

Exam 02 Review

2019-11-20

```
library(Sleuth3)
library(knitr)
library(broom)
library(tidyverse)
library(arm)
library(nnet)
```

Data Description

- We would like to identify crab species based on the closing force and propodus height of claws
 - `ex0722` data set in the `Sleuth3` R package
- **Predictors:**
 - `Force` : Closing force of claw (newtons)
 - `Height` : Propodus height (mm)
- **Response:**
 - `Species` : Hemigrapsus nudus (Hn), Lophopanopeus bellus (Lb), Cancer productus (Cp)

Part I: Lb species?

Suppose we want to use `Force` and `Height` to determine whether or not a crab is from the *Lophopanopeus bellus* (Lb) species.

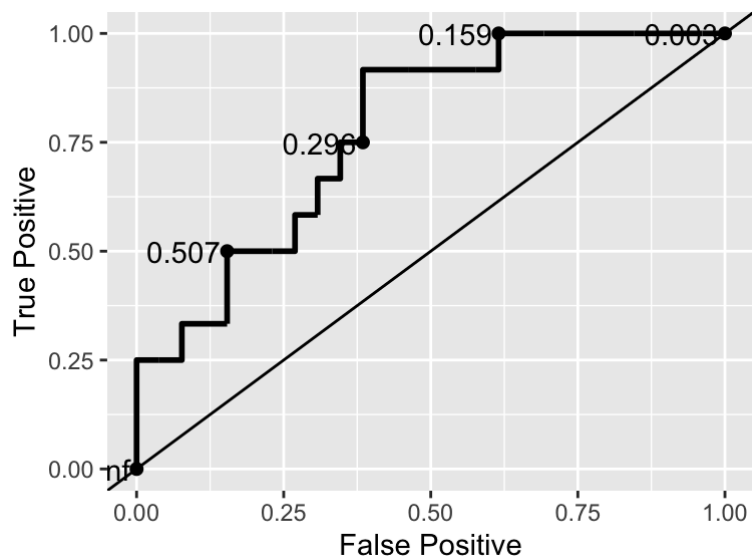
1. What type of model should we use? Briefly explain your choice.
2. Briefly explain how you would conduct exploratory data analysis.

We will use the mean-centered variables for `Force` and `Height`. The model output is below.

| term | estimate | std.error | statistic | p.value |
|-------------|----------|-----------|-----------|---------|
| (Intercept) | -1.130 | 0.463 | -2.443 | 0.015 |
| forceCent | 0.211 | 0.092 | 2.279 | 0.023 |
| heightCent | -0.895 | 0.398 | -2.249 | 0.025 |

3. Write the equation for the odds of a crab being from the Lb species.
4. Interpret the intercept in the context of the problem.
5. Interpret `forceCent` in the context of the problem.

The ROC curve is below.



```
## [1] 0.775641
```

6. What does *sensitivity* mean in the context of this data? What does *specificity* mean?

7. Suppose we use a threshold of 0.507. What is the *sensitivity* at this threshold? What is the *specificity*?

Part 2: Which species?

Suppose we want to use force and height to determine a crab's species. The model output is below:

| y.level | term | estimate | std.error | statistic | p.value |
|---------|-------------|----------|-----------|-----------|---------|
| Hn | (Intercept) | -1.193 | 1.106 | -1.079 | 0.281 |
| Hn | forceCent | -0.494 | 0.196 | -2.514 | 0.012 |
| Hn | heightCent | 0.179 | 0.474 | 0.378 | 0.705 |
| Lb | (Intercept) | 0.021 | 0.602 | 0.034 | 0.973 |
| Lb | forceCent | 0.095 | 0.101 | 0.941 | 0.347 |
| Lb | heightCent | -0.902 | 0.429 | -2.103 | 0.035 |

1. Write the equation of the model.

2. Interpret the intercept for the odds a crab is Hn vs. Cp species.

3. Interpret the coefficient of `forceCent` for the odds a crab is Lb .vs Cp species.