

CLAWS AND EFFECT:

Finding strategies to increase pet adoption

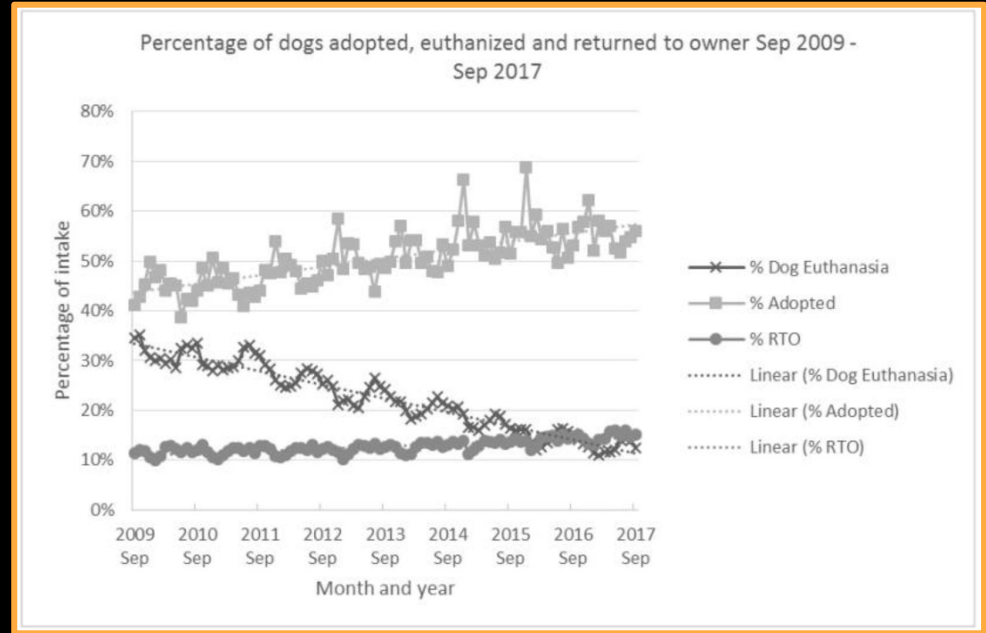
Drew Horton

Topics in Optimization // Fall 2021




Background

- Around **6.3 million pets enter animal shelters** nationwide every year.
- Approximately **920,000** of those animals are **euthanized**
 - Number has declined from 2.6 million in 2011.
 - Decline can be partially explained by an increase in the percentage of animals adopted.



Motivation

- pet adoption was booming during the early pandemic but has since slowed as people returned to work
- some shelters have seen an increase of pets relinquished by the owners

 The Denver Channel

[After record adoptions at start of pandemic, animal shelters report overcrowding](#)

As soon as we adopt a dog out, we're moving [more] dogs back up [from the kennel to the shelter floor]." Gutierrez says the capacity at...

1 week ago



 KDVR

[Adoption returns skyrocket at Colorado dog rescue](#)

(KDVR) — Puppy adoptions were through the roof during the pandemic, but now the exact opposite is happening. Animal rescues are seeing...

4 days ago



Idea

- Transferring pets between shelters/rescues is a strategy that is commonly used in animal facilities to help increase adoption rates.
- According to Pet Animal Cares Facility Act(PACFA) Program, in 2019:
 - 2983 adult dogs and 1229 juvenile dogs were transferred between Colorado animal rescues/shelters.
 - 14154 adult dogs and 16138 juvenile dogs were transferred into Colorado shelters from out of state.

GOAL: demonstrate how circuit walks can be used to strengthen how shelters transfer pets amongst themselves



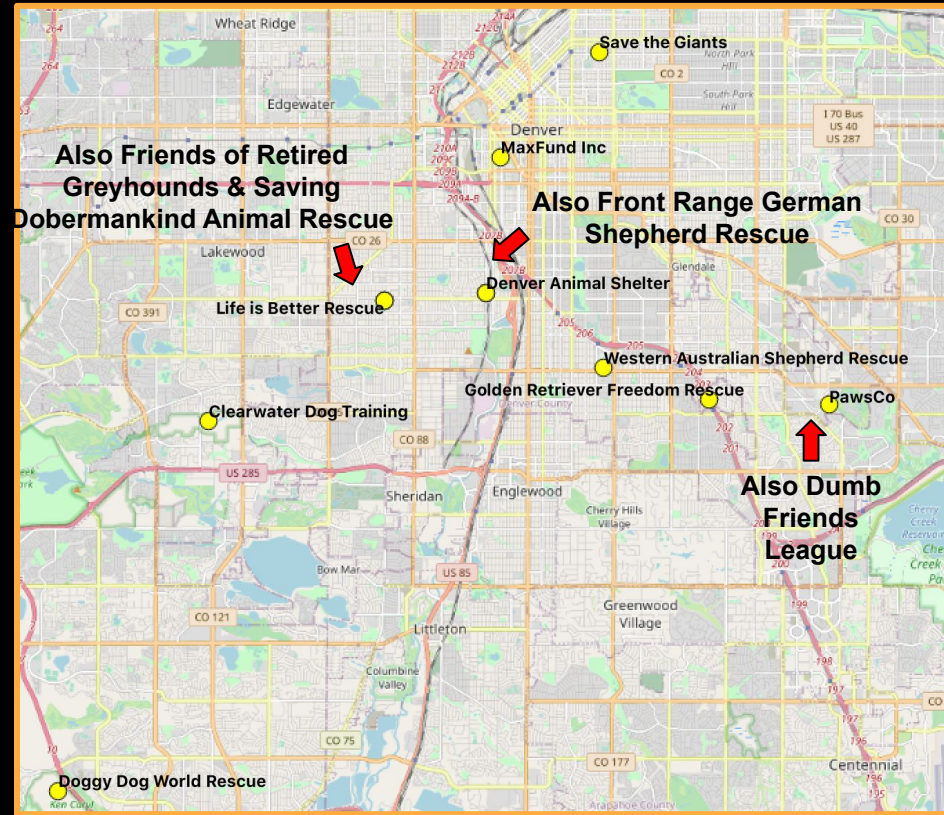
Data

- **The Pet Animal Care Facilities Act (PACFA) Program**
 - a licensing and inspection program
 - dedicated to protecting the health and well-being of pet animals in facilities throughout Colorado.
 - collects the animal shelter and rescue data for Colorado
- **Data**
 - yearly, 2015-2020
 - individual shelter level data for all of CO
 - all animal types
 - numerical data such as # of dogs relinquished by owner, # stray cats, # euthanized, #adopted



Assumptions/Simplifications

- We will only look at dogs
- **2 nodes**
 - juvenile and adult
 - 701 puppies, 5347 adults
- We will only look at the 13 shelters/rescues in the Denver area that handle dog adoption
 - Some of these shelters operate as separate entities but run out of the same building
 - We will treat them as separate facilities
- **13 Clusters**
- We will not differentiate between facilities that specialize in types of dogs (such as rescues that specialize in German Shepards)
- We will assume the capacity for each shelter is the largest number of dogs that shelter has seen in any year



Current State

- Current state is an "imagined start state of 2021"
- used data from 2019
 - 701 puppies, 5347 adults
- Some shelters are empty because they didn't have data from 2019

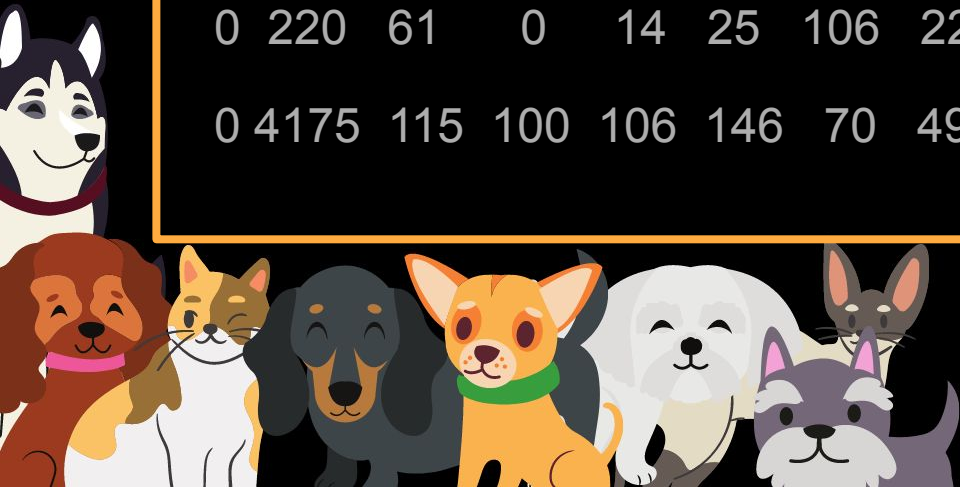
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0	220	61	0	14	25	106	228	18	12	17	0	0
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Puppies

0	4175	115	100	106	146	70	494	72	31	38	0	0
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Adult dogs



Ideal State

- Constructed at adoption rate for each shelter
 - the number of dogs adopted in 2020 and divided this by the total number of dogs in the shelter that year(minus all that were returned to owner)
- We begin by sending as many adult dogs as we can(fill to adult dog capacity) to the shelter with the highest demand, and then continued greedily.
- Repeat with puppies

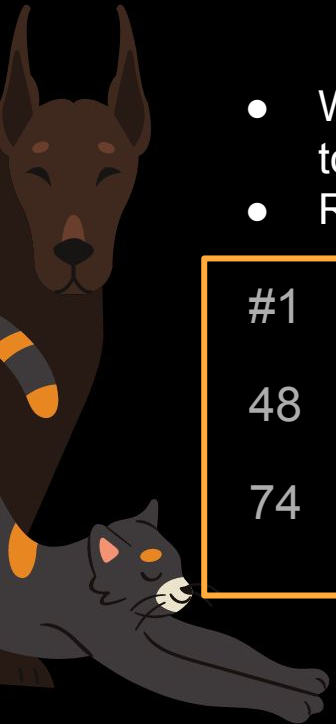
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48	0	6	0	108	39	199	34	3	6	228	30	0
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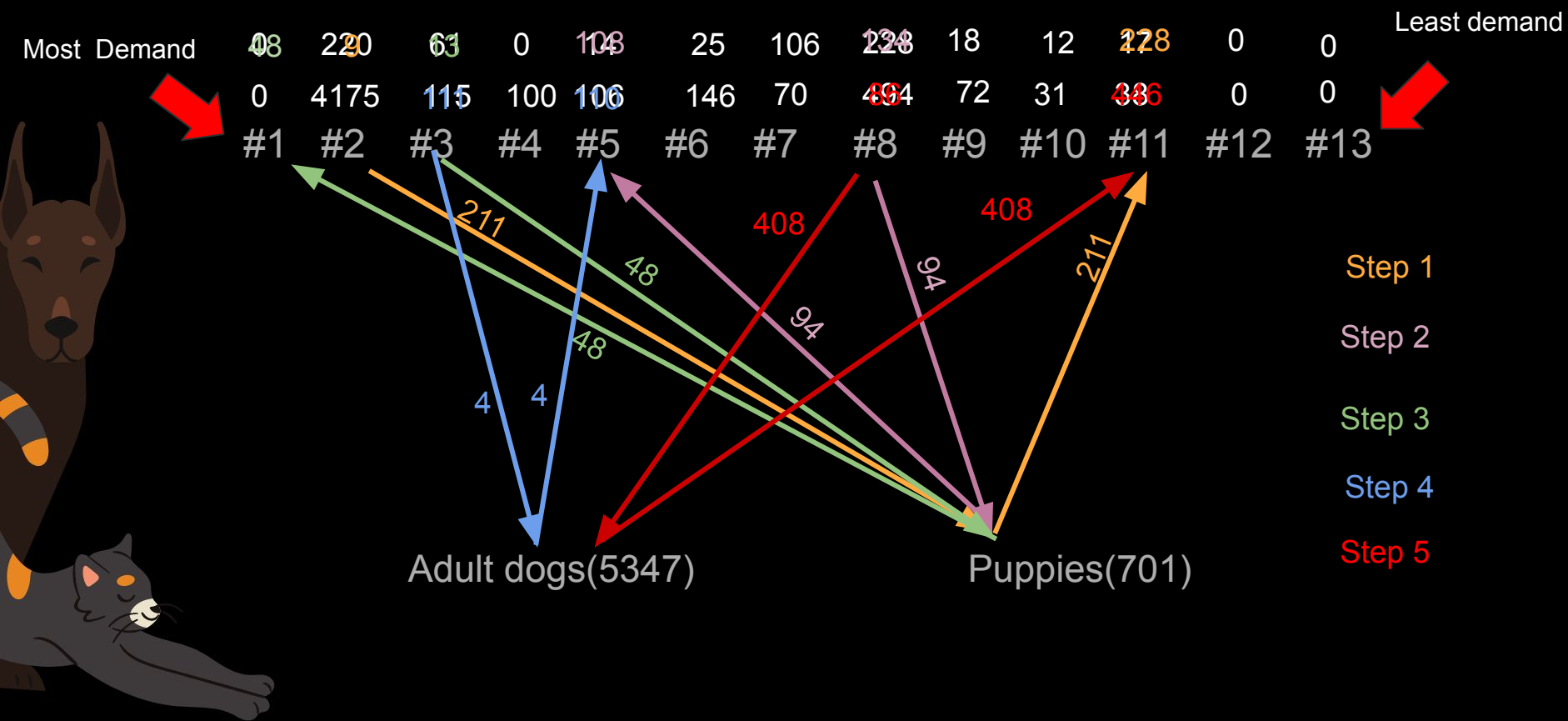
74	50	111	86	380	215	261	86	49	27	4008	0	0
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Puppies

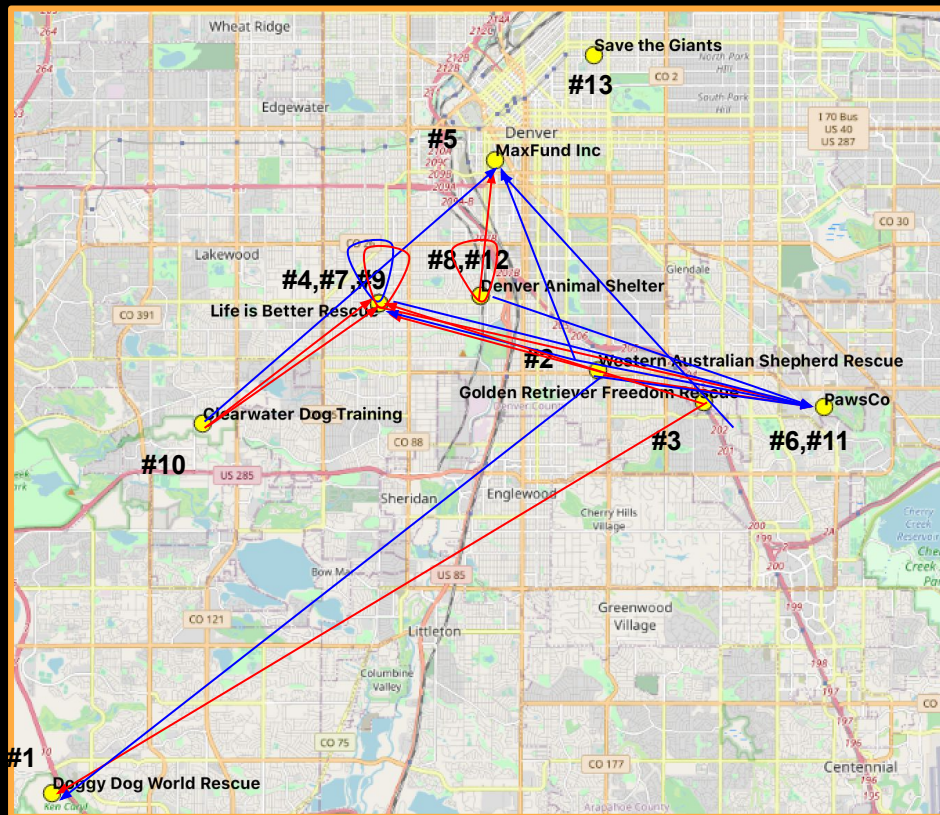
Adult dogs



Results



The sign-compatible circuit walk



20 total steps

1. 211 puppies from shelter #2 to #11
2. 94 puppies from shelter #8 to #5
3. 48 puppies from shelter #3 to #1
4. 4 adult dogs from shelter #3 to #5
5. 408 adult dogs from shelter #8 to #11
6. 3562 adult dogs from #2 to #11
7. 4 adult dogs from #10 to #5
8. 14 puppies from #9 to #6
9. 6 puppies from #10 to #7
10. 14 adult dogs from #4 to #6
11. 74 adult dogs from #2 to #1
12. 9 puppies from #2 to #7
13. 30 puppies from #8 to #12
14. 55 adult dogs from #2 to #6
15. 23 adult dogs from #9 to #7
16. 168 adult dogs from #2 to #7
17. 1 puppy from #9 to #7
18. 7 puppies from #3 to #7
19. 70 puppies from #10 to #9
20. 266 adults from #2 to #5



Policy Recommendations

- This project provides a preliminary structure for a method to strengthen the way we transfer animals in and out of shelters, rescues, and foster homes.
- encourage shelters to keep as much data as they can to help us learn more about adoption patterns
 - comfortable capacities of shelters
 - with information about breed we can look at transferring animals to areas with more specific demand



Some shortcomings

- Start vertex is using old data, not accurate to current state
- Ideal vertex leaves some shelters with 0 dogs and 0 puppies, this is most likely not actually “ideal”.
- Some of the shelters likely only handle certain types of dogs, but we ignored this for simplicity.



Future Work

- Create a integer program to help pick a better ideal state
- Figure out a better way to pick circuits for the circuit walk
- Extend analysis to nationwide
 - Some states have higher rates for euthanasia, so using this program to transfer pets out of high kill areas into high demand areas could save many pets.
- Incorporate breeds of animals
 - Instead of looking at just adult dogs and puppies, we could look at different breeds.



References

Rowan A, Kartal T. Dog Population & Dog Sheltering Trends in the United States of America. Animals (Basel). 2018;8(5):68. Published 2018 Apr 28. doi:10.3390/ani8050068

Steffen Borgwardt, Charles Viss, Circuit walks in integral polyhedra, Discrete Optimization, 2020,100566, ISSN 1572-5286, <https://doi.org/10.1016/j.disopt.2019.100566>.

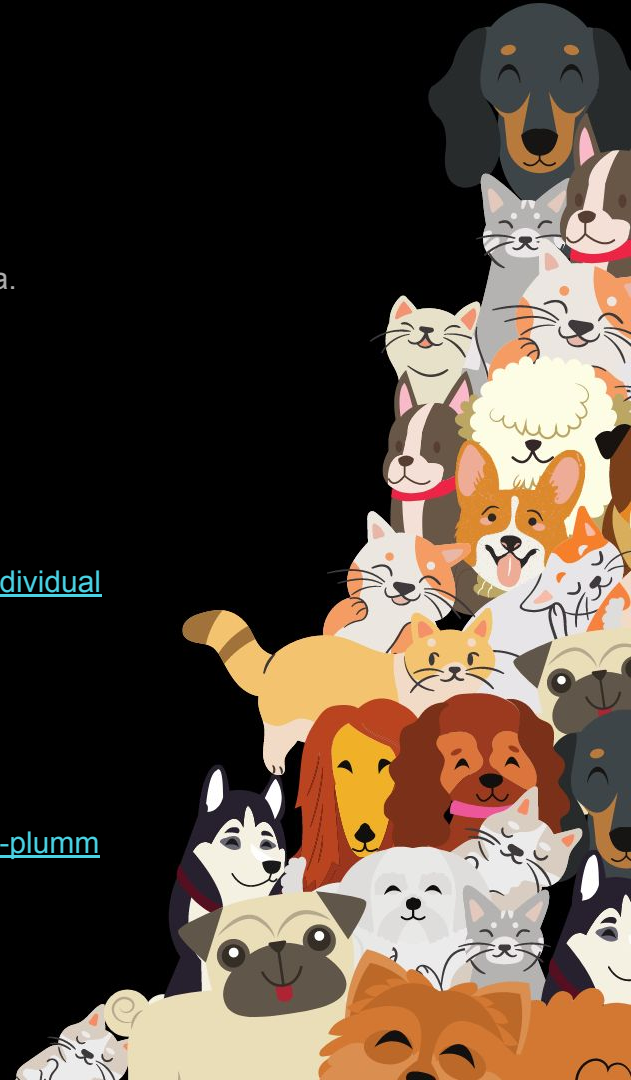
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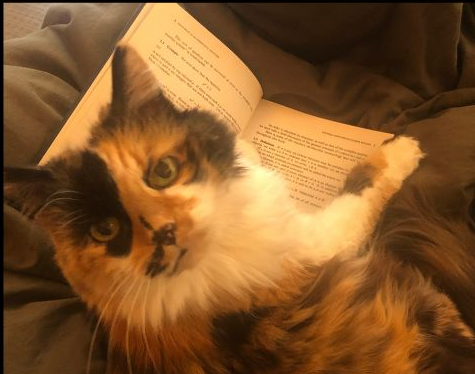
<https://ag.colorado.gov/ics/pet-animal-care-facilities-act-pacfa/animal-shelter-and-rescue-individual-statistics>

Pet Statistics

<https://www.asPCA.org/helping-people-pets/shelter-intake-and-surrender/pet-statistics>

<https://www.nytimes.com/2019/09/03/upshot/why-euthanasia-rates-at-animal-shelters-have-plummeted.html>





QUESTIONS?

**ADOPT
DON'T
SHOP**

