Animal Shelter Dilemma

What makes an animal adoptable

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Project Name: Animal Shelter Dilemma

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Context

- **Animal shelters struggle with resources, each time that an animal stays longer in the shelter the cost increase exponentially.**

- **The overcrowding and constant introduction of animals with a high probability of issues (health and behavior) increase the demand for an already stretch management and resources.**

- **Over time this was correlated to an increase in workers turnover, unsanitary conditions, and poorer veterinary care. Moreover, it tends to finish in euthanization for many animals that were not given a real opportunity.**

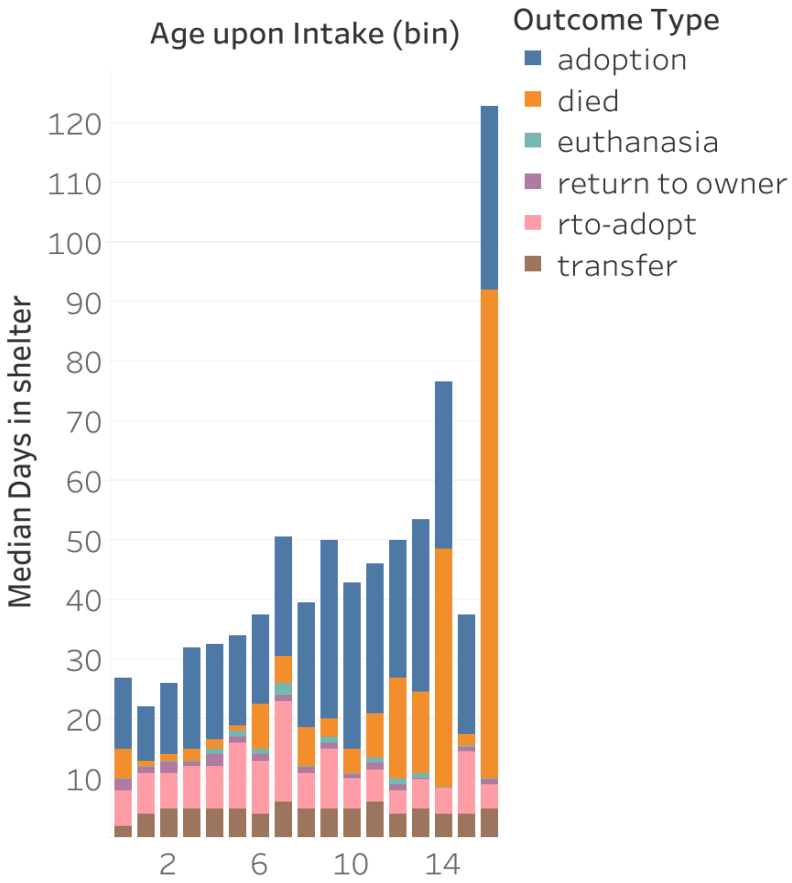
Research Question

- **The overall problem is the efficiency issues in relation to the resources used for each animal.**
- **The research question is if there is discrimination again or in favor of certain dogs and/or cats? (Race, size, age).**

Let’s explore the issues found in the papers

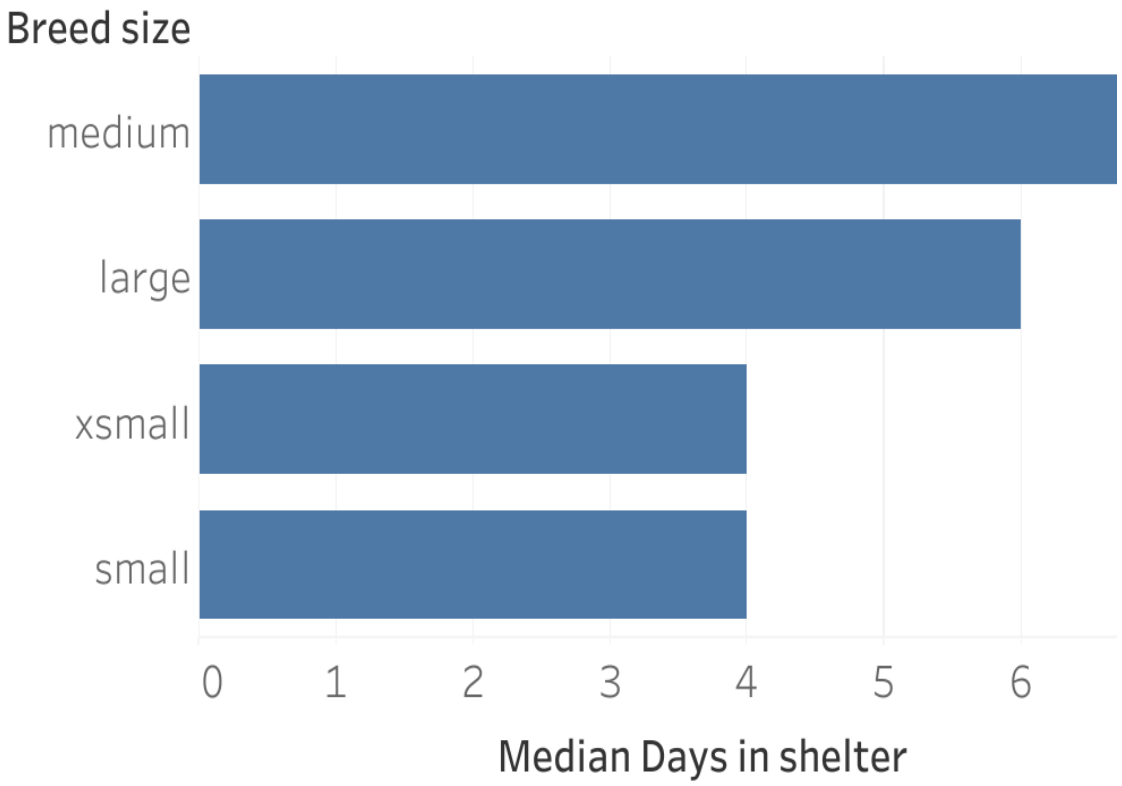
Age Preferences

- The paper by William Brown in ‘Effects of Phenotypic Characteristics” suggests that there is a preference for younger dogs over older ones among all the No-kill Animal Shelters in New York.
- In comparison, this data set suggests the same trend.
- As the animal age increase the median days in shelter increase and the outcome become less desirable



Size Preferences

- the smallest dogs (lapdogs) had a shorter adoption wait time than medium and large dog.
- The other papers also concur with this statement and this dataset suggests the same.



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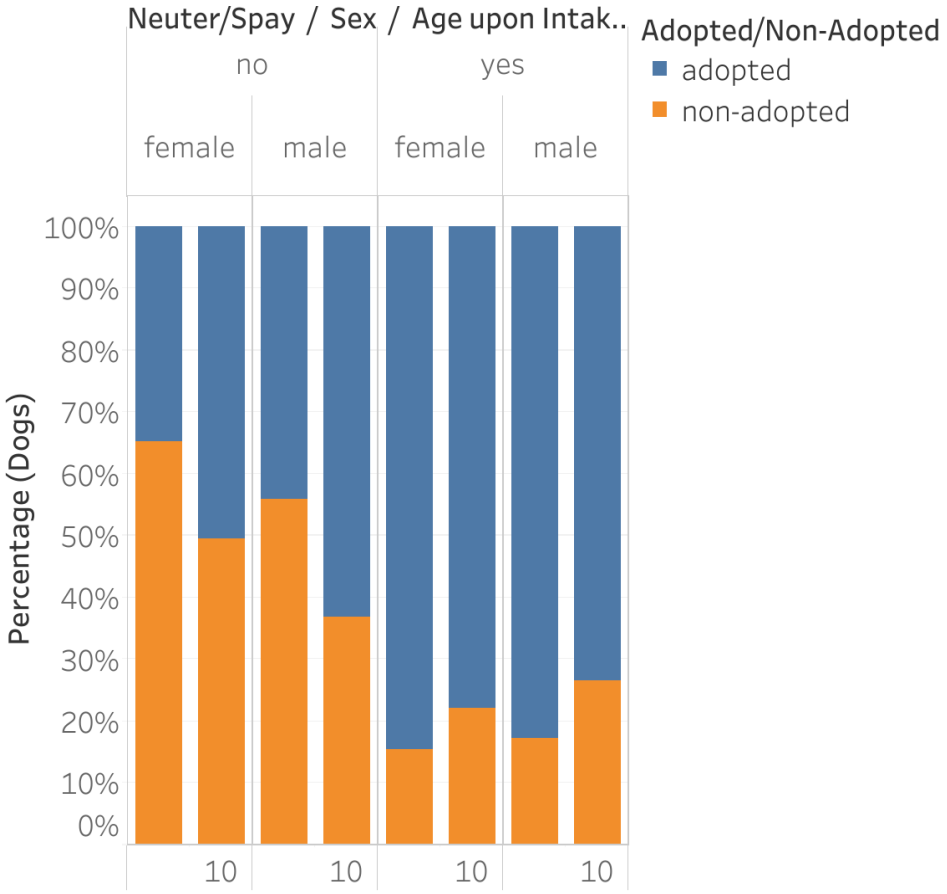
Gender Preferences

- According to Martin Soto in Adoption of Shelter Dogs (Brasil).
- Females dogs are preferred over males, except in Brazil.
- In Brazil, the exception seems to be associated with spay/neuter differences.
- In this paper follow the same trend only if the animal is spayed/neutered. However, it reversed to the Brazilian trend if they are intact.
- Further explanation about this trend in the dataset, in the next slice.

Neuter vs Spay

- If the dog is intact, it is observable that female's dogs are less demanded when they can reproduce (under 10 years old).
- On the left side of the graph, unneutered females are 34% adopted and unneutered males are 44% adopted (all under 10 years old).
- Assuming that dogs after 10 years cannot reproduce because the max standard age is 7-8 years (legally 5-6 years), only few cases passed the threshold of 10



Other issues studied in the main paper are appearance, rural vs urban, and perceptions.

Methodology

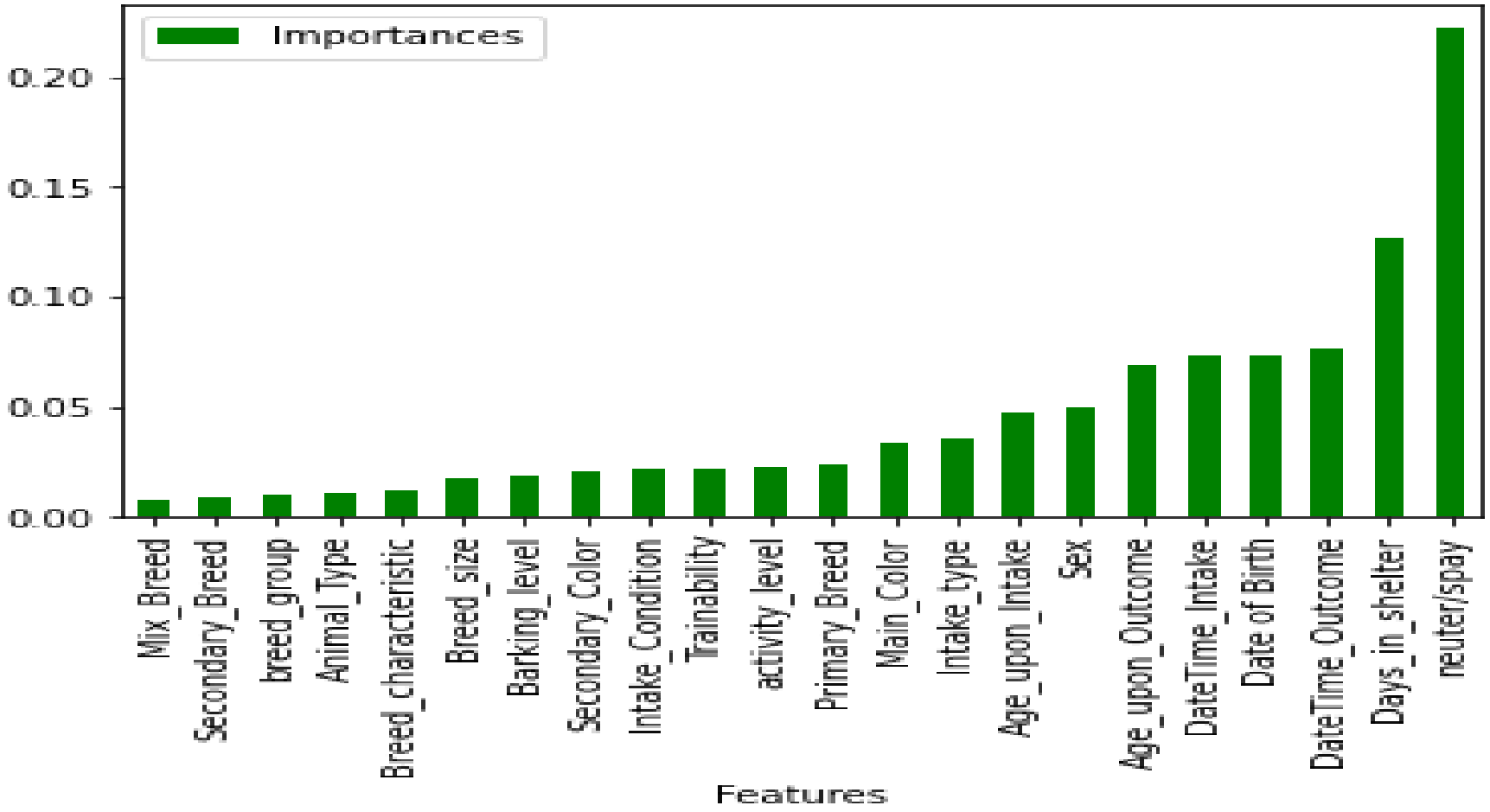
The methodologies to determine if an animal would be adopted or not were accomplish by predictor models (KNN, Random Forest, and SVM)

Pre-procedures for models (part 1)

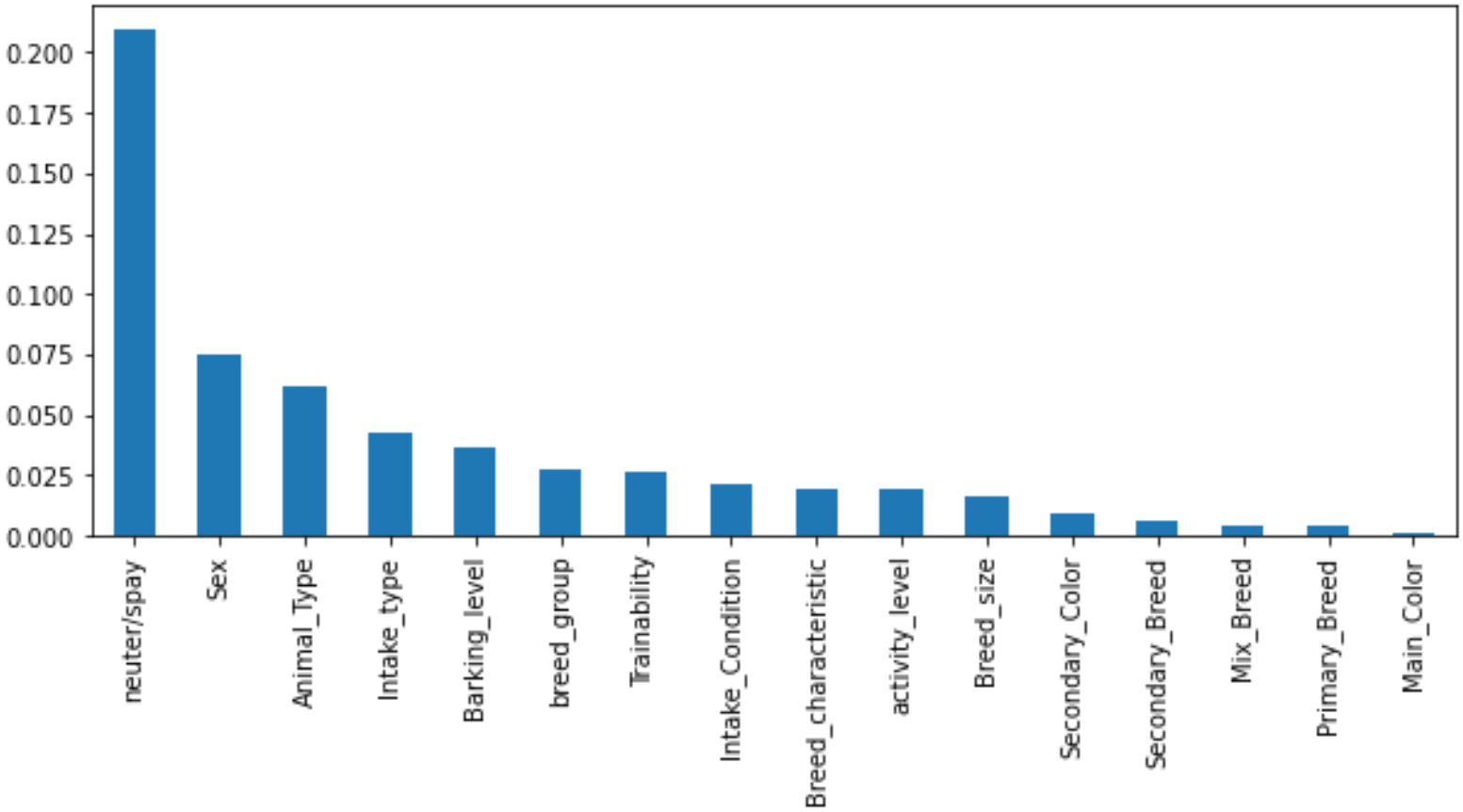
- The pre-procedures consisted of feature selection techniques such as wrapper method, embedded and filter.

- Overall the feature selector predicted a higher performance with 8-11variables.

Embedded Method



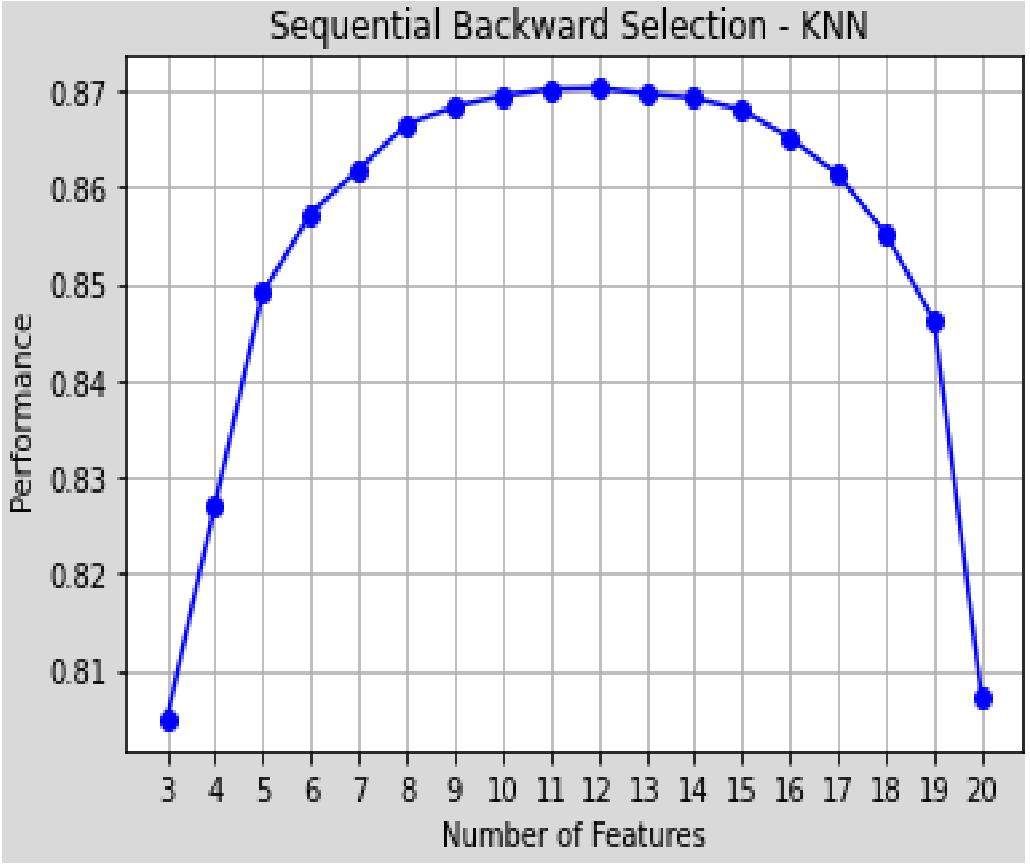
Filter Method



The Wrapper method

- The most important variables were:

1.Intake Type
2.Intake Condition
3.Animal Type
4. Age upon Intake
5. Mix
6. Sex
7. Days in shelter
8. Age upon Outcome
9. neuter/spay.



Analysis of most importance variables

The variables could be divided in groups:

1. Important and non-obvious
2. Important under specific conditions
3. Irrelevant

The most important variables with new topics for research

- The most important and non-obvious were features that affected the model significantly and it did not appears in the initial exploration and similar papers.

- The most important feature by far is neuter/spay.

The important features under specific conditions

- The features overall does not affect much the models but for specific groups they are important.

- The majority of new variables were exclusively for dogs and cats. Therefore, the selector omit them because it does not affect the entire population.

Pre-procedures (part 2)

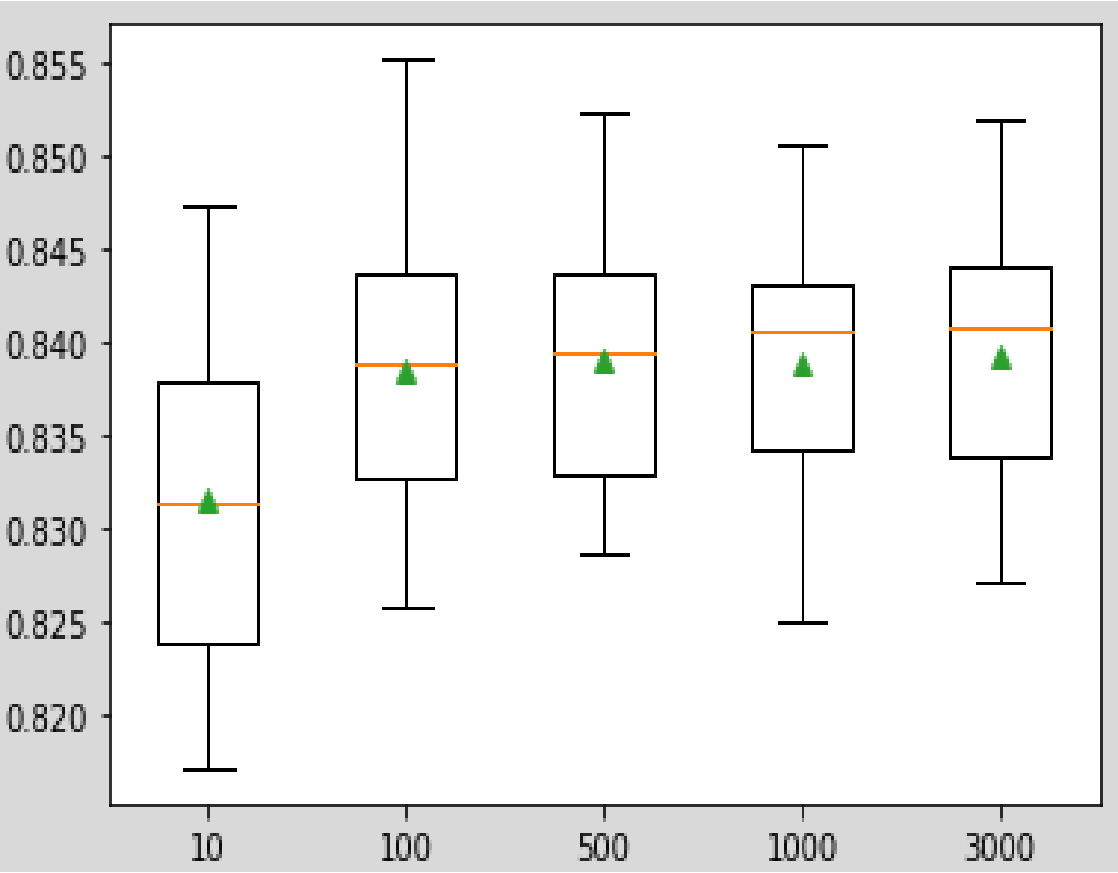
The second part of the pre-procedures consist in dropping irrelevant variables, cleaning target variable (reduce to binary option), label encoding, split data (20:80 ratio) balancing (under sampling) and standardization (removing mean and scaling the unit variance)

Result of predictive models (Random Forest)

- Random Forest result in an accuracy of 83%.
- The K-fold Cross validation had an output of 84% accuracy and the Log loss had a result of -0.456 (the closer to zero the better) with standard deviation of 0.02 (minimal).
- The number of trees analysis show that the performance improves significantly until 10 trees (83.2% accuracy), then the rate of improvement decreases significantly.
- To achieve the same level accuracy, obtained in the K-fold cross validation it is require increasing the number of trees.

Random Forest (performance vs number of trees)

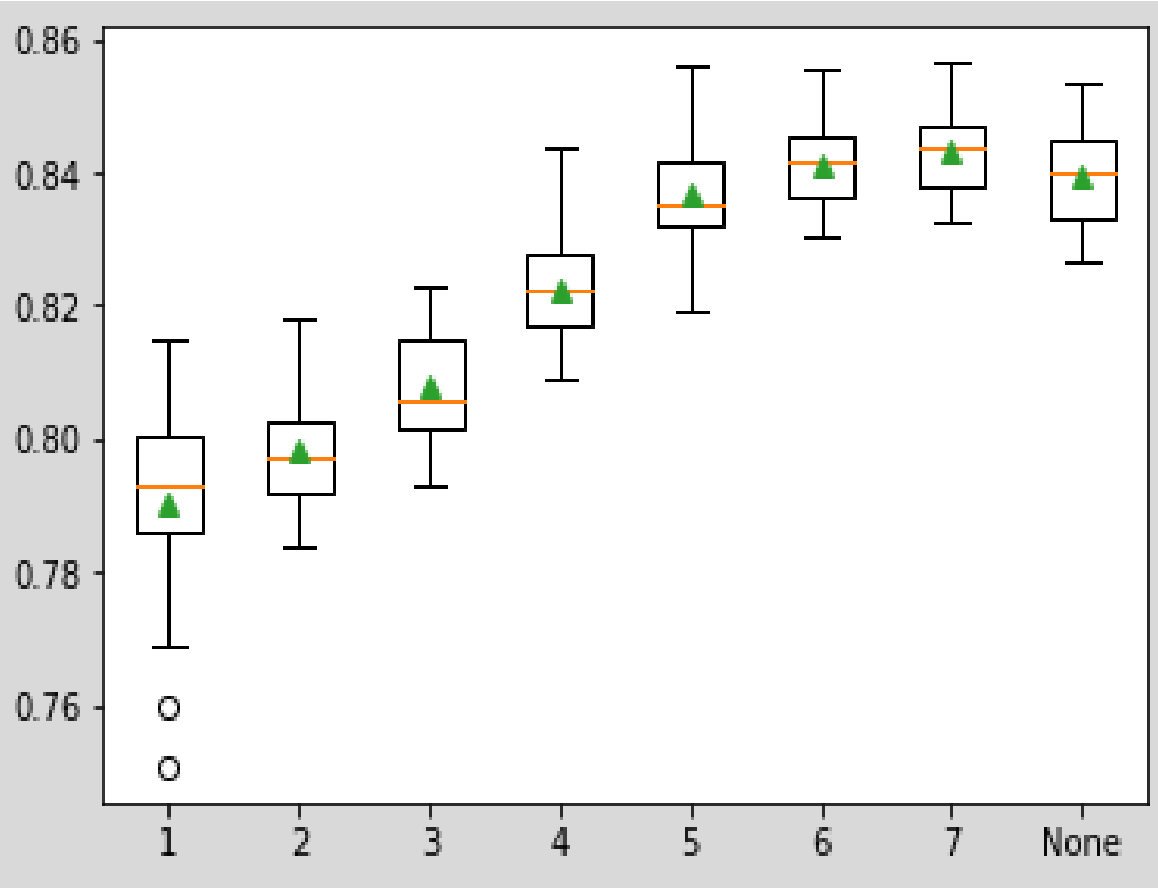
- It can be observed the patterns (x is the number of trees and y is performance).



Random Forest (depth analysis)

- it can be observed the random forest tree depth effect on performance (x is the level of depth and y is performance).

- The last x variable is none because no more depth were required and it decreased the performance (84.3 => 83.9)



Result of predictive model (KNN)

- The KNN model used three cluster, one for each category (adopted, no-adopted and unknown).
- The initial accuracy score is 82% but after the K-fold cross validation it increase to 83% with standard deviation of 0.008.
- The Log loss reported -1.752 with standard deviation of 0.17.

Result of predictive model (SVM)

- The initial results were 80% accuracy, 0.77 precision and 0.75 recall.
- After K-fold cross validation, the accuracy increases to an accuracy of 81.5% and the log loss is 0.02.

Insights

The first discovery was the discrepancies in adoption between neuter and intact.

The second discoveries was the euthanasia differences between breeds of dogs.

The third discovery was the change in adoption type according to age

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Neuter vs Intact

- The most common argument that explains the differences in adoption is the possibility of undesirable breeding. Moreover, animal shelters have the incentive to promote neuter dogs and American veterinarian practices do the same.

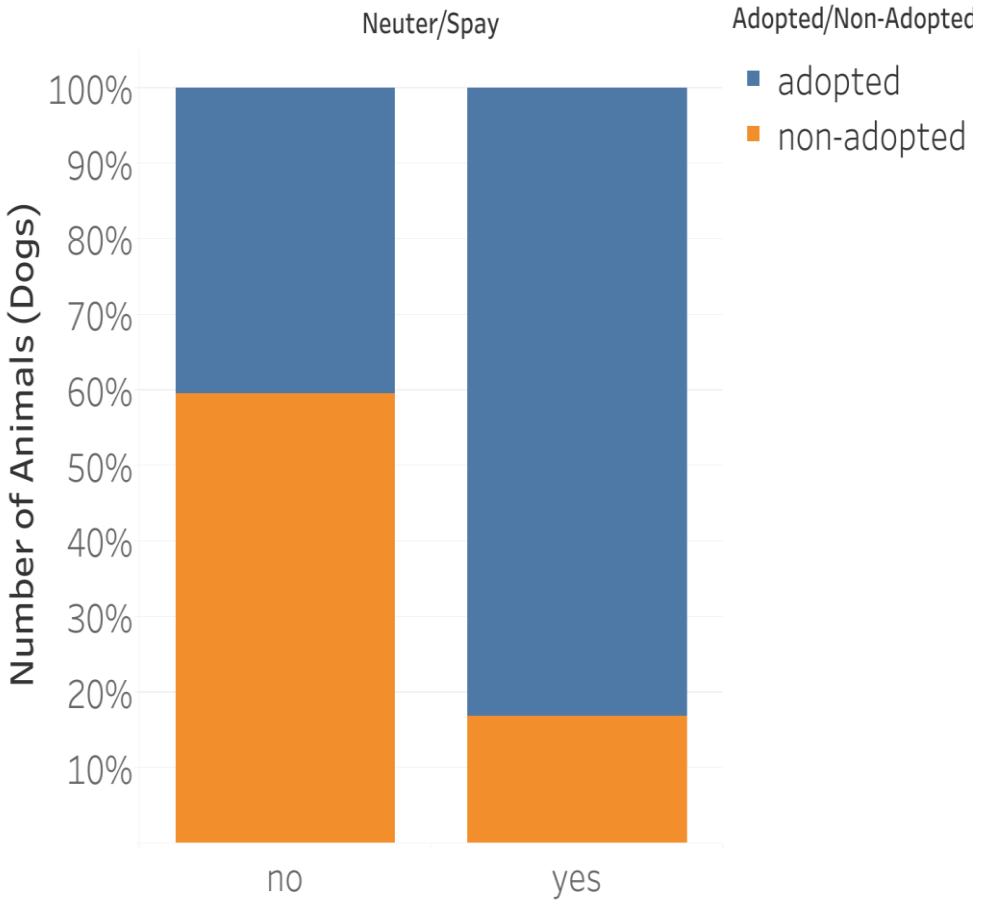
- Another argument is the cost related to surgery and the association between intact and future illnesses like mammary tumors, pyometra and prostate cancer. However, this assumption may vary according to the country because veterinaries in Europe and South America recommend based on the individual case and not based on policy.

- According to the Danish Centre for Bioethics, there is no reason to claim that routine neutering is morally acceptable knowing that there is an increased number of studies that contradict each other and there is not a definitive answer about secondary long-term effects. Suggesting that, Spaying/neutering an animal work for the desire intend of breeding containment but not necessarily for long-term health.

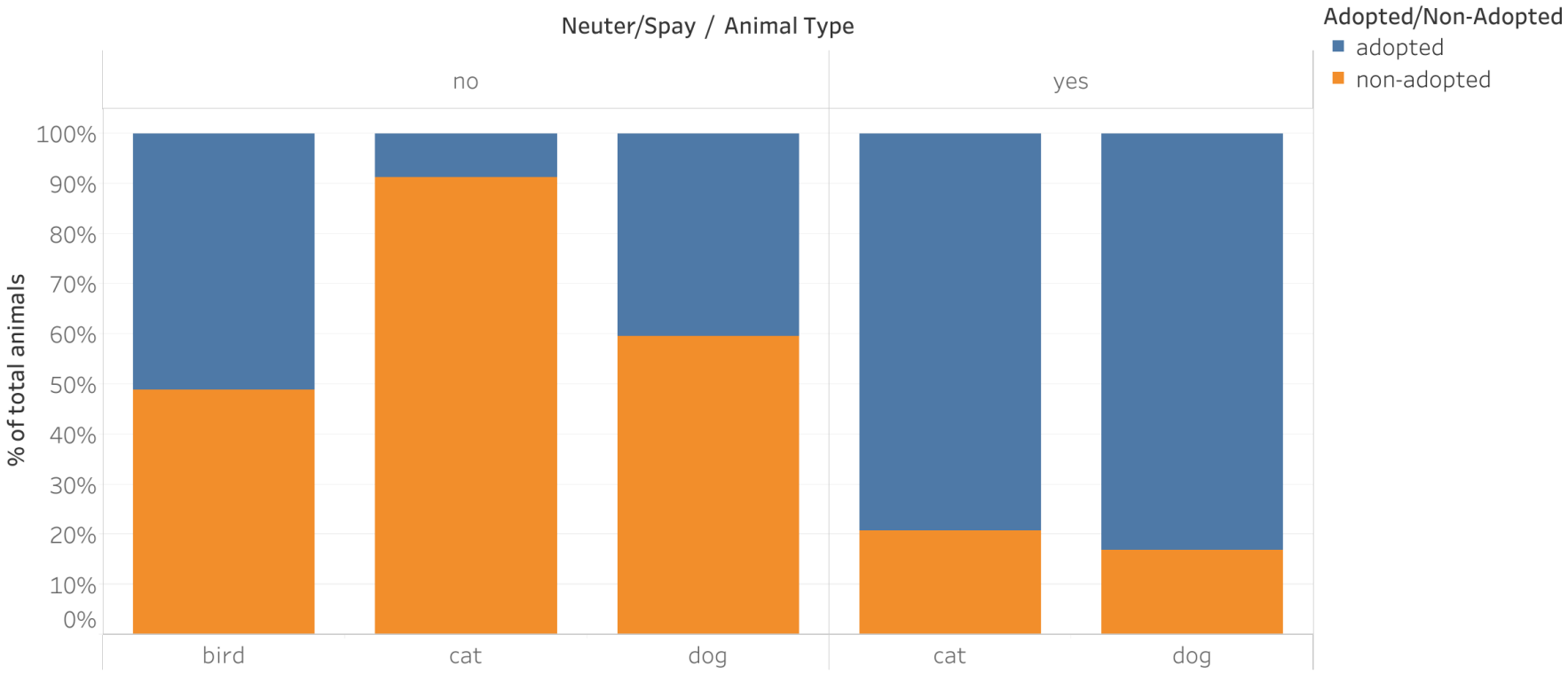
Neuter vs Intact

Large discrepancies in adoption rates between the animals that were neutered or spayed to the ones that did not.

A proximally 30,000 animals are intact. Out 110,000 in total.



Neuter vs Intact (by animal type)



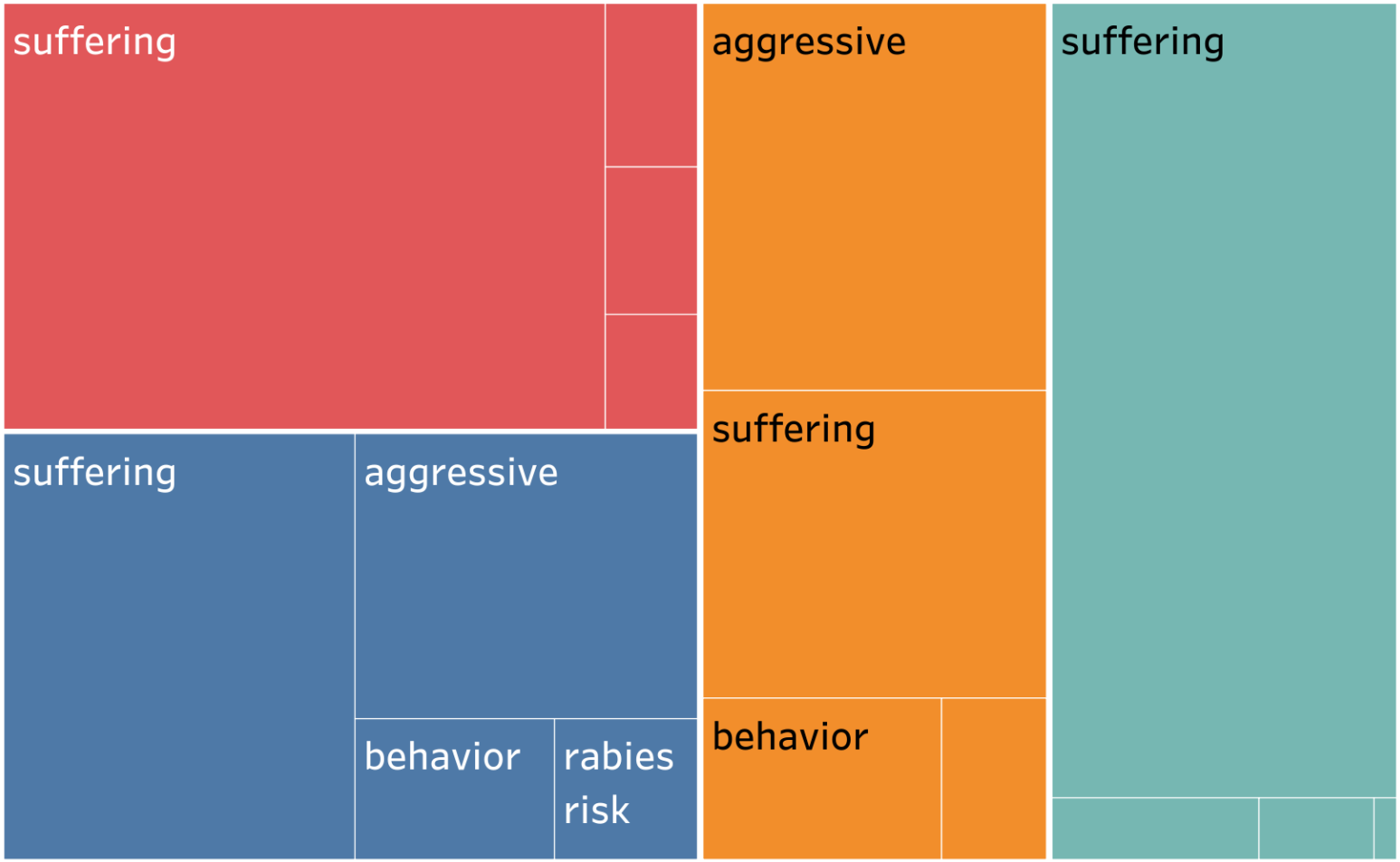
Euthanasia differences between breeds of dogs.

- The dataset suggests that large breeds and medium-size breeds are at risk of a higher level of euthanasia for aggressiveness and behaviorally issues. Moreover, the higher level of euthanasia in the medium and large breeds can be explained by the inclusion of guard dogs and pit bulls.

- In the next graph, it is possible to observe that a large section of the euthanasia reasons small and very small is suffering. Meaning that euthanasia in a very small or small dog is highly probable due to some severe health issue or because age. However, the other sizes present a higher level of euthanasia for aggressiveness and behavior.

- Medium size breeds have 45% of the euthanasia due to aggressiveness (the biggest in this size category) and large size breeds have 33% (the second biggest).

Euthanasia by size & reason



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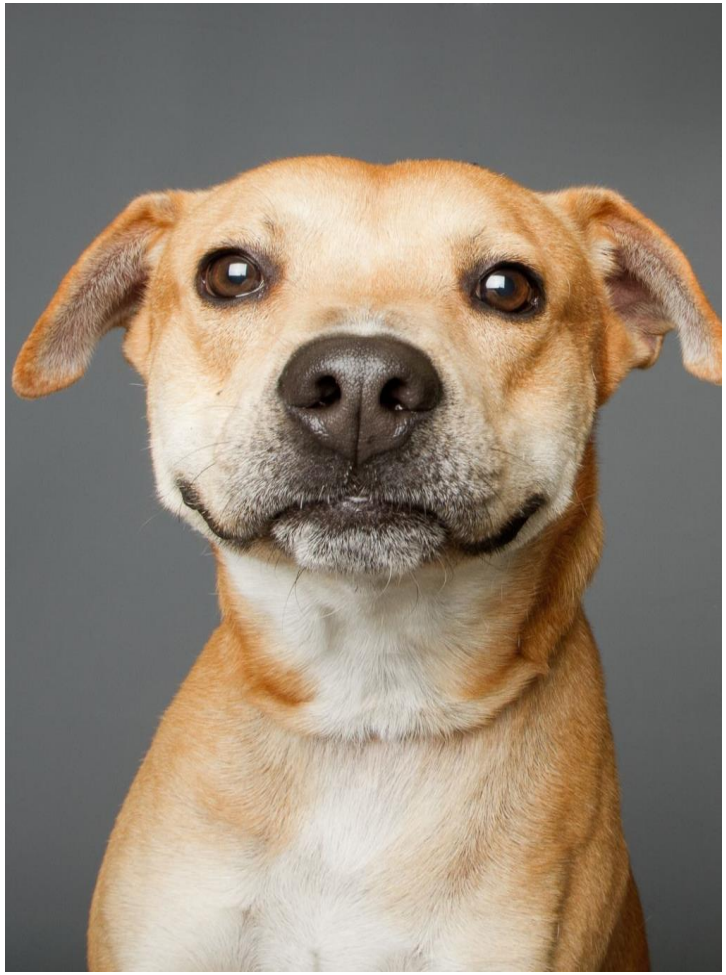
The difference previously mention is of concern because aggressiveness and behaviorally issues are not perpetual factors in these breeds and sizes. At some point in animal life, these issues rise without anyone properly addressing it. Meaning the cost for an untrained or unattended dog is higher according to the size.

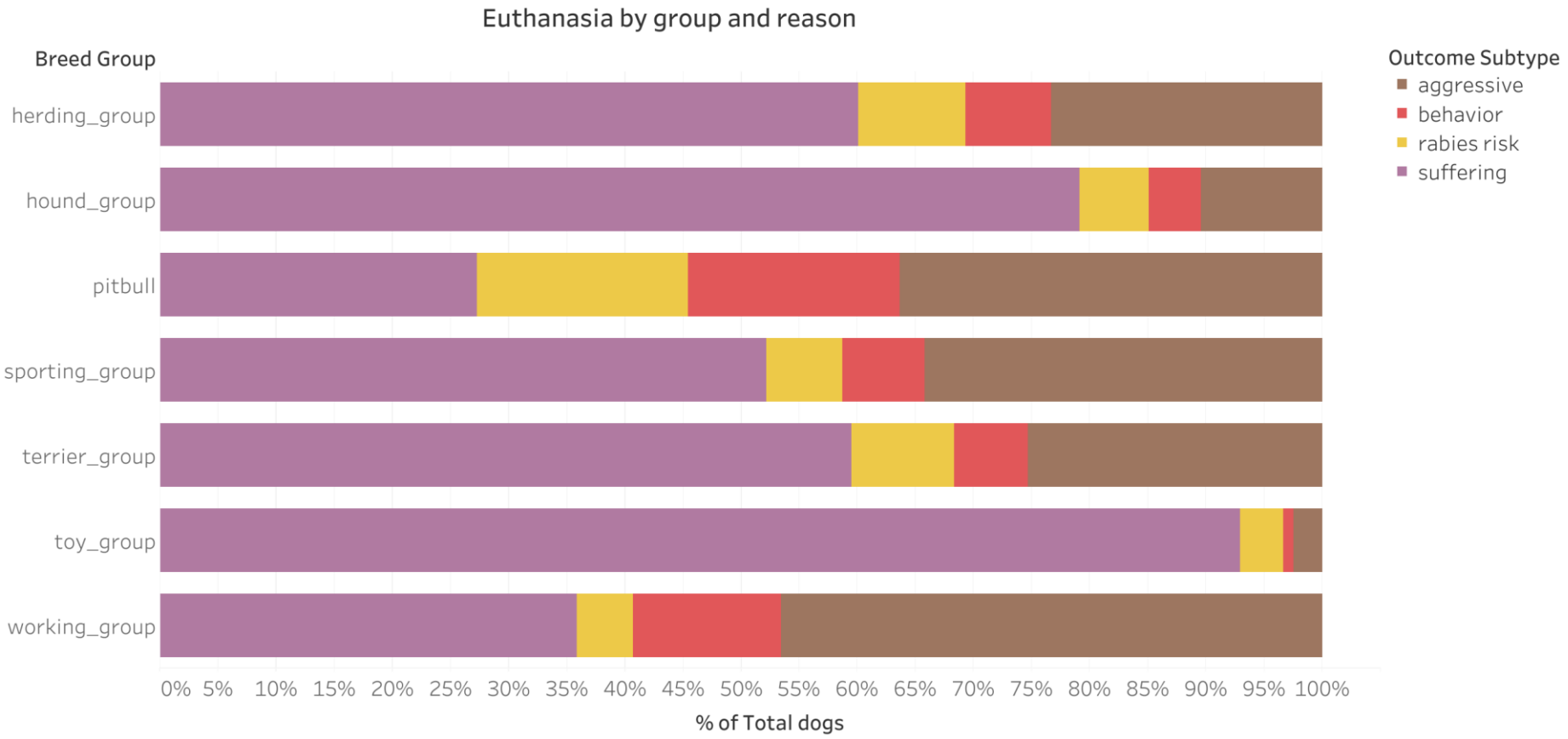


Euthanasia differences by breeds

- The group of breeds that constitutes almost exclusively the medium and the large size breeds are the most disfavored (pit bulls and working breeds).

- The working group is formed by the combination of breeds that work as a guard on farms or for personal protection and other very specific work. The Pitbulls were considered part of the working group but over time their reputation change with their inclusion in dog fights.

- In the next graph, the pit bulls that are euthanized by suffering is slightly over 25% and for working breeds is slightly over 35%. The rest is euthanized by aggressiveness, behaviour and rabies risk.



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Adoption type according to age

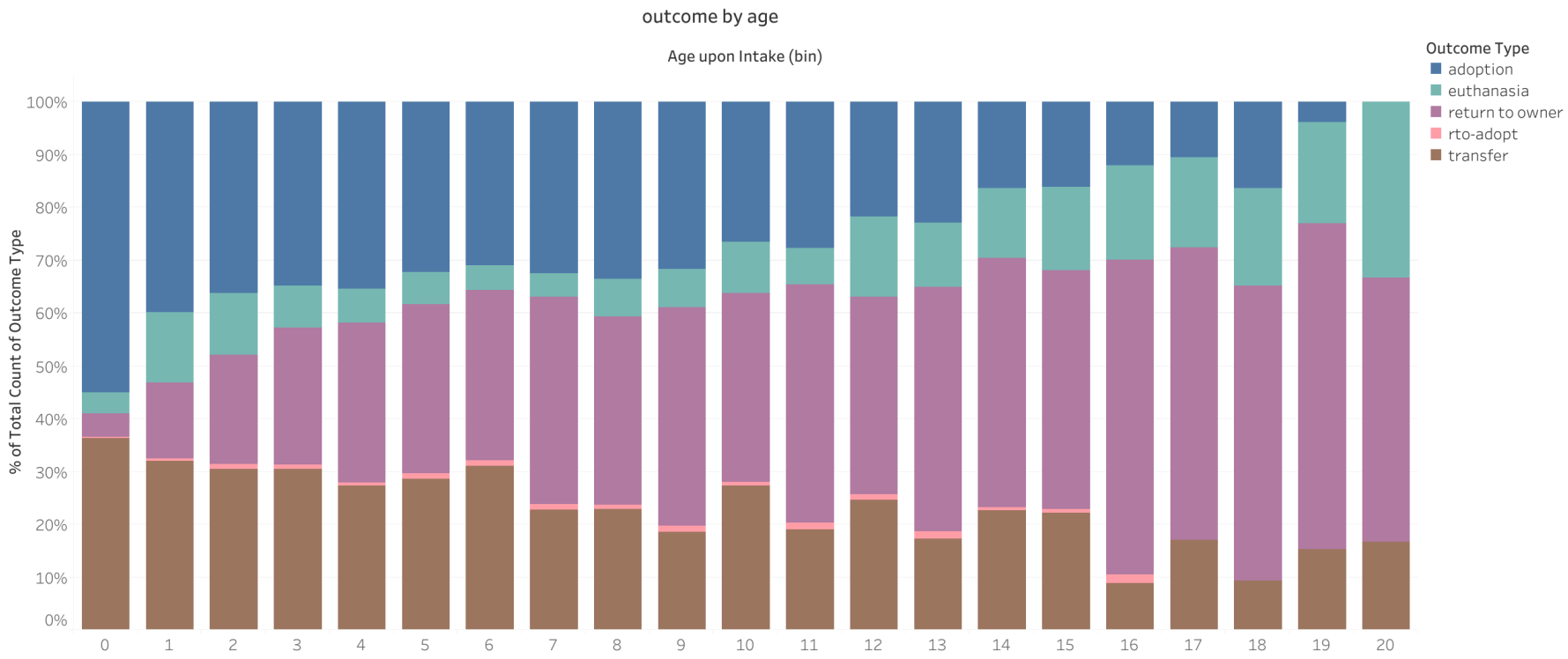
•As the dog gets older the adoption by new adopters decreases, at the same time, previous adopters and owners increase the percentage of adoptions.

•This suggests that as the dogs' age increases the probability of getting adopted by a new person is lower and the only option for these animals is to get adopted by the same person or get transferred to another location.

•The ones that get transferred may get a better chance of adoption, but some will go to different kinds of sanctuaries.

•The last detail in the next graph is a higher level of euthanasia as age increases.

Type of adoption according to age



Conclusion

- There are differences that may be considered statistical discrimination in favor of certain animals.
- The statistical discriminations were found in variables related to age, health, neuter/spay, and breed/size.
- The most important to determine the future of an animal is neuter/spay.

Final Suggestions

- To address these discoveries the creation of a Medicare system for older dogs would solve one of the main issues in the adoption process, which is health that deteriorates with age.

- This would decrease the barrier of adoption for dogs over 5 years and their age could become a positive variable because older dogs have the tendency to be calmer and require less exercise than younger dog. This would require more studies.

End