linear regression to estimate the **total** causal effect of each year of growth on weight.

3. Now suppose the causal association between age and weight might be different for boys and girls. Use a single linear regression, with a categorical variable for sex, to estimate the total causal effect of age on weight separately for boys and girls. How do girls and boys differ? Provide one or more posterior contrasts as a summary.

4 - OPTIONAL CHALLENGE. The data in `data(0xboys)` (`rethinking` package) are growth records for 26 boys measured over 9 periods. I want you to model their growth. Specifically, model the increments in growth from one period (`Occasion` in the data table) to the next. Each increment is simply the difference between height in one occasion and height in the previous occasion. Since none of these boys shrunk during the study, all of the growth increments are greater than zero. Estimate the posterior distribution of these increments. Constrain the distribution so it is always positive—it should not be possible for the model to think that boys can shrink from year to year. Finally compute the posterior distribution of the total growth over all 9 occasions.