



Predicting Animal Adoptions at the Austin Texas Animal Shelter

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General Assembly - Data Science 5K

Booz | Allen | Hamilton

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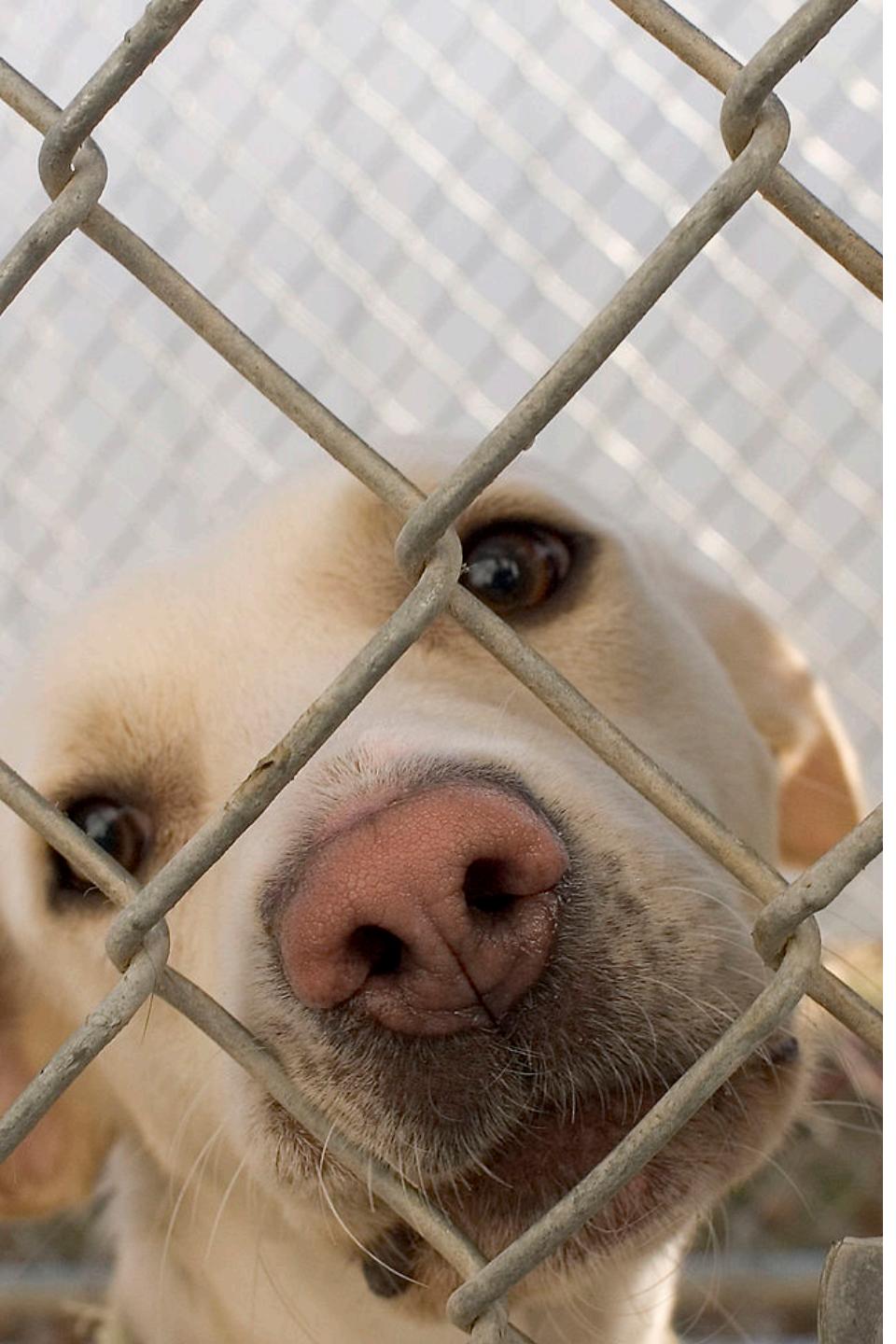
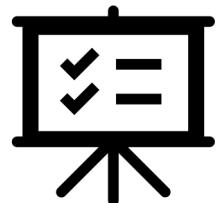


Table of Contents

- I. Executive Summary
- II. Background and Overview
- III. The Data
- IV. The Process
- V. Data Analysis and Visualizations
- VI. The Model and Results
- VII. Recommendations
- VIII. Conclusion
- IX. Appendix

Executive Summary



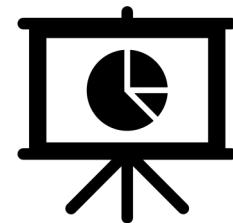
Objectives

Approximately over **6.5** million animals are brought to animal shelters.



Insights

Dogs are adopted more than cats.



Recommendations

Goal: To find creative ways to showcase the animals.

Background and Overview

Austin Animal Center Fiscal Year 2018 Outcomes

| | Neonatal Kitten | Kitten | Adult Cat | Neonatal Puppy | Puppy | Adult Dog | Total |
|------------------------|-----------------|-------------|-------------|----------------|-------------|-------------|--------------|
| Adoption | 2 | 2119 | 852 | 0 | 1904 | 2871 | 7748 |
| Deceased | 31 | 29 | 27 | 7 | 9 | 14 | 117 |
| Disposal | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Euthanized | 26 | 43 | 126 | 6 | 14 | 70 | 285 |
| Missing | 0 | 4 | 0 | 0 | 0 | 1 | 5 |
| Return to Owner | 6 | 47 | 294 | 0 | 318 | 2477 | 3142 |
| SNR | 0 | 245 | 559 | N/A | N/A | N/A | 804 |
| Transfer | 806 | 428 | 427 | 199 | 612 | 1270 | 3742 |
| Total | 871 | 2915 | 2285 | 212 | 2857 | 6703 | 15843 |

Background:

- According to the ASPCA, approximately **6.5** million companion animals enter U.S. animal shelters nationwide every year.
- Of those, approximately 3.3 million are dogs and 3.2 million are cats.
- Each year, approximately 1.5 million shelter animals are euthanized (670,000 dogs and 860,000 cats).
- Approximately 3.2 million shelter animals are adopted each year (1.6 million dogs and 1.6 million cats).
- About 710,000 animals who enter shelters as strays are returned to their owners. Of those, 620,000 are dogs and only 90,000 are cats.

The Data

Animal_ID: All animals receive a unique Animal ID during intake.

DOB: Date of birth of the animal.

Date_Time: Date and time that the animal left the shelter.

Outcome: Outcomes represent the status of animals as they leave the Animal Center (adopted, transferred, returned to owner, euthanized, or died).

Outcome_Adoption: 1 = if adopted, 0 = if other

Animal_Species: Cat or dog

Animal_Species_Number: Dog = 2 and Cat = 3

Age_Outcome: Age that they left the shelter.

Age_Outcome_Days: Converted to days of age. Ex: Instead of 1 month = 31 days.

Breed: Breed of species (Ex: Domestic Shorthair Mix)

Color: Color of animal

Data Fast Facts:

- From: The Austin Texas Animal Shelter
- Dates: January 1, 2014 to December 31, 2019
- There are 102,873 rows and 11 columns in total.
- Annually over **90%** of animals entering the center, are adopted, transferred to rescue or returned to their owners.
- The Outcomes data set reflects that of Austin, TX. is the largest "No Kill" city in the country.

The Process

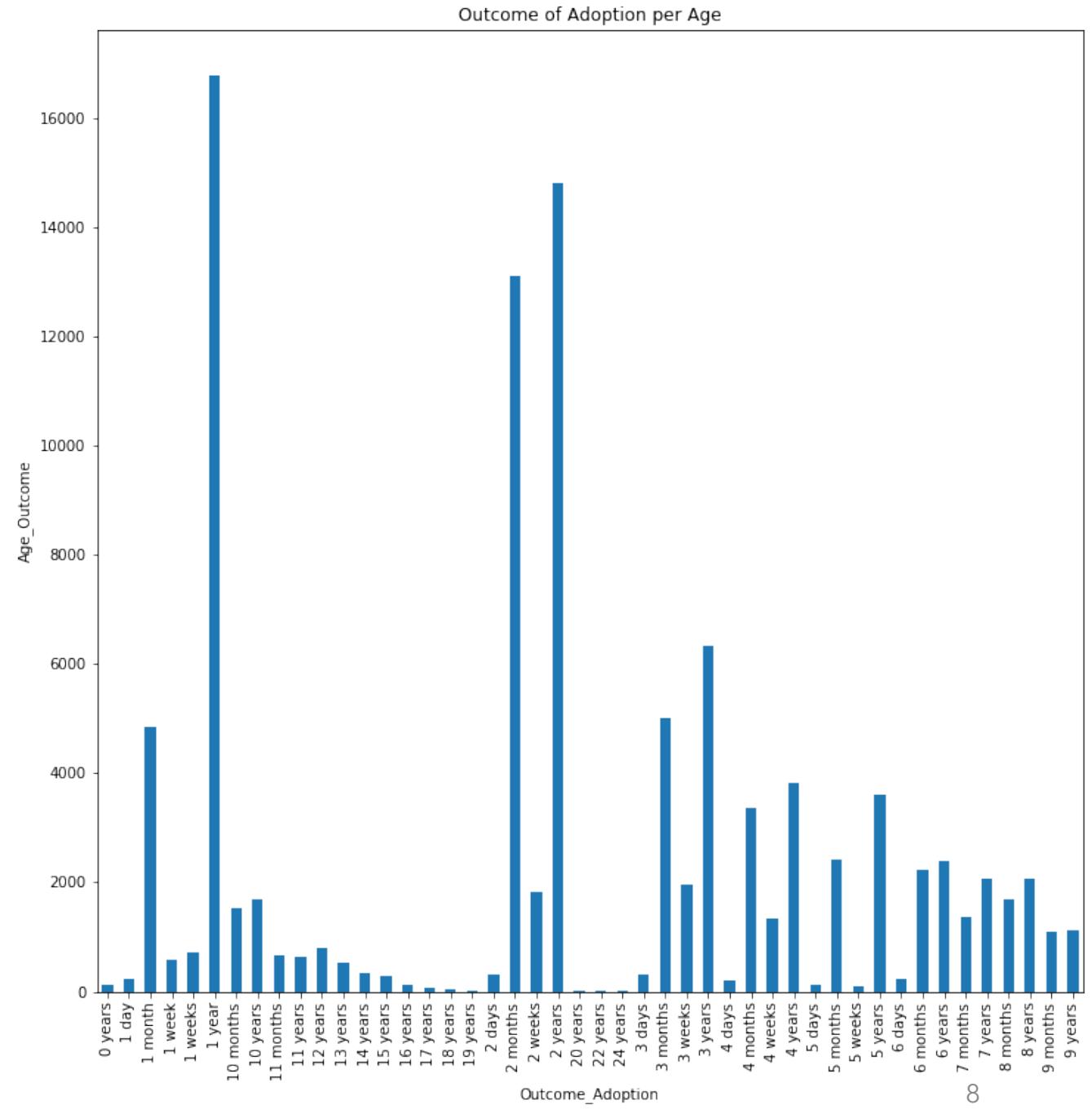
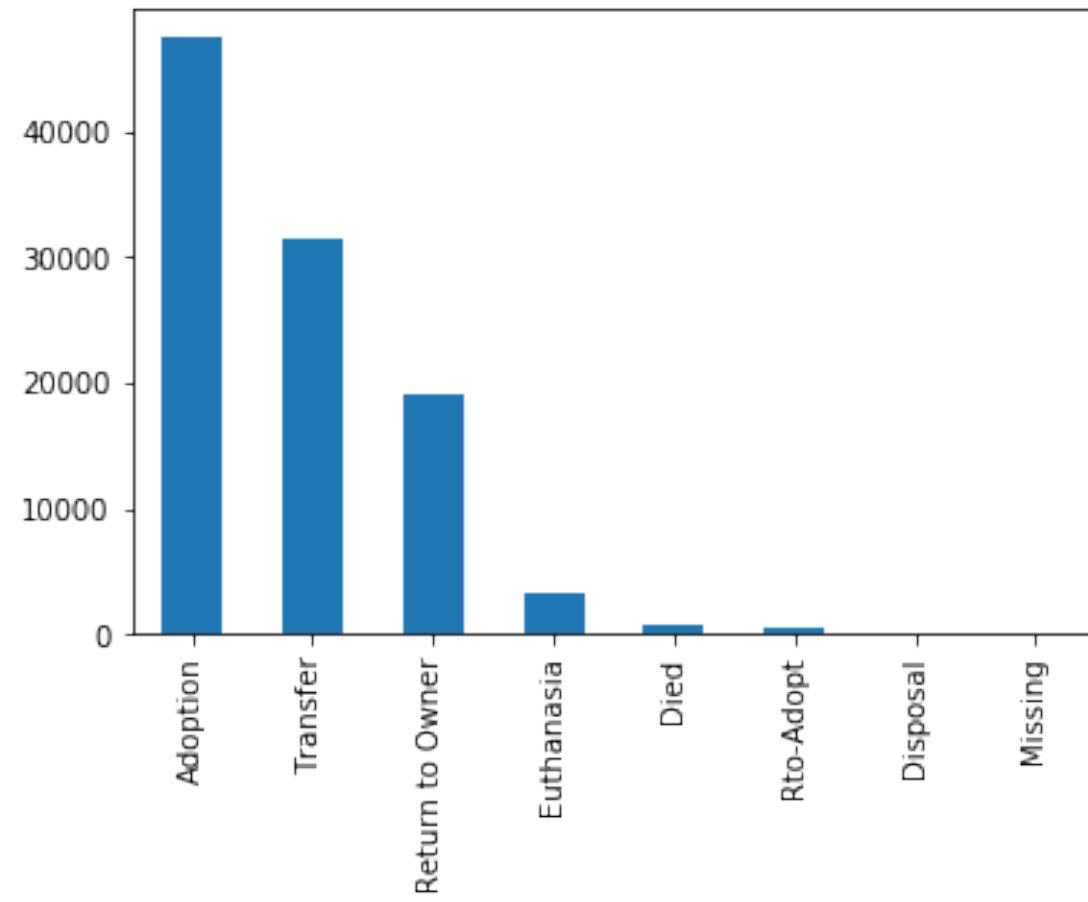


Exploratory Data Analysis

| | | | | | |
|----------------------|-------|-----------------------------|-------|--|-------|
| Dog | 61603 | Adoption | 47421 | Black/White | 11083 |
| Cat | 41270 | Transfer | 31580 | Black | 8701 |
| Name: Animal_Species | | Return to Owner | 19156 | Brown Tabby | 6249 |
| | | Euthanasia | 3209 | White | 3669 |
| | | Died | 832 | Brown/White | 3411 |
| | | Rto-Adopt | 549 | Tortie/Brown | ... |
| | | Disposal | 64 | Brown Brindle/Tricolor | 1 |
| | | Missing | 62 | Agouti/Cream | 1 |
| | | Name: Outcome, dtype: int64 | | Tricolor/Red | 1 |
| | | | | Seal Point/Buff | 1 |
| | | | | Name: Color, Length: 536, dtype: int64 | 1 |

Data Visualizations

Animals Outcome



Cross Validation For Each Fold

Model 1

MSE: 0.24143481538291095

R2: 0.025294616803439363

Model 2

MSE: 0.241545958887172

R2: 0.025293312499491627

Model 3

MSE: 0.24257302872366632

R2: 0.02529816338115043

Model 4

MSE: 0.24225946577382995

R2: 0.02529404076089348

Model 5

MSE: 0.24320390865664734

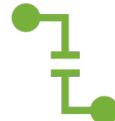
R2: 0.025286802572641598

Summary of Cross Validation

Mean of MSE for all folds: 0.24220343548484533

Mean of R2 for all folds: 0.0252933872035233

Modeling



Split Data Into
Factors (X) and
Target (Y)



Instantiate a
Linear Regression
Model Object



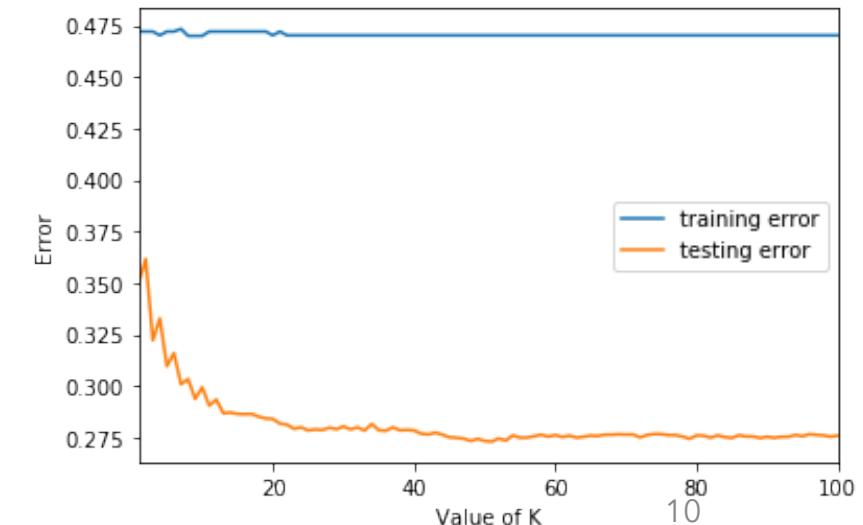
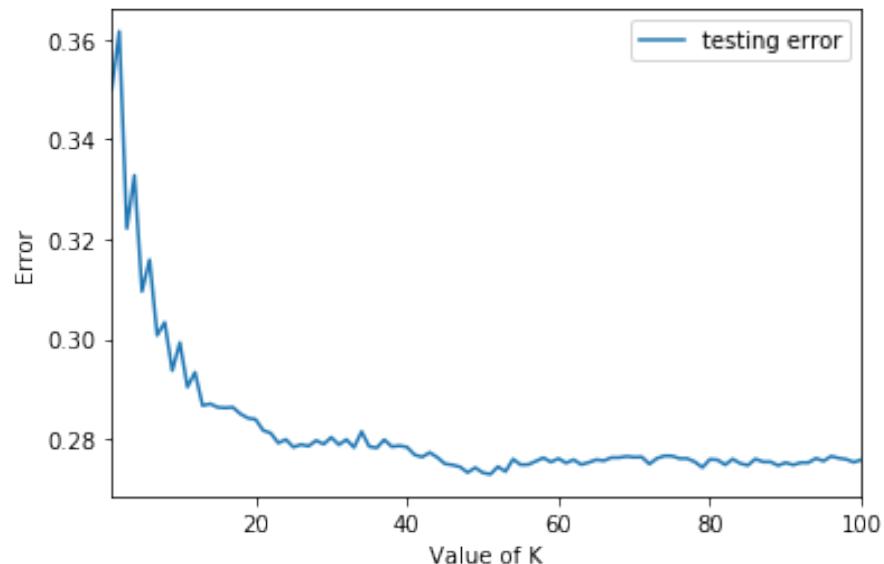
Evaluate the
Model

KNN Process and Low Testing Errors



- Impressively low testing error

| K | training error | testing error |
|-----|----------------|---------------|
| 100 | 0.470221 | 0.275866 |
| 99 | 0.470221 | 0.275361 |
| 98 | 0.470221 | 0.275944 |
| 97 | 0.470221 | 0.276177 |
| 96 | 0.470221 | 0.276566 |



```
In [89]: # Set X and Y
feature_cols = ['Animal_Species_Number', 'Age_Outcome_Days']
X = animals[feature_cols]
y = animals.Outcome_Adoption

lr = LinearRegression()
lr.fit(X, y)

y_pred = lr.predict(X)
```

```
In [88]: y_pred
```

```
Out[88]: array([0.49083846, 0.53530253, 0.48597652, ..., 0.48076703, 0.39596712,
 0.46829362])
```

Prediction

Recommendations and Discussion

- Based on the general analysis, there should be more emphasis on:
 - Adopting cats in general;
 - Older animals (all species);
 - And have an overall emphasis on adopting over euthanizing since over **3,000** animals were still euthanatized during this time period.
- Recommendations
 - Marketing more for adoption with fun marketing tactics.
 - Adopt-a-thon
 - Pet photoshoot
 - Pet coffee shop day
 - Encouraging animal fostering (transfer outcome).
 - Become a foster pet parent!
 - Find out most reasons why animals are returned to their owners.



Conclusions



- Next Steps:
 - *Challenge:* Locating the exact date the animal left the shelter, so we only had the approximate age when they left the shelter.
 - *Challenge:* The prediction model was harder than expected, especially with 2 variables.
 - *Lesson Learned:* To be more careful with the 0/1 and 2/3 attributions.
 - *Lesson Learned:* In the future, I would try using a different model for prediction and using various other variables, such as breed, to make the model more complex.
 - Examples: PCA Model and Random Forrest
 - *Lesson Learned:* I would also break out animal outcomes next time.



Questions or
Comments?

Thank you!

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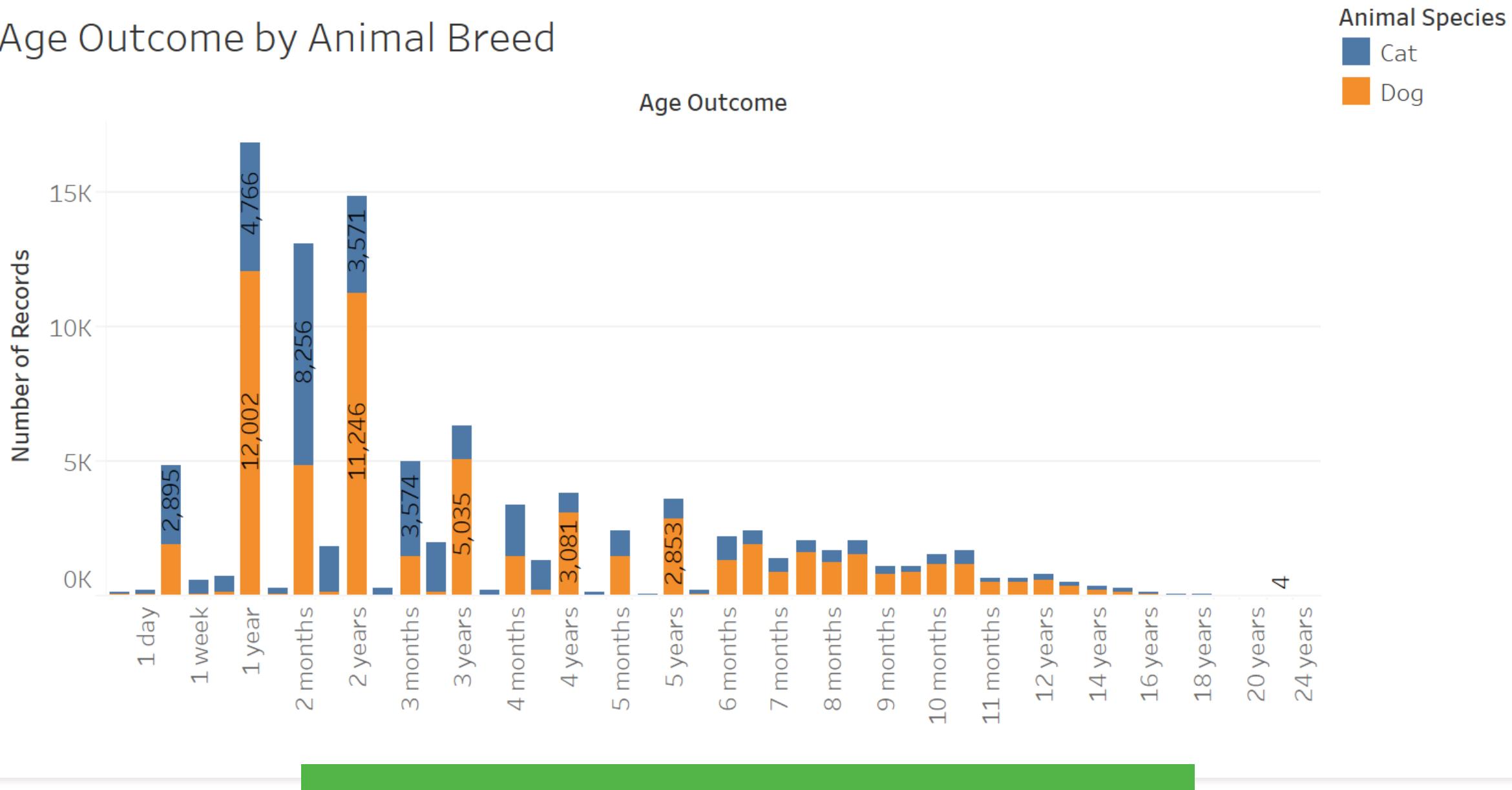
Appendix

Citations

- Data from Austin Texas Animal Shelter
 - Source: <https://data.austintexas.gov/Health-and-Community-Services/Austin-Animal-Center-Outcomes/9t4d-g238>
 - http://www.austintexas.gov/sites/default/files/files/Animal_Services/Monthly_Reports/2017-2018_FY_Final.pdf
- Facts about U.S. Animal Shelters:
 - <https://www.aspca.org/animal-homelessness/shelter-intake-and-surrender/pet-statistics#:~:text=>

Age Outcome by Animal Breed

Age Outcome



Outcome by Breed

