

# **Analysis of Frederick County Animal Control Data**

*Understanding and Predicting Animal Shelter Outcomes*

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# Meet Scooby

- Scooby is a senior dog that was surrendered by his previous owner
- He waited 39 days, but he was adopted!
- Unfortunately, not every dog or cat that enters a shelter will end up finding their forever home for a variety of reasons

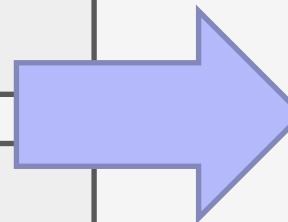


## Descriptive Analysis

- Identify peak intake months
- Identify areas where the most dogs and cats are coming from
- Identify popular adoption times
- Identify trends in how long animals wait to be adopted

## Predictive Analysis

- Determine if machine learning can be used to predict a dog or cat's shelter outcome (adoption/return vs. euthanasia)
- Identify the top determinants for predicting the outcome



Actionable  
Insights

# Data

- Covers October 2011 – September 2019
- ~34,000 unique animals
  - 85% are dogs and cats
- Examples of fields:
  - Species
  - Primary Breed
  - Primary Color
  - Age Group
  - Gender
  - Name
  - Intake Type
  - Outcome Type

**Animal Intakes**

Animal ID	Animal Name	Species	...	Operation Type	Age Group	...
A12167351	NYLA	Dog		Stray	Adult (1yr-4yrs)	
A12183835	MAZDA	Cat		Return	Juvenile (8wks-11mon)	
...						

**Animal Outcomes**

Animal ID	Animal Name	Species	...	Outcome Type	Outcome Subtype	..
A12167351	NYLA	Dog		Return to Owner/Guardian	Stray Reclaim	
A12183835	MAZDA	Cat		Euthanasia	Temperament	
...						

# Data Pre-Processing



## Join

Combined intakes and outcomes by joining on intake date and animal ID



## Clean

Removed irrelevant features, cleaned animal name and jurisdiction fields for consistency



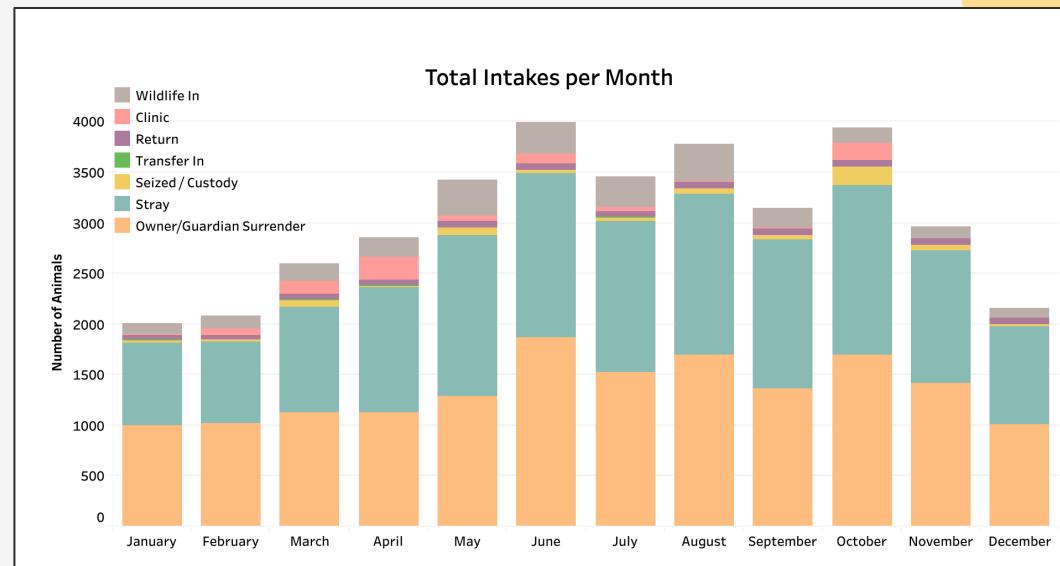
## Feature Engineer

Created new features: date/time, time in shelter, is mix, is black, energy level, shedding level, etc.

# **Descriptive Analysis**

# Animal Intakes per Month

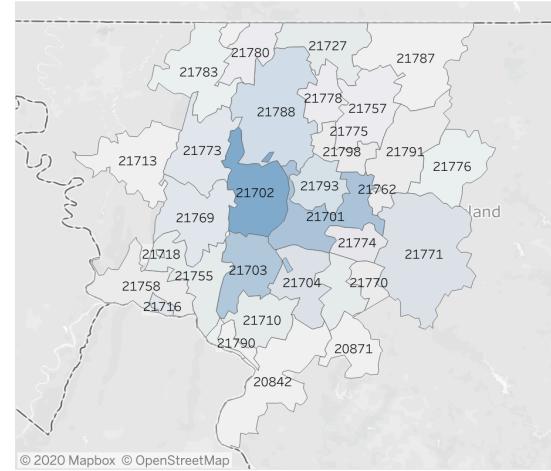
- Intakes are highest in the Summer months and October
  - Driven by strays and surrenders
  - People surrender their animals in the summer to avoid pet sitting/kennel fees
- **Suggestion:** Potentially lower/waive adoption fees during months of high intake



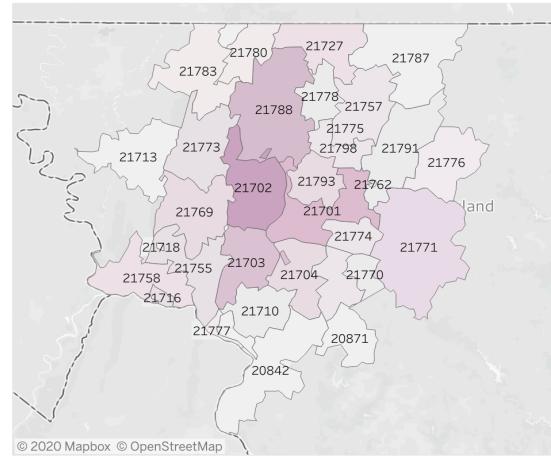
# Analysis of Jurisdiction

- Majority of cats and dogs are coming from cities in Frederick (21702, 21701, 21703)
  - Thurmont (21788) is a huge problem for cats
    - Very rural area
    - Top contributor for seized cats
    - 2<sup>nd</sup> top contributor to stray cats
  - **Suggestion:** Implement spay/neuter programs to help control the number of cats or work with local vets to reduce costs

## Where are the dogs coming from?

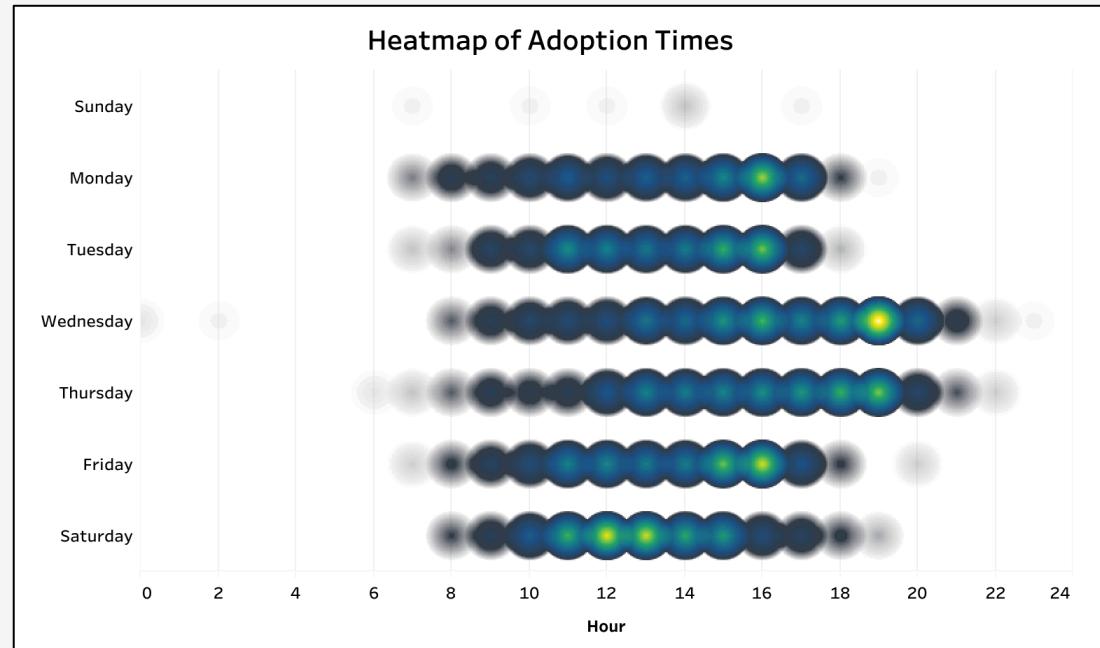


Where are the cats coming from?



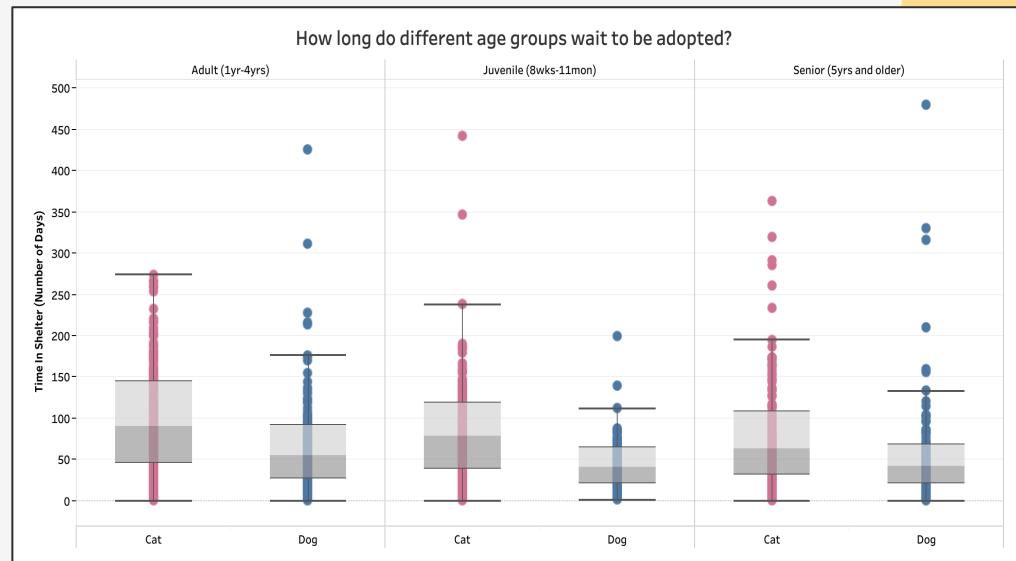
# Analysis of Adoption Times

- Weekday evenings, especially Wednesdays, and Saturdays between 11-1 are the most common adoption times
- **Suggestion:** Schedule adoptions on weekday evenings and Saturday afternoons; potentially extend hours on Wednesdays and add more staff to assist with adoptions



# Adoption Wait Times

- Hypothesis testing showed a significant difference in the distribution of wait times for each age group for both dogs and cats (Kruskal Wallis)
- Juvenile dogs are adopted the fastest
- Adult cats wait a median of 91 days to be adopted
- **Suggestion:** Promote adult cats on social media more often or place them in the front to potentially encourage speedier adoptions



*For each age group, cats typically wait longer to be adopted than dogs*

# **Predictive Analysis**

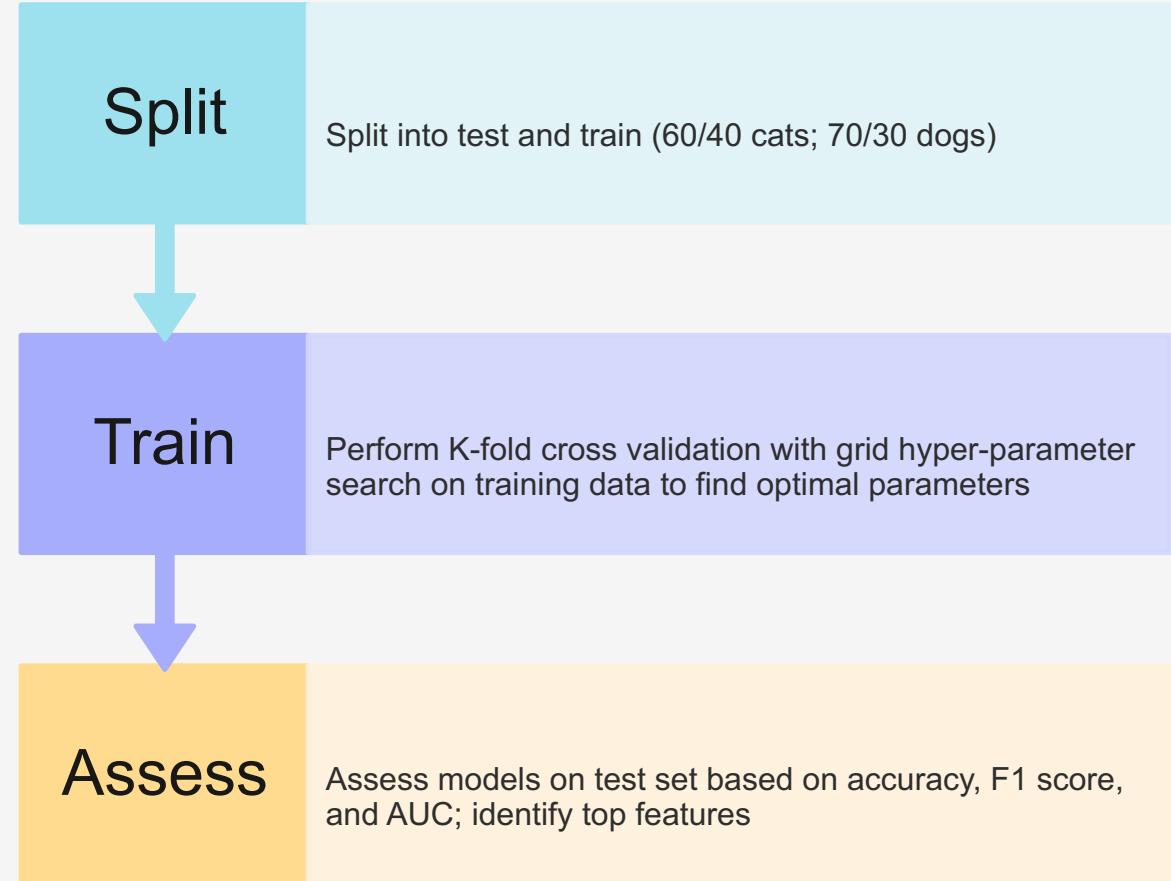
# Predicting Shelter Outcomes

- **Goal:** Predict a cat or dog's shelter outcome
  - euthanasia vs. adoption/return to owner
  - Removed all other outcomes (13% of dogs and 13% of cats)
  - Separate models for dogs and cats
- **Algorithms:**
  - Random Forest
  - XGBoost
  - Logistic Regression with Lasso Regularization
- Chosen algorithms provide insight into important features

Datasets			
	# Adoption/Return	# Euthanasia	Total
Cat Dataset	5,959	9,807	15,757
Dog Dataset	6,510	2,418	8,928

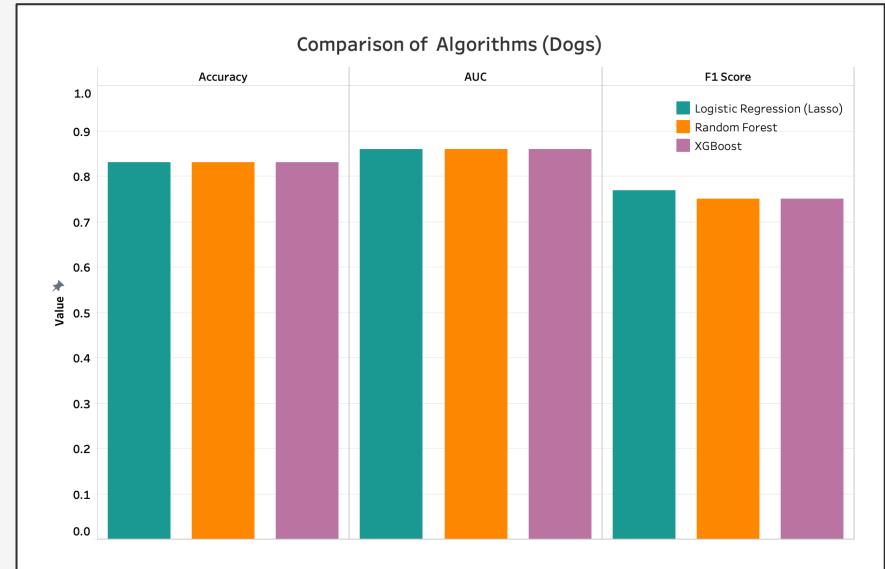
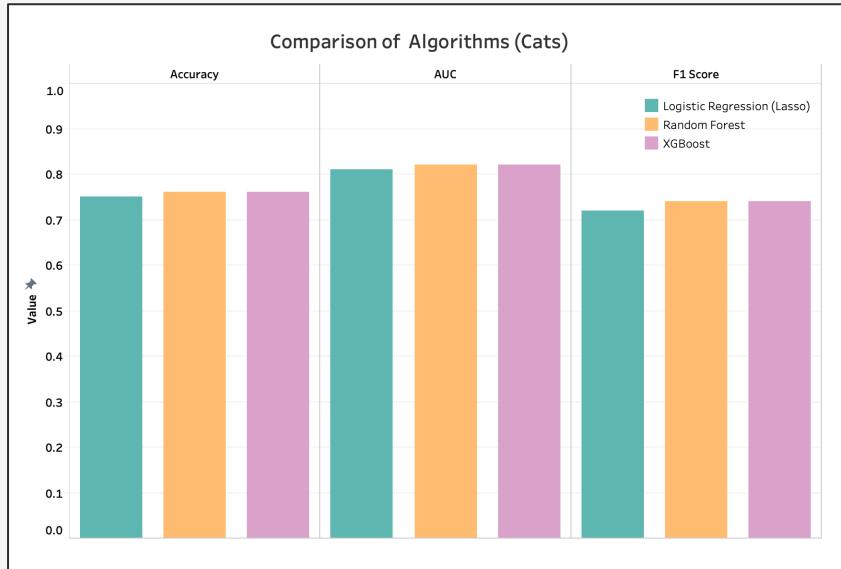
*Both datasets have imbalanced classes*

# Approach



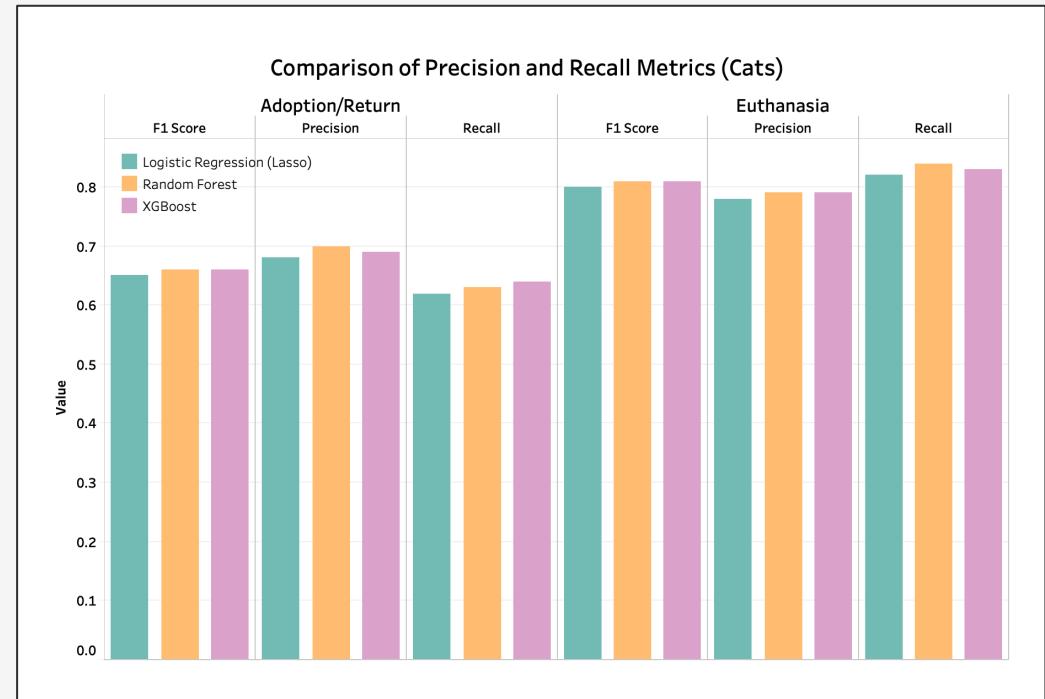
# Results

- For both cats and dogs, the algorithms performed nearly the same
- F1 score for cat model was ~0.74 and ~0.76 for dog model
  - Metrics are close to 1, but still show room for improvement



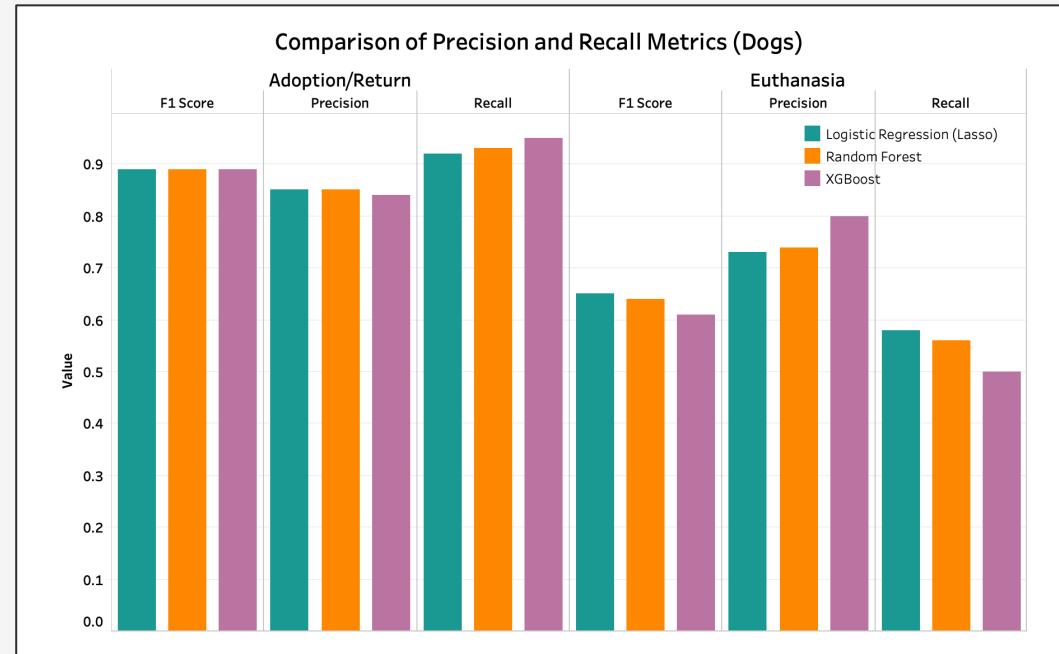
# Model Assessment - Cats

- Cat model has low recall for adoption/return class
- Model misclassifies cats that have a higher chance of adoption/return more often



# Model Assessment - Dogs

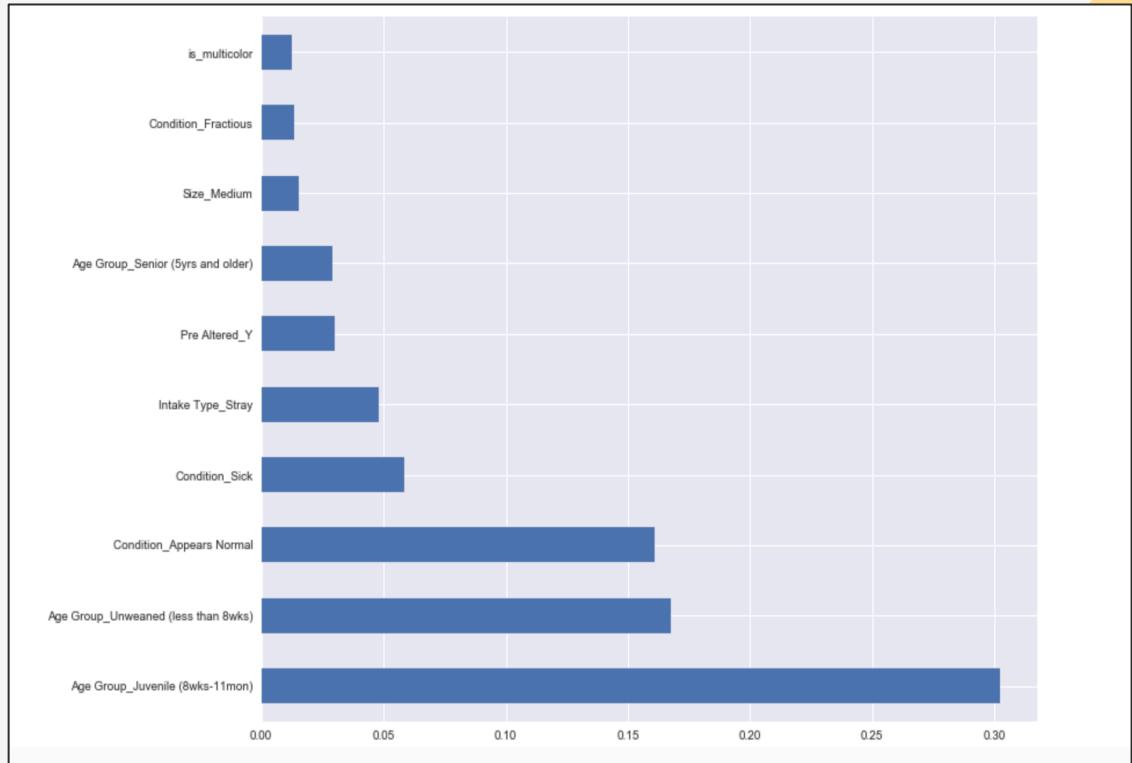
- Dog model has low recall for euthanasia class
- Model misclassifies dogs that have a higher chance of euthanasia more often
- Low recall for euthanasia is more detrimental than the opposite



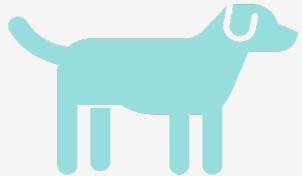
# Top Predictive Features - Cats



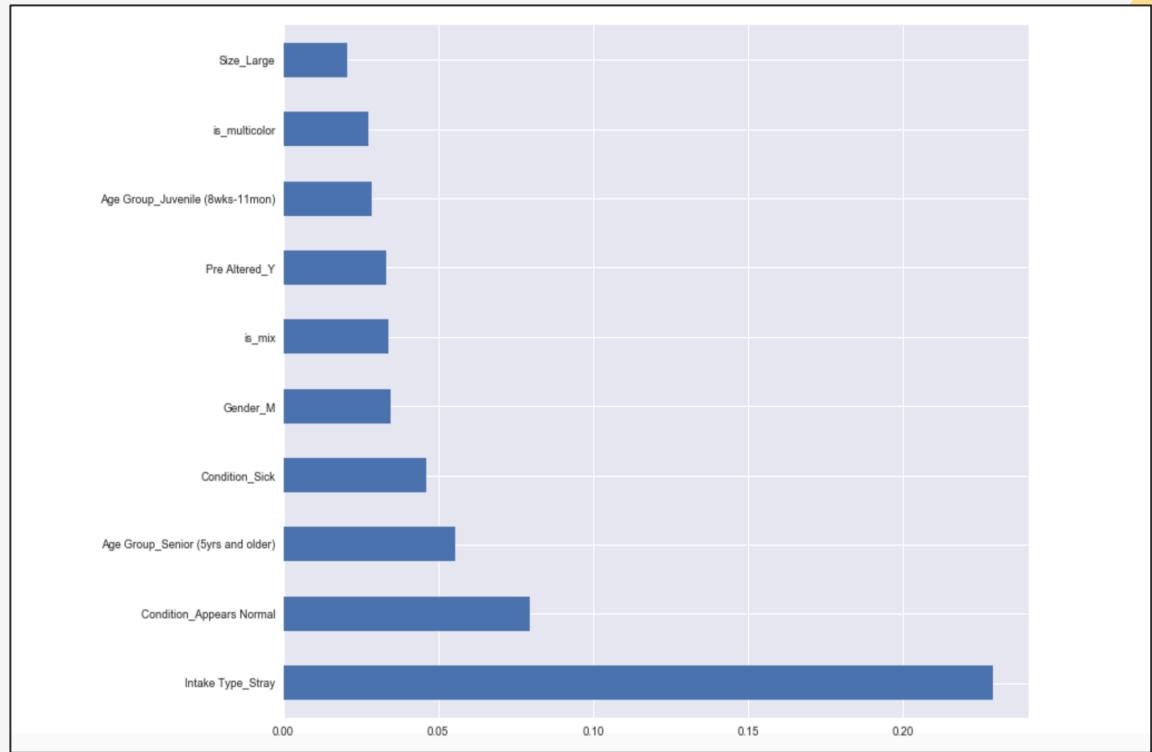
Age Group  
Condition  
Intake Type



# Top Predictive Features - Dogs



Intake Type  
Condition  
Age Group



# Conclusions

- Descriptive analysis showed insights into:
  - peak intake times
  - locations producing the most intakes
  - ideal adoption times
  - how long animals typically wait until they are adopted
- Predictive analysis resulted in models that can predict the binary outcome of euthanasia vs. adoption/return with some success
  - Most predictive features are related to age, general condition of the animal, and if they were a stray or not
- More data from additional shelters and detailed behavioral data could improve model performance

# Questions?

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# **Backup Slides**

# **Frederick County Animal Control**

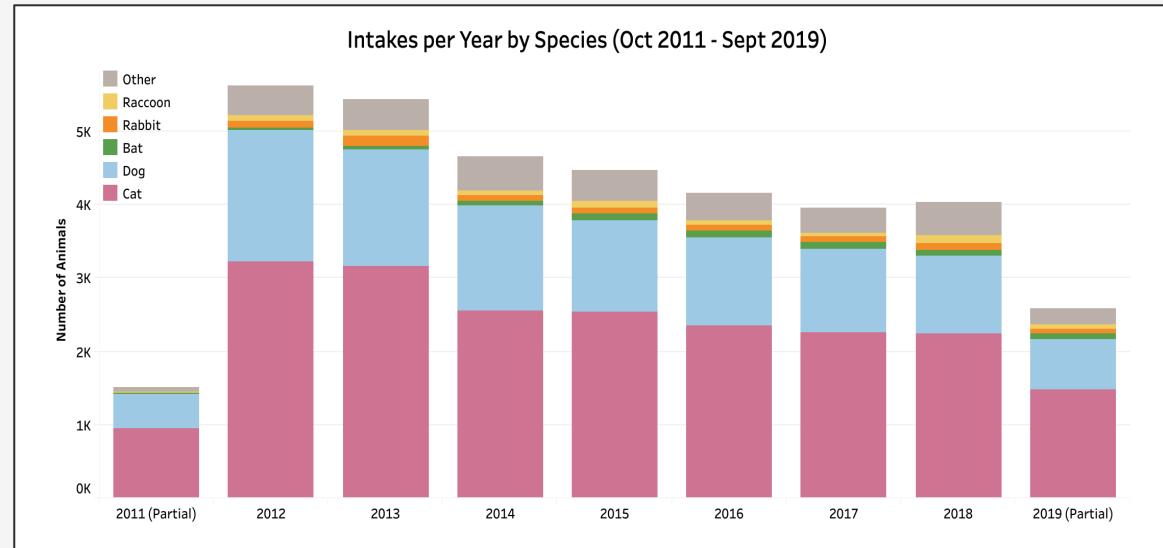
## **Mission:**

- Prevent animal cruelty, abuse, and neglect
- Shelter animals without homes and help them find suitable homes
- Educate the public on animal issues to create a more aware community



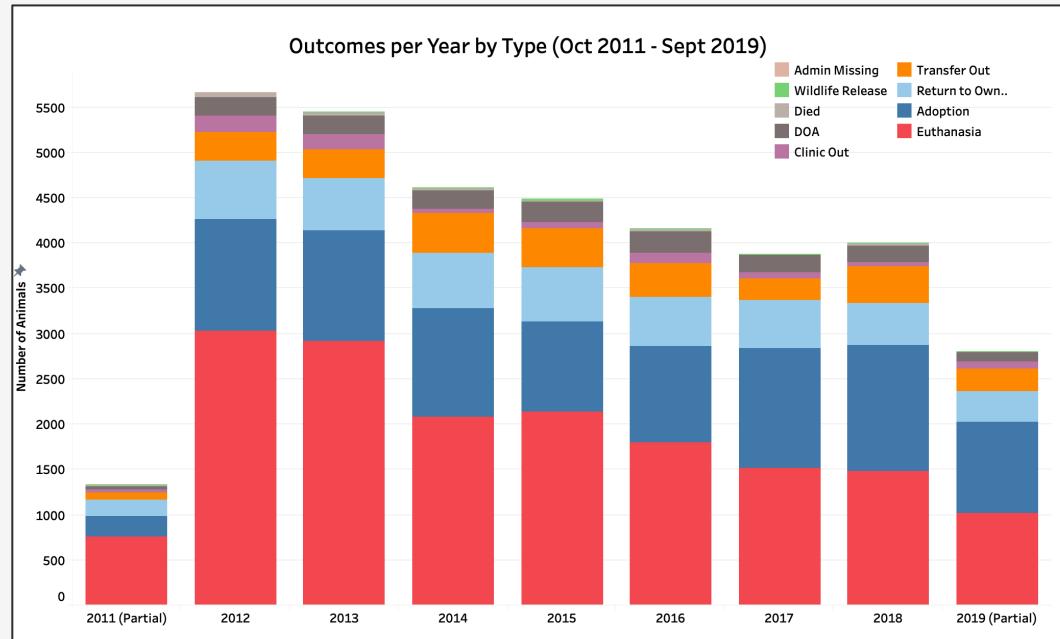
# Animal Intakes per Year

- Total intakes per year is decreasing
- Roughly 2,000 cats and 1,000 dogs
- Cats are almost double the amount of dogs



# Outcomes per Year

- There is a downward trend in the number of euthanized animals per year
- In recent years, the number of adoptions/returns outweigh the number of euthanized animals



# Discussion

## Areas of Improvement:

- An increase in the volume of data would likely improve models
- Including more detailed animal behavior features could potentially provide additional insights

## Future Work:

- Analyze how advertising/marketing/social media impacts adoption rates
- Predict length of time an animal spends at the shelter