Hawks: A Data Analysis on 3 Different Hawk Species

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Hawks: A Data Analysis on 3 Different Hawk Species

ABSTRACT

Hawks are a part of a large group of predatory birds with varying species that include sharp talons and beaks (see Appendix A). At the Cornell College in Mount Vernon, Iowa from the years 1992 through 2003, a study on various measurements on three different hawk species (Cooper's, Red-tailed, and Sharp-shinned) was performed. A data analysis will be performed on the three different species of hawks based off specific measurements of the winged creature.

BACKGROUND

A Cooper's hawk is a medium-sized hawk native to North America that tends to live in wooded habitats and is easily confused with it smaller family member, the Sharp-shinned (Wikipedia). The Red-tailed (or 'Chickenhawk') is another bird of prey that is located across North America within forest or desert biomes (Wikipedia). Lastly, the Sharp-shinned hawk is a small hawk located in North America and is separated into four smaller sub-species (Wikipedia).

BUSINESS UNDERSTANDING

Hawks are not susceptible to extinction, but they have been prone to be vulnerable to hunting for game as well as have gathered predators against them such as larger birds of prey, red foxes, or racoons (see Appendix B). A data analysis will be performed upon three different hawk species (Cooper's, Red-tailed, and Sharp-shinned) to determine which measurements contribute to the survival of the winged animal.

DATA UNDERSTANDING

Table 1

hawks.csv dataset

(Head)

A data frame with 908 observations on 19 variables.

```
##   X Month Day Year CaptureTime ReleaseTime  BandNumber Species Age Sex Wing
## 1 1     9  19 1992       13:30           877-76317      RT   I     385
## 2 2     9  22 1992       10:30           877-76318      RT   I     376
## 3 3     9  23 1992       12:45           877-76319      RT   I     381
## 4 4     9  23 1992       10:50           745-49508      CH   I   F  265
## 5 5     9  27 1992       11:15          1253-98801      SS   I   F  205
## 6 6     9  28 1992       11:25          1207-55910      RT   I     412
##   Weight Culmen Hallux Tail StandardTail Tarsus WingPitFat KeelFat Crop
## 1    920   25.7   30.1  219          NA     NA        NA      NA   NA
## 2    930     NA     NA  221          NA     NA        NA      NA   NA
## 3    990   26.7   31.3  235          NA     NA        NA      NA   NA
## 4    470   18.7   23.5  220          NA     NA        NA      NA   NA
## 5    170   12.5   14.3  157          NA     NA        NA      NA   NA
## 6   1090   28.5   32.2  230          NA     NA        NA      NA   NA
```

Month 8=September to 12=December

Day Date in the month

Year Year: 1992-2003

CaptureTime Time of capture (HH:MM)

ReleaseTime Time of release (HH:MM)

BandNumber ID band code

Species CH=Cooper's, RT=Red-tailed, SS=Sharp-Shinned

Age A=Adult or I=Immature

Sex F=Female or M=Male

Wing Length (in mm) of primary wing feather from tip to wrist it attaches to

Weight Body weight (in gm)

Culmen Length (in mm) of the upper bill from the tip to where it bumps into the fleshy part of the bird

Hallux Length (in mm) of the killing talon

Tail Measurement (in mm) related to the length of the tail (invented at the MacBride Raptor Center)

StandardTail Standard measurement of tail length (in mm)

Tarsus Length of the basic foot bone (in mm)

WingPitFat Amount of fat in the wing pit

KeelFat Amount of fat on the breastbone (measured by feel

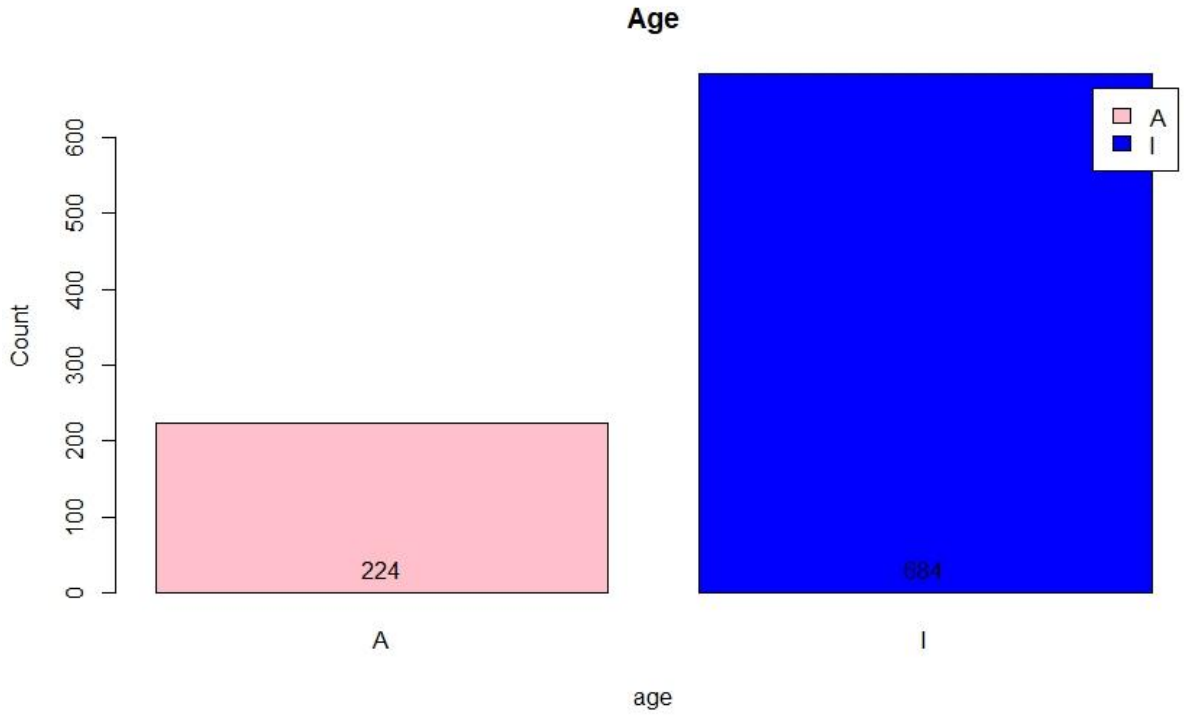
Crop Amount of material in the crop, coded from 1=full to 0=empty

DATA PRPARATION

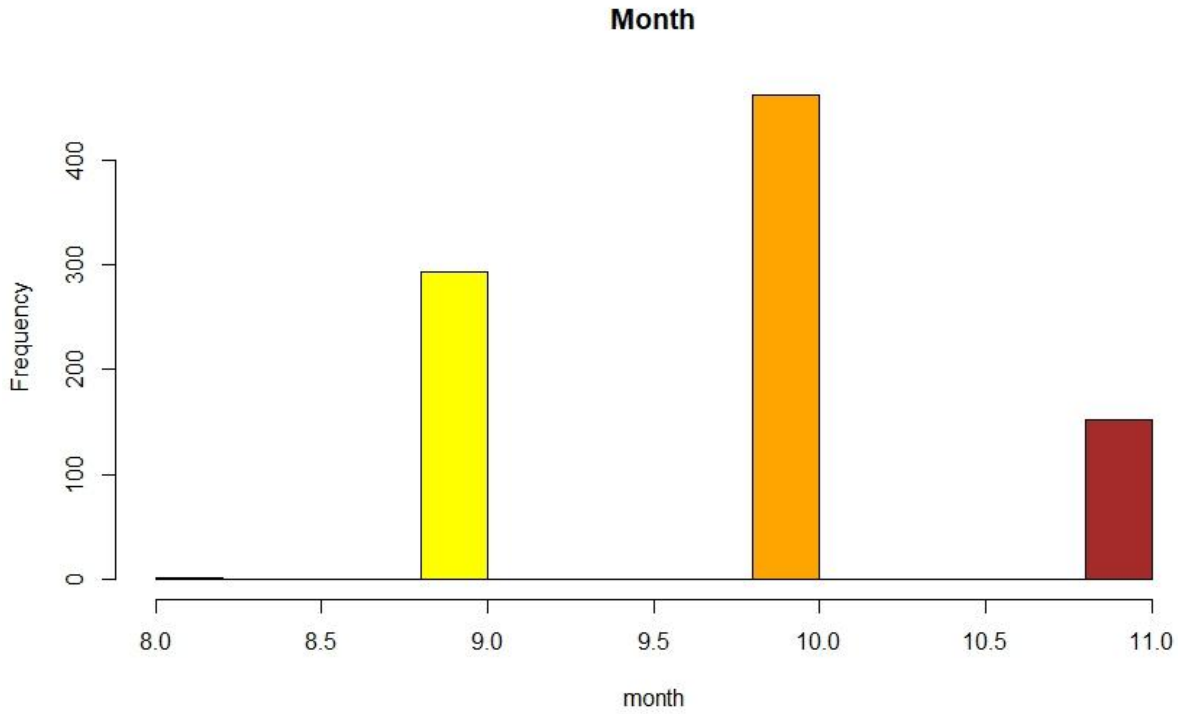
Due to the fact that this data is supplied from a R repository, there is no Nulls, but there is missing values as well as NaN's, thus the only data manipulation will be replacing those NaN's.

Business Questions

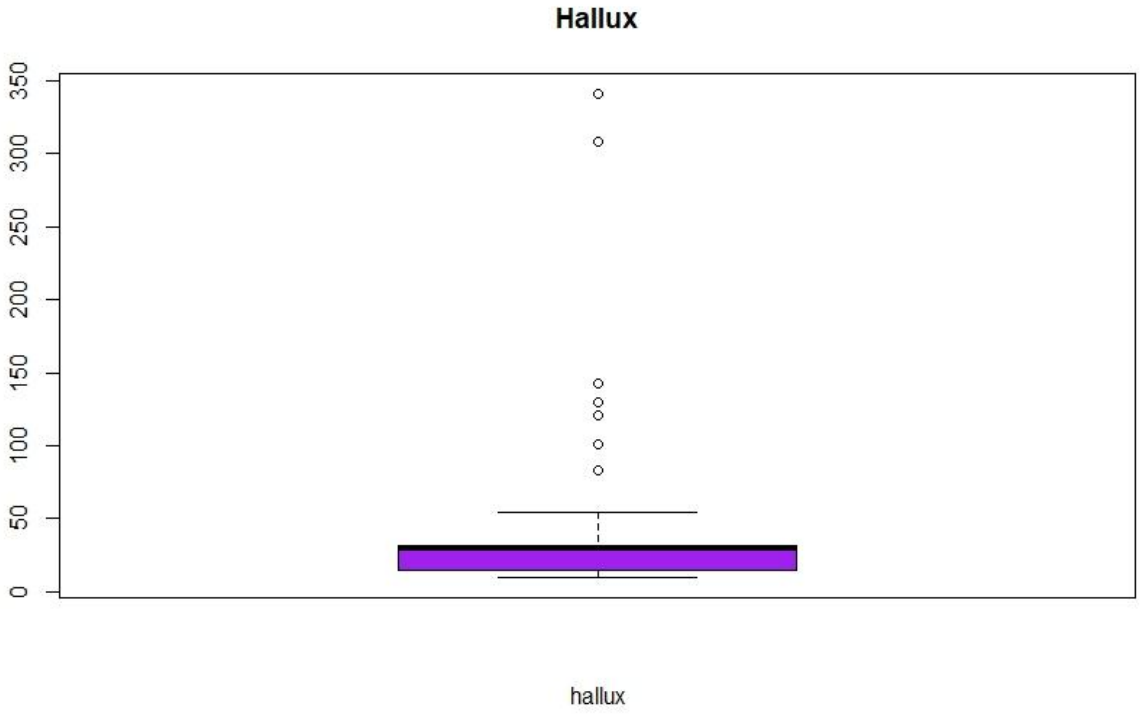
1) Which species of hawks grew to maturity (adulthood)?
2) Which species of hawks migrated south in the month of November?
3) Which species of hawks has a lengthier hallux (killing talon)?
4) Does the time of capture have anything to do with the maturity of the species of hawks?



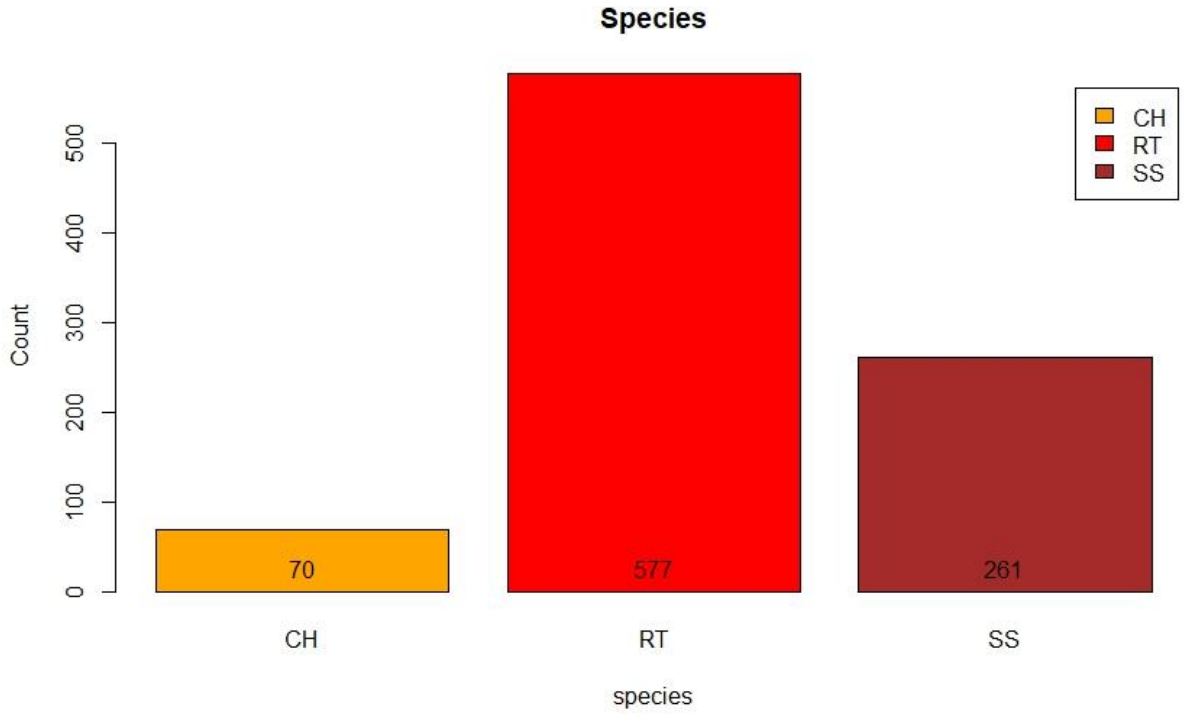
A bar chart was made for the age variable based off the hawks data set; there is more immature hawks rather than adult.



A bar chart was made for the month variable based off the hawks data set; there is more hawks present in the month of October compared to others.



A boxplot was made for the hallux variable based off the hawks data set; there is outliers which will still be included (i.e., not removed from the original dataset).



A bar chart was made for the species variable based off the hawks data set; there is more red-tailed hawks compared to others.

Assumptions

I. A Red-tailed hawk is the most species recorded, hence, will be the species to grow to maturity the most.

II. Due to the Sharp-shinned hawk being identified from Cornell Lab of Ornithology for being the hawk to migrate the most in November, this hawk will be the most to take part in migration in the month of November (Sharp-shinned Hawk).

III. Due to the Red-tailed hawk being the largest out of the three hawk species recorded, it will have a lengthier hallux (or killing talon).

IV. If a hawk is immature, then it will tend to be captured more during afternoon times along with a Red-tailed hawk being the most prominent out of the three.

MODELING/METHODS

To perform this data analysis of the varying specific measurements, clustering models will be built for age, month, and hallux versus the species of hawks while a regression model will be built on capture time, age, & species of hawks versus the hallux.

DEPLOYMENT/RESULTS

After building clustering models for age, month, and hallux versus the species of hawks as well as a regression model for capture time, age, and species of hawks versus the hallux, a performance check on the models will be executed to deliberate whether these models correspond to the hypotheses.

Cross table of Species of Hawks vs Age:

Species	Adult	Immature	Total
Cooper's	32	38	70
Red-tailed	123	454	577
Sharp-shinned	69	192	261
————-	———	———	———-
Total	224	684	908

A cross table was ultimately utilized for the species of hawks versus the age of a hawk which concluded that a Red-tailed hawk is the most out of the three species of hawks that grew to maturity or better known as adulthood. There is no performance on the cross table as it is not a model.

Cross table of Species of Hawks vs Month:

Species	August	September	October	November	Total
Cooper's	0	31	34	5	70
Red-tailed	1	150	314	112	577
Sharp-shinned	0	112	114	35	261
————-	———	———	———-	———	———
Total	1	293	462	152	908

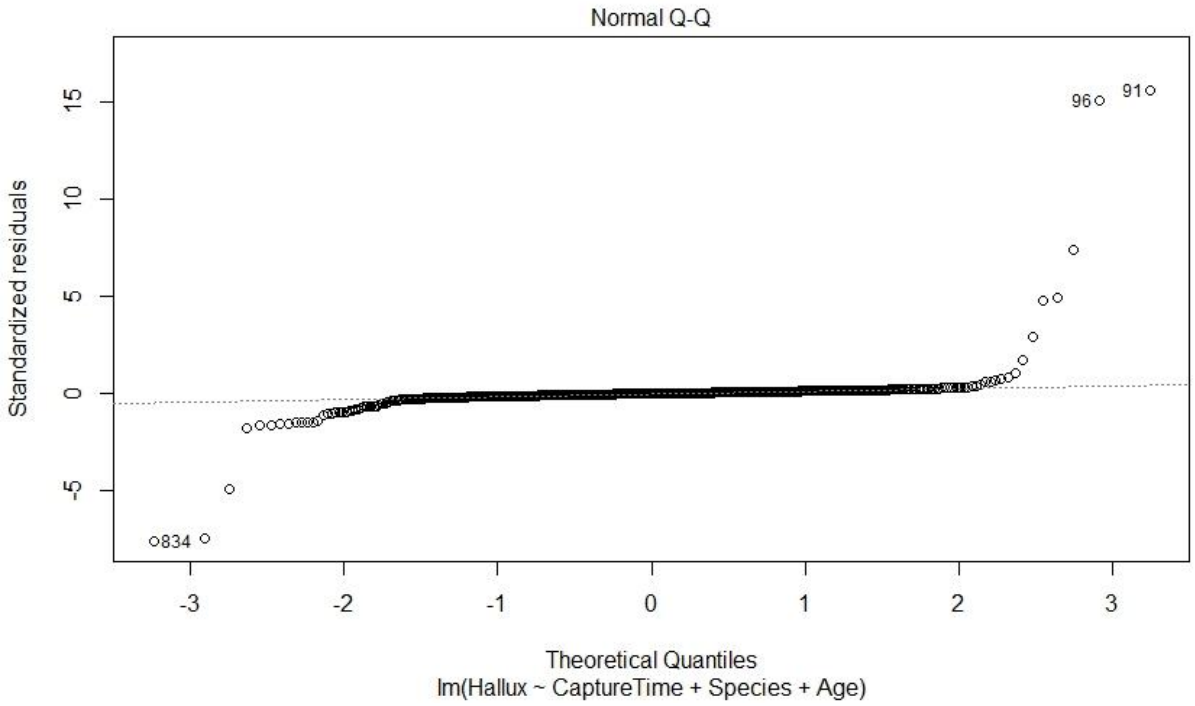
A cluster model was built for the month variable by first creating a dissimilarity matrix, followed by a multivariate gradient plot based off the dissimilarity matrix. The best number of clusters that would fit the month variable was 4, so a multidimensional scaling plot was projected for the month variable which was colored by the PAM cluster. Another plot was visualized of the species of hawks and PAM cluster for the month variable. Lastly, a cross table was showcased to indicate that Cooper's hawks was the most out of the three species of hawks to participate in migration in the month of November. The performance on the model built was nearly 100% accurate.

Cross table of Species of Hawks vs Hallux:

Species	Hallux Avg
Cooper's	22.82
Red-tailed	31.96
Sharp-shinned	15.10

A cluster model was built for the hallux variable by first creating a dissimilarity matrix, followed by a multivariate gradient plot based off the dissimilarity matrix. The best number of clusters that

would fit the hallux variable was 2, so a multidimensional scaling plot was projected for the hallux variable which was colored by the PAM cluster. Another plot was visualized of the species of hawks and PAM cluster for the hallux variable. Lastly, a cross table was showcased to indicate that Red-tailed hawks was the most out of the three species of hawks to have a lengthier hallux or killing talon. The performance on the model built was nearly 100% accurate.



A regression model was built for capture time, age, and species of hawks versus the hallux variable. A table was first created for the three different variables: capture time, species, and age, followed by a regression model being constructed with the hallux variable against the factors: capture time, species, and age. A projection of the summary of the regression model was portrayed while an observation of the confidence intervals of the model was presented as well. Lastly, various plots were exhibited based off the regression model. The performance on the

model built was highly inaccurate consequently having no relationship between the three variables versus the hallux column in the hawks data set.

SUMMARY & CONCLUSIONS

Since the hawks dataset is structurally formatted in a way where there is some data preparation or wrangling that needs to be done, the more legwork will be building the models based off the business questions proposed to the business problem of which measurements contribute to the survival of the winged animal. Following the CRISP-DM process, after the models have been built, a performance check of whether the models are up to par for answering the business problem will be administered. For the first question, the Red-tailed hawk was the most species of hawks that grew to adulthood. For the second question, the Cooper's hawk was the most species of hawks to participate in migration in the month of November. For the third question, the Red-tailed hawk was the most species of hawks with the lengthier hallux (or killing talon). Finally, the last question deemed invalid, indicating that capture time has nothing to do with the age (adult or immature) of a species of hawks versus the hallux. Lastly, an understanding of what the data analysis of the hawks dataset will be executed. This data analysis on a data set known as hawks was not subpar to perform, yet it has a lot of bias. Due to the Red-tailed hawk being the most common species of hawks in the Western Hemisphere, there was a more abundant amount of test subjects or observations within the dataset for that specific species of hawks, thus, translating to a partiality of the Red-tailed hawk over the other two species of hawks as it pertains to the business questions based off the business problem. Although, the age and the hallux of a hawk contribute the most to survival of a species of hawks.

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Appendices

Appendix A

Hawk

The article glosses over what a hawk is and partially compares them to eagles and owls. It further describes the descriptions of a hawk as well as provides interesting facts about different hawk species. It continues with the habitat of a hawk, the distribution of them, and their diet. The next topics discussed were about hawks and their interaction with humans as well as domestication and should a hawk be a pet. The last subjects were about the keeping of a hawk, their behavior, and the reproduction of the animal.

Appendix B

What Eats Hawks: [The Shocking Truth]

The article discusses what eat hawks followed by a hawk's location as related to its natural prey and predators. It continues about the hawk being considered top of the food chain for birds of prey with their eggs only being liable. It concludes with pertinent facts about the hawk.