









Who Gets Adopted?

Who Gets Adopted?

Predicting Shelter Outcomes from Intake-Day Data.







**Can we predict on the very day an animal
arrives its chances of finding a home?**



Helping shelters save more lives.





Every year, thousands are lost to
intuition





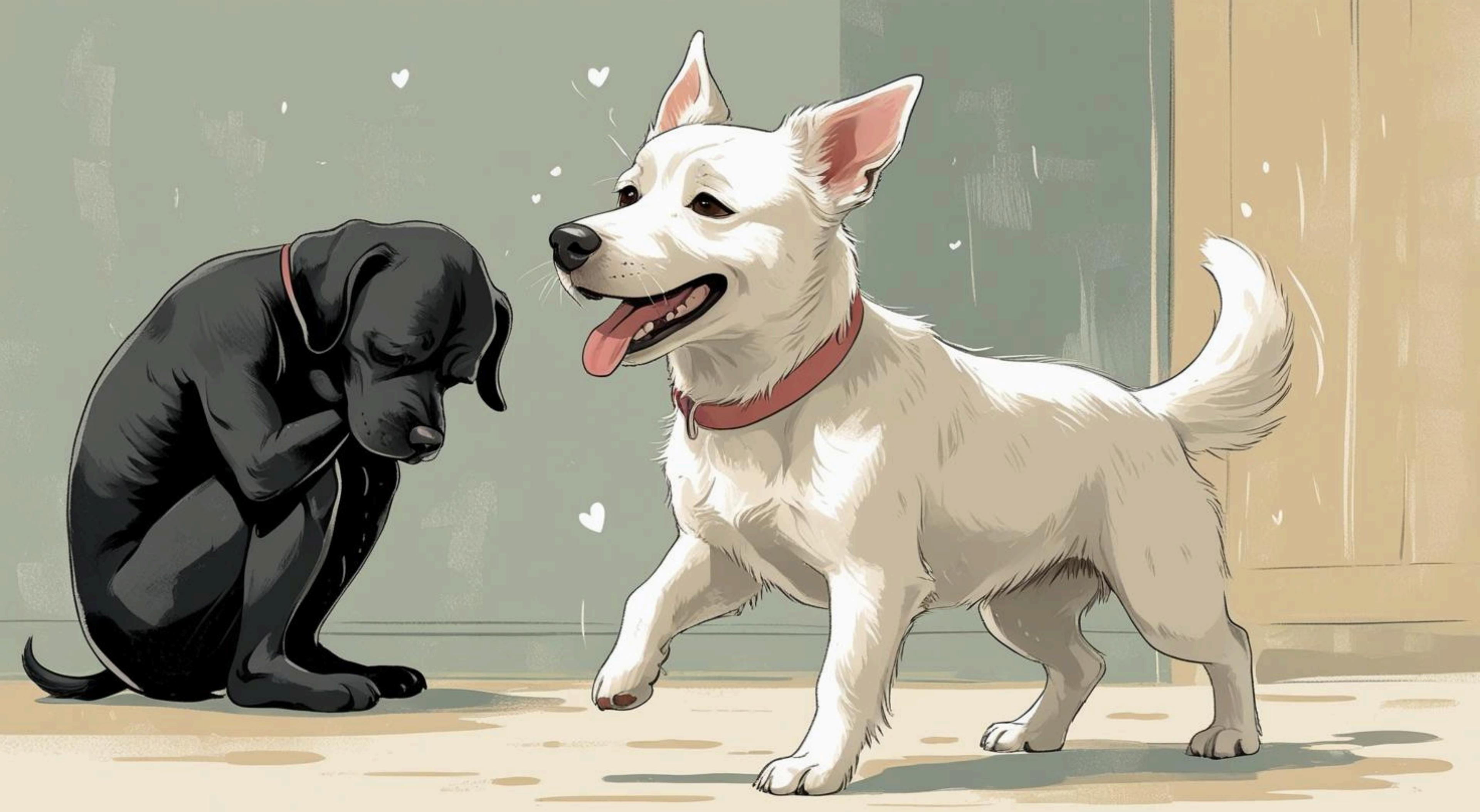


Our Research Question

Which intake traits truly predict adoption?

**Can we trust a machine-learning model to
make real-time predictions?**

Black-dog syndrome



WHY YOU SHOULD ADOPT A BLACK DOG

REASON #4691 BLACK DOGS LOOK **GREAT** **IN ANY COLOR.**

DID YOU KNOW THAT BLACK DOGS ARE USUALLY THE LAST ONES TO GET ADOPTED? HELP BREAK BLACK DOG SYNDROME AND ADOPT A BLACK DOG.



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WHY YOU SHOULD ADOPT A BLACK DOG

REASON #239 BLACK DOGS **ARE** **GRE** **IN ANY**

DID YOU KNOW THAT BLACK DOGS ARE USUALLY THE LAST ONES TO GET ADOPTED? HELP BREAK BLACK DOG SYNDROME AND ADOPT A BLACK DOG.



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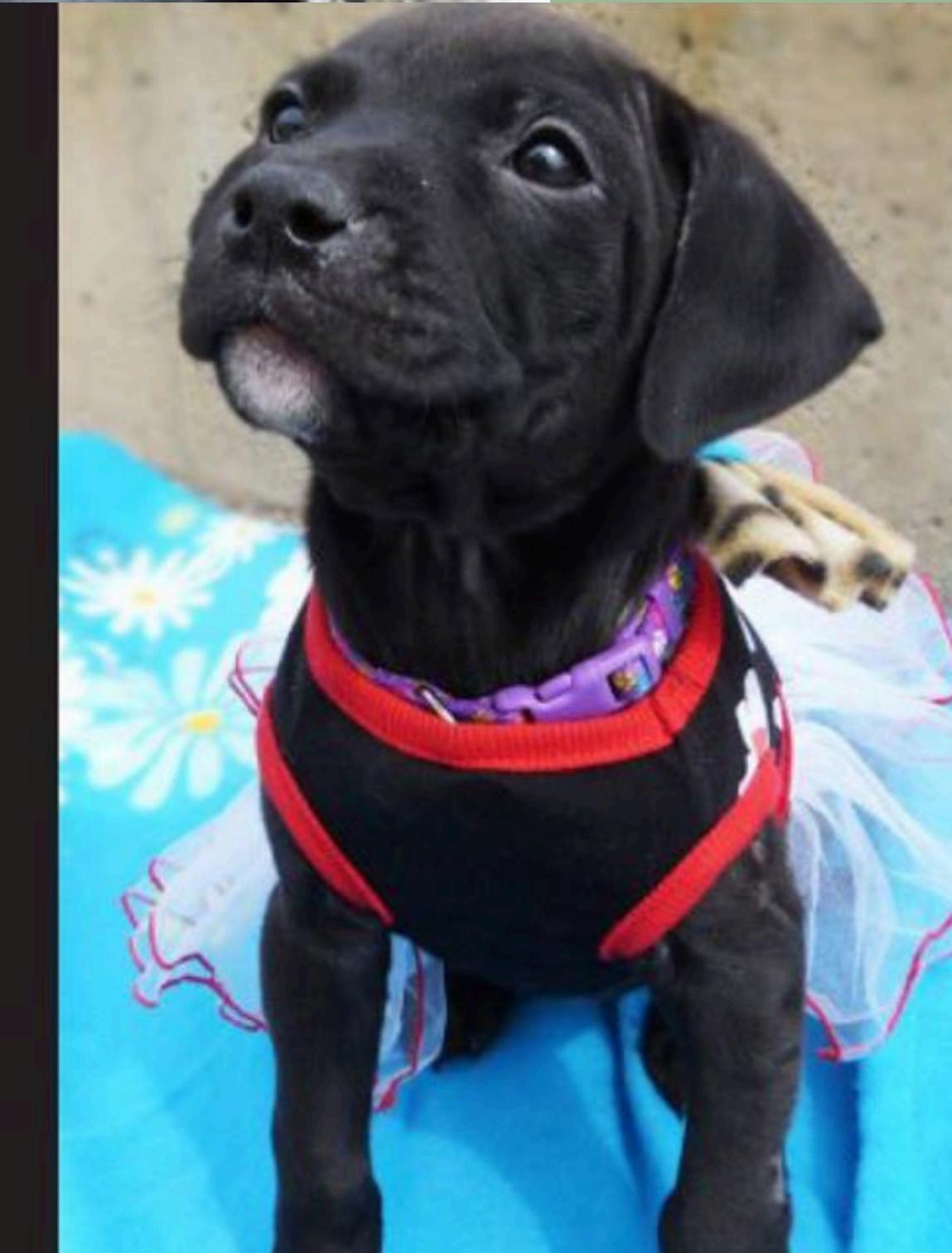
WHY YOU SHOULD ADOPT A BLACK DOG

REASON #239 BLACK DOGS MAKE YOU LOOK **TOUGH**

DID YOU KNOW THAT BLACK DOGS ARE USUALLY THE LAST ONES TO GET ADOPTED? HELP BREAK BLACK DOG SYNDROME AND ADOPT A BLACK DOG.



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WHY YOU SHOULD ADOPT A BLACK DOG

REASON #966 BLACK DOGS **ARE** **GRE** **IN ANY**

DID YOU KNOW THAT BLACK DOGS ARE USUALLY THE LAST ONES TO GET ADOPTED? HELP BREAK BLACK DOG SYNDROME AND ADOPT A BLACK DOG.



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WHY YOU SHOULD ADOPT A BLACK DOG

REASON #967 BLACK DOGS MAKE YOU **TOUCH**

DID YOU KNOW THAT BLACK DOGS ARE USUALLY THE LAST ONES TO GET ADOPTED? HELP BREAK BLACK DOG SYNDROME AND ADOPT A BLACK DOG.



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REASON #967 BLACK DOGS MAKE YOU **TOUCH** **BLACK DOGS** **ROCK** **ANY ACCESSORY**

DID YOU KNOW THAT BLACK DOGS ARE USUALLY THE LAST ONES TO GET ADOPTED? HELP BREAK BLACK DOG SYNDROME AND ADOPT A BLACK DOG.



Is black-dog bias still a thing?

**Spoiler: The data tells a different
story**



Austin Animal Center

10229



POLICE
Austin
Texas

```
tibble [36,682 x 9] (S3: tbl_df/tbl/data.frame)
$ outcome_type : Factor w/ 2 levels "Adopted", "Not_Adopted": 1 2 1 2 2 2 2 1 2 1 ...
..- attr(*, "names")= chr [1:36682] "Adoption" "Euthanasia" "Adoption" "Euthanasia" ...
$ animal_type : Factor w/ 2 levels "Cat", "Dog": 2 2 2 1 2 2 2 2 2 2 ...
$ mixed_purebred: Factor w/ 2 levels "Mixed", "Purebred": 1 1 2 2 2 2 1 1 2 1 ...
$ color_group : Factor w/ 3 levels "Black", "Brown", ...: 1 1 1 1 2 2 2 2 2 1 ...
$ health_status : Factor w/ 2 levels "Healthy", "Sick_Aged_Pregnant": 1 2 2 2 2 2 2 1 2 1 ...
$ sex : Factor w/ 2 levels "Female", "Male": 2 2 2 1 2 2 1 2 2 1 ...
$ neutered : Factor w/ 2 levels "Intact", "Neutered_Spayed": 2 2 2 2 2 2 2 2 1 2 ...
$ age_norm : num [1:36682] 0.727 0.636 0.773 0.864 0.682 ...
$ age_group : Factor w/ 4 levels "Adult", "Juvenile", ...: 4 4 4 4 4 4 4 4 4 4 ...
- attr(*, "na.action")= 'omit' Named int [1:6] 6405 41824 55745 67133 67137 67139
..- attr(*, "names")= chr [1:6] "6405" "41824" "55745" "67133" ...
```



Dog or cat?

Mixed or purebred?

Color ?

Health status?

Sex?

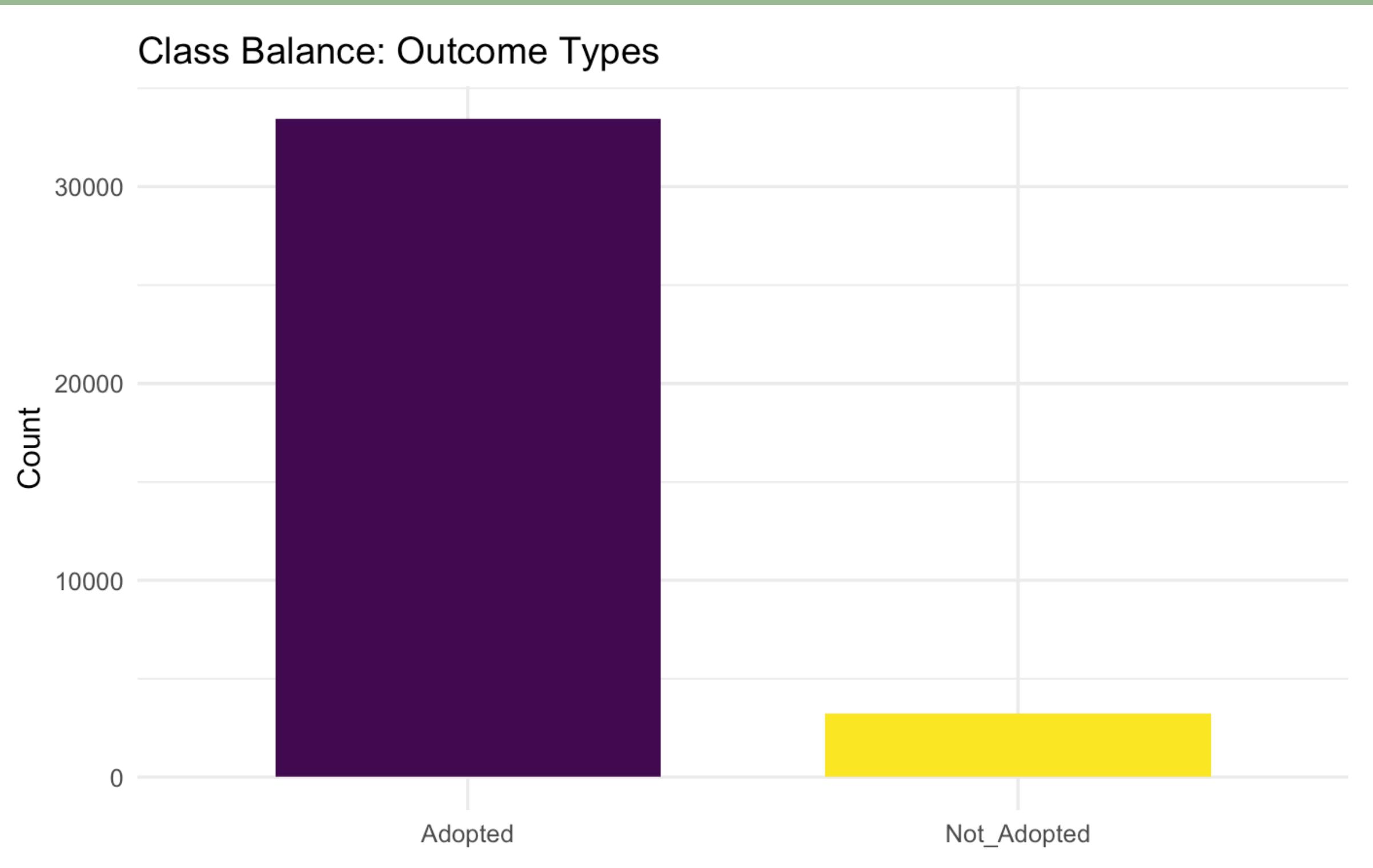
Neutered?

Age ?

outcome_type	animal_type	mixed_purebred	color_group	health_status	sex	neutered
Adopted :33434	Cat:14328	Mixed :35176	Black:11593	Healthy :33056	Female:18056	Intact :26611
Not_Adopted: 3248	Dog:22354	Purebred: 1506	Brown:18506	Sick_Aged_Pregnant: 3626	Male :18626	Neutered_Spayed:10071
			Light: 6583			

age_norm	age_group
Min. :0.000000	Adult : 5643
1st Qu.:0.007472	Juvenile :13145
Median :0.045455	Puppy_Kitten:15729
Mean :0.082538	Senior : 2165
3rd Qu.:0.090909	
Max. :1.000000	

Class Balance: Outcome Types



```
set.seed(2025)
split <- initial_split(df, strata = outcome_type, prop = 0.80)
train <- training(split)
test <- testing(split)
folds <- vfold_cv(train, v = 10, strata = outcome_type)
```

```
rec <- recipe(outcome_type ~ ., data = train) %>%
  step_other(all_nominal_predictors(), threshold = 0.01) %>%
  step_dummy(all_nominal_predictors()) %>%
  step_zv(all_predictors()) %>%
  step_smote(outcome_type) %>% # SMOTE balancing
  step_normalize(all_numeric_predictors())
```

Logistic Regression?

Random Forests?

Gradient Boosting?

Evolution of Tree Algorithms



Decision
Trees

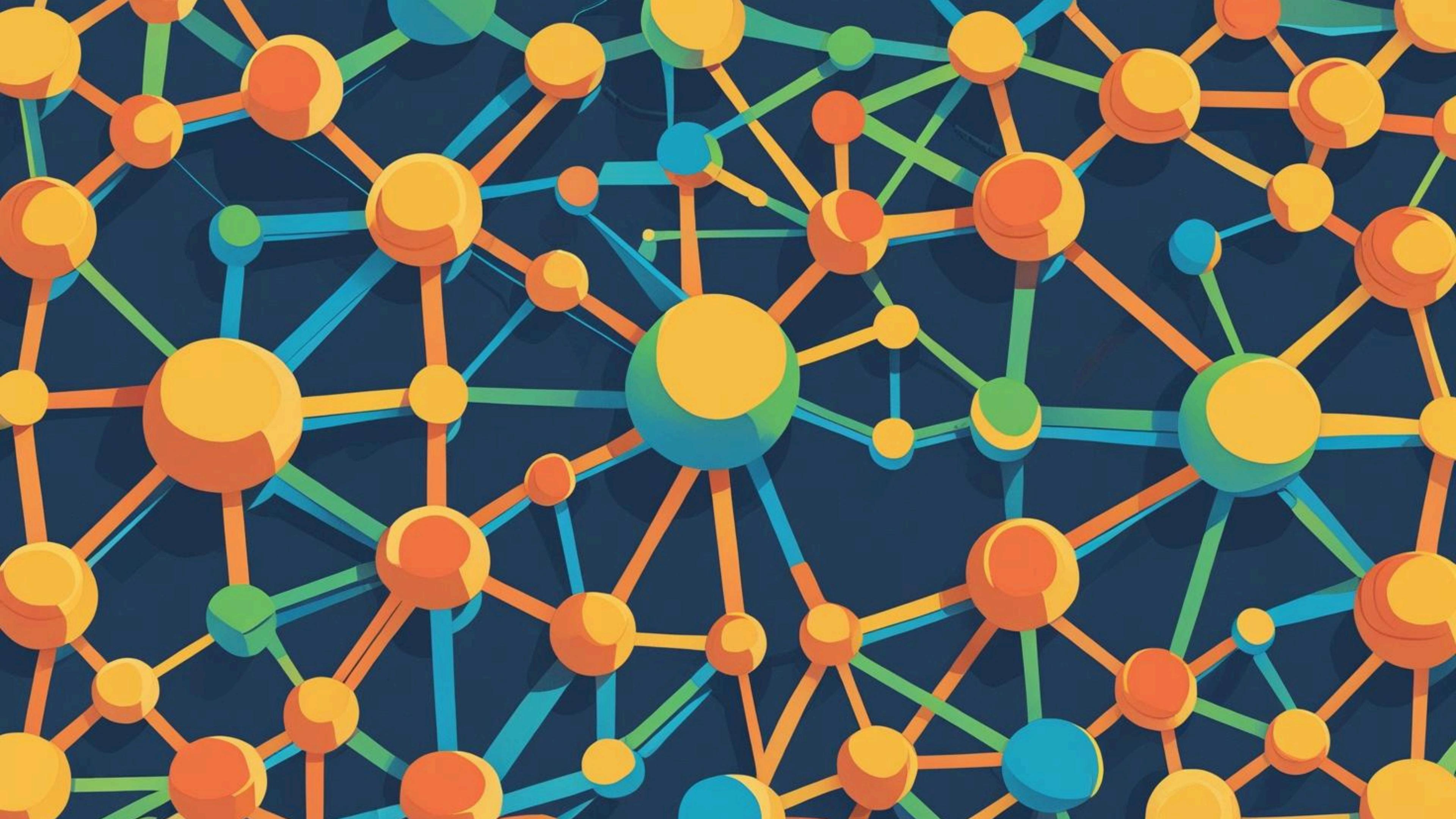
Bagging

Random
Forest

Boosting

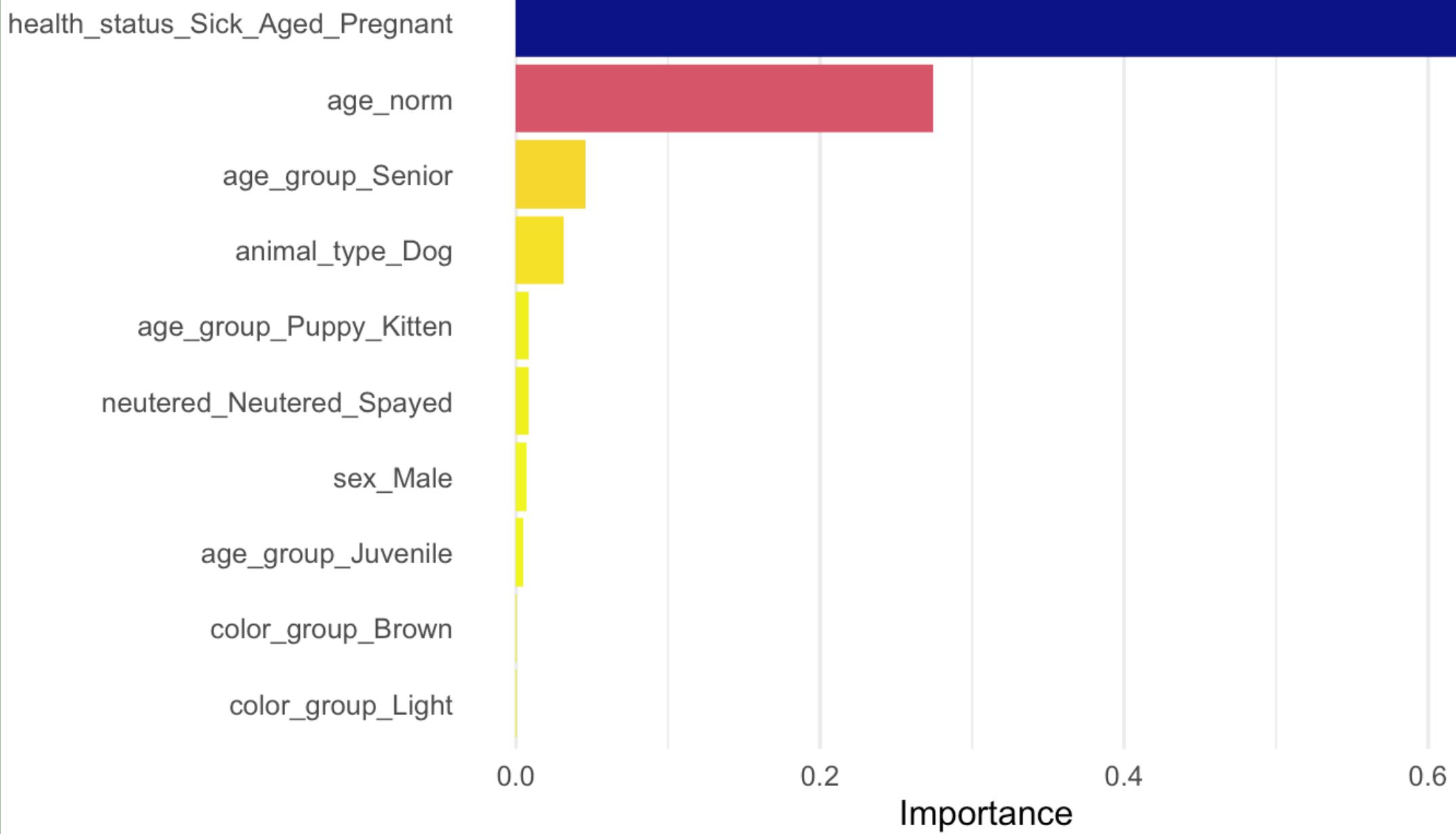
Gradient
Boosting

XG-Boost



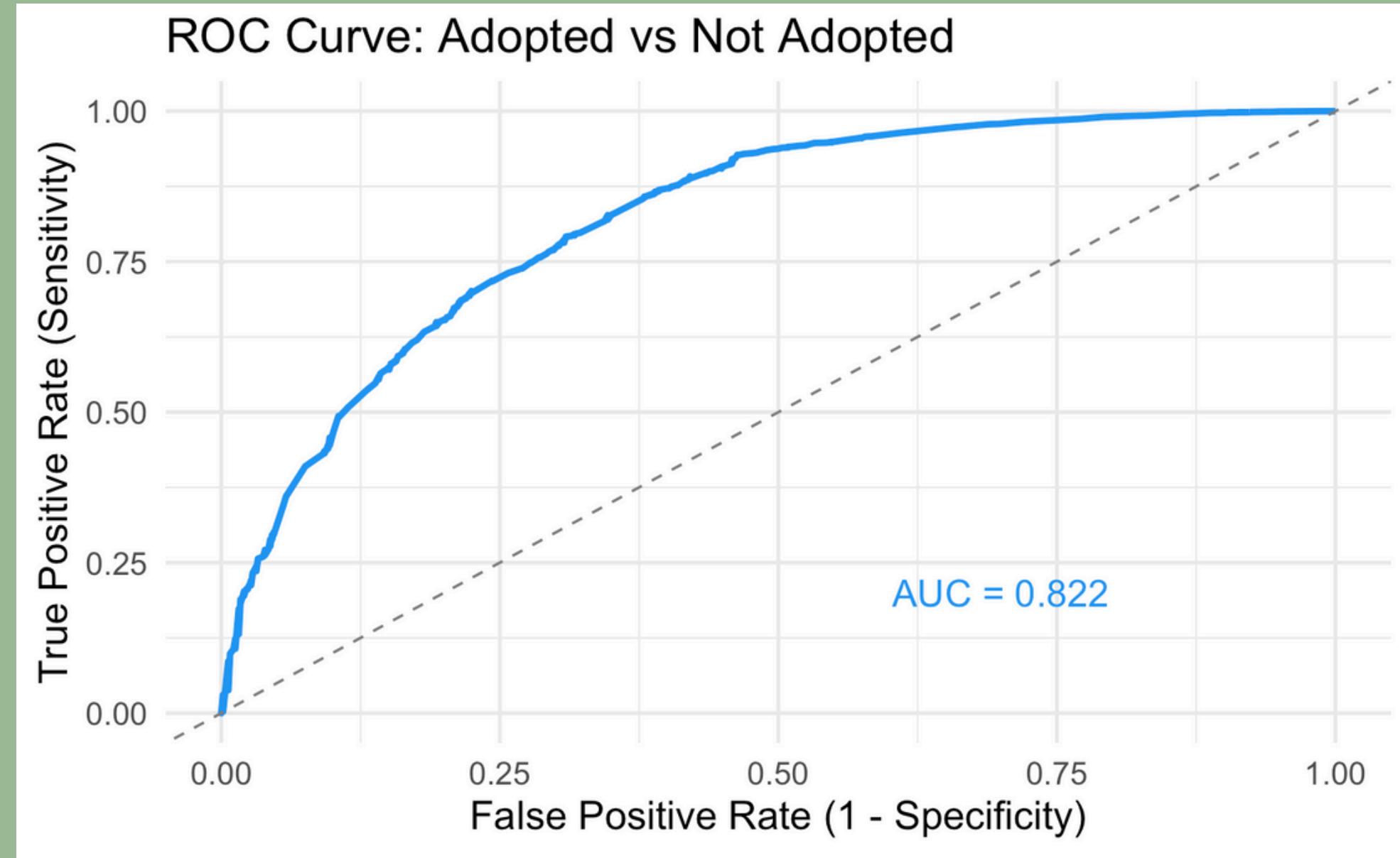


Top-10 Feature Importances



What about the color?



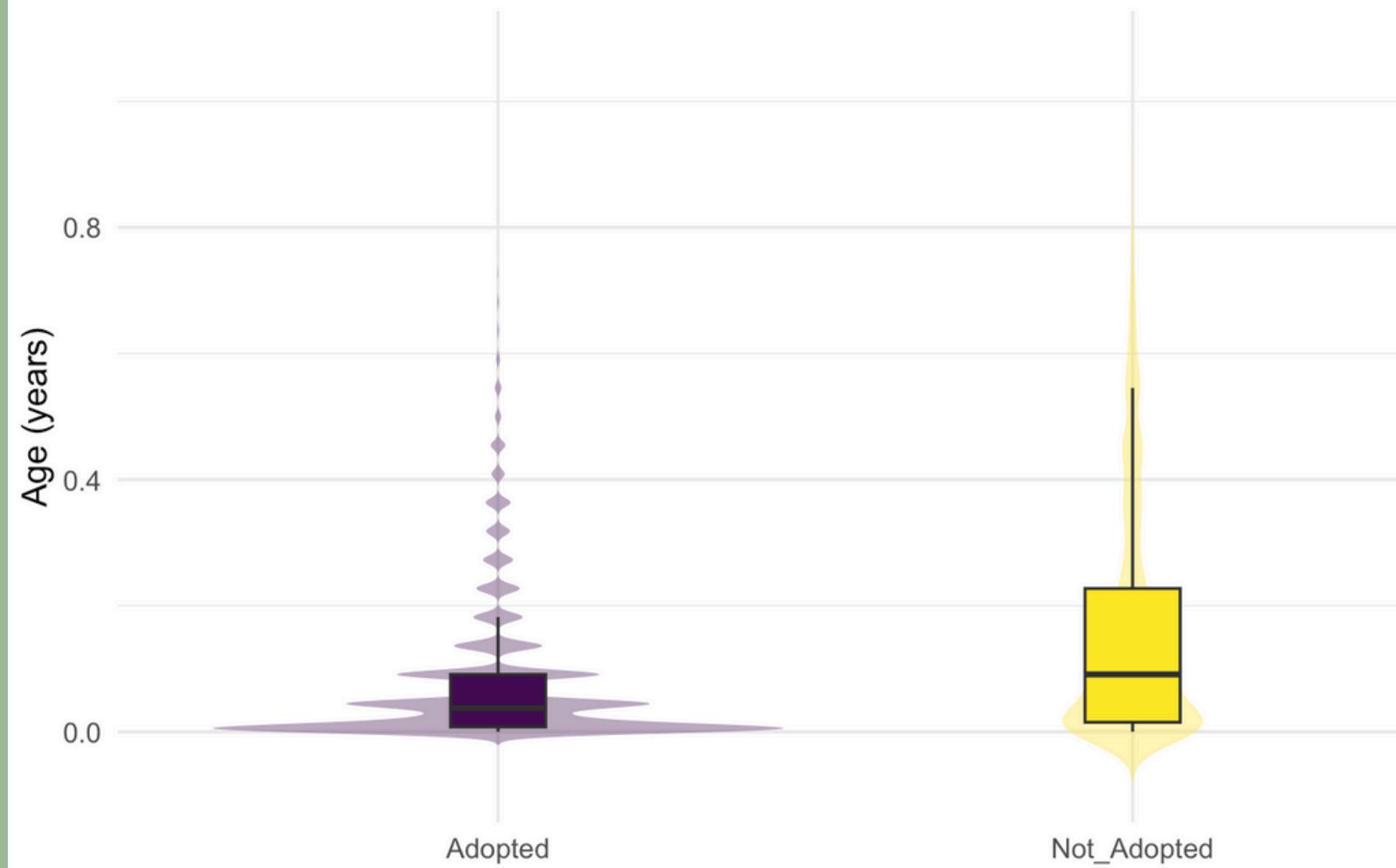


Metric	Score	Interpretation
Accuracy	0.786	≈ 4 of every 5 predictions are correct.
Sensitivity (Recall)	0.796	79.6 % of animals that were <i>actually adopted</i> were predicted correctly (5 333 / 6 700).
Specificity	0.683	68.3 % of <i>non-adopted</i> animals were flagged correctly (435 / 637).
F-measure	0.872	Strong balance between precision and recall.
ROC-AUC	0.822	Good class separation across all thresholds.
PR-AUC	0.975	Excellent precision even when recall is pushed high-crucial under heavy class imbalance.

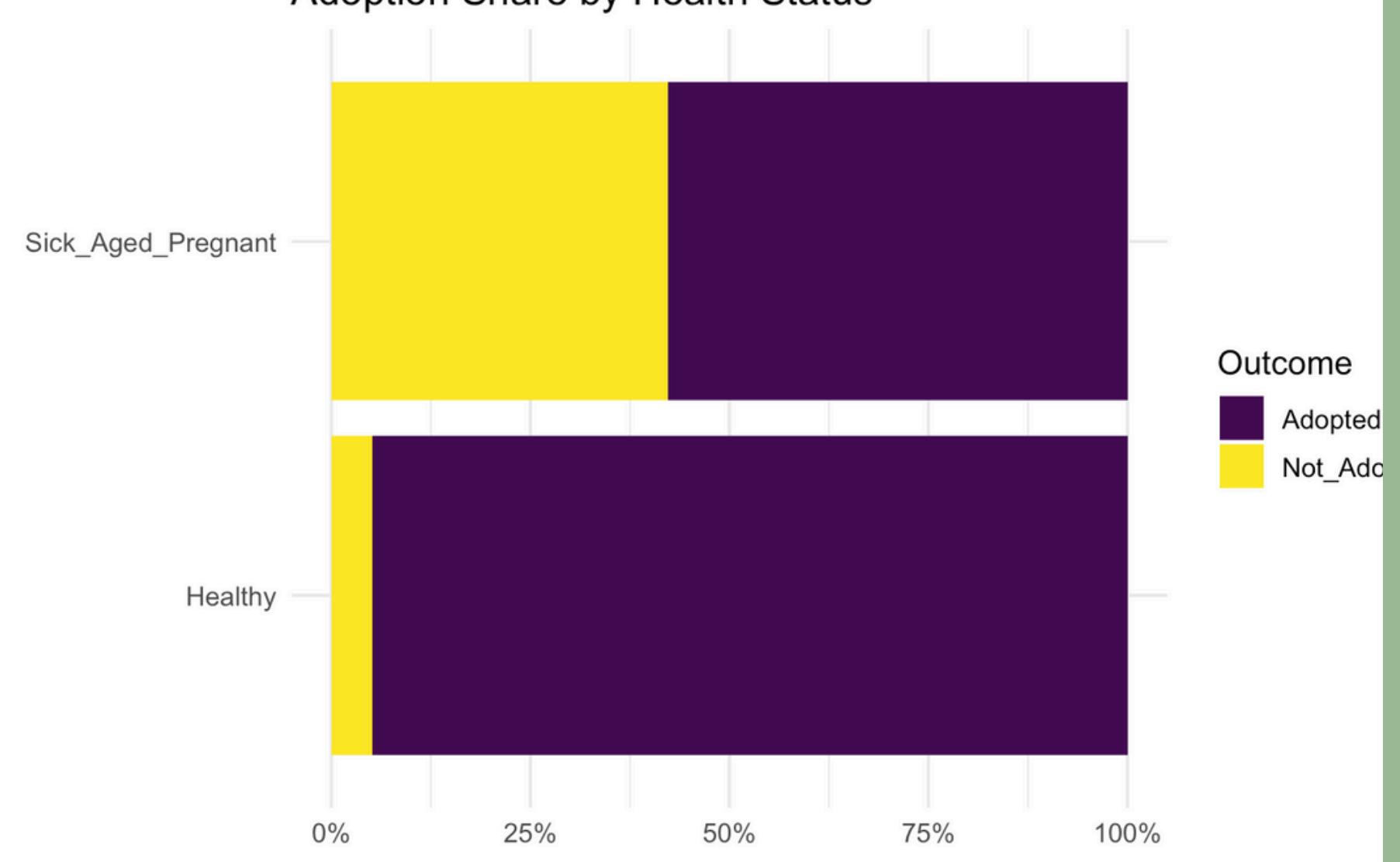


	Truth = Adopted	Truth = Not Adopted
Pred = Adopted	5 333 (TP)	202 (FP)
Pred = Not Adopted	1 367 (FN)	435 (TN)

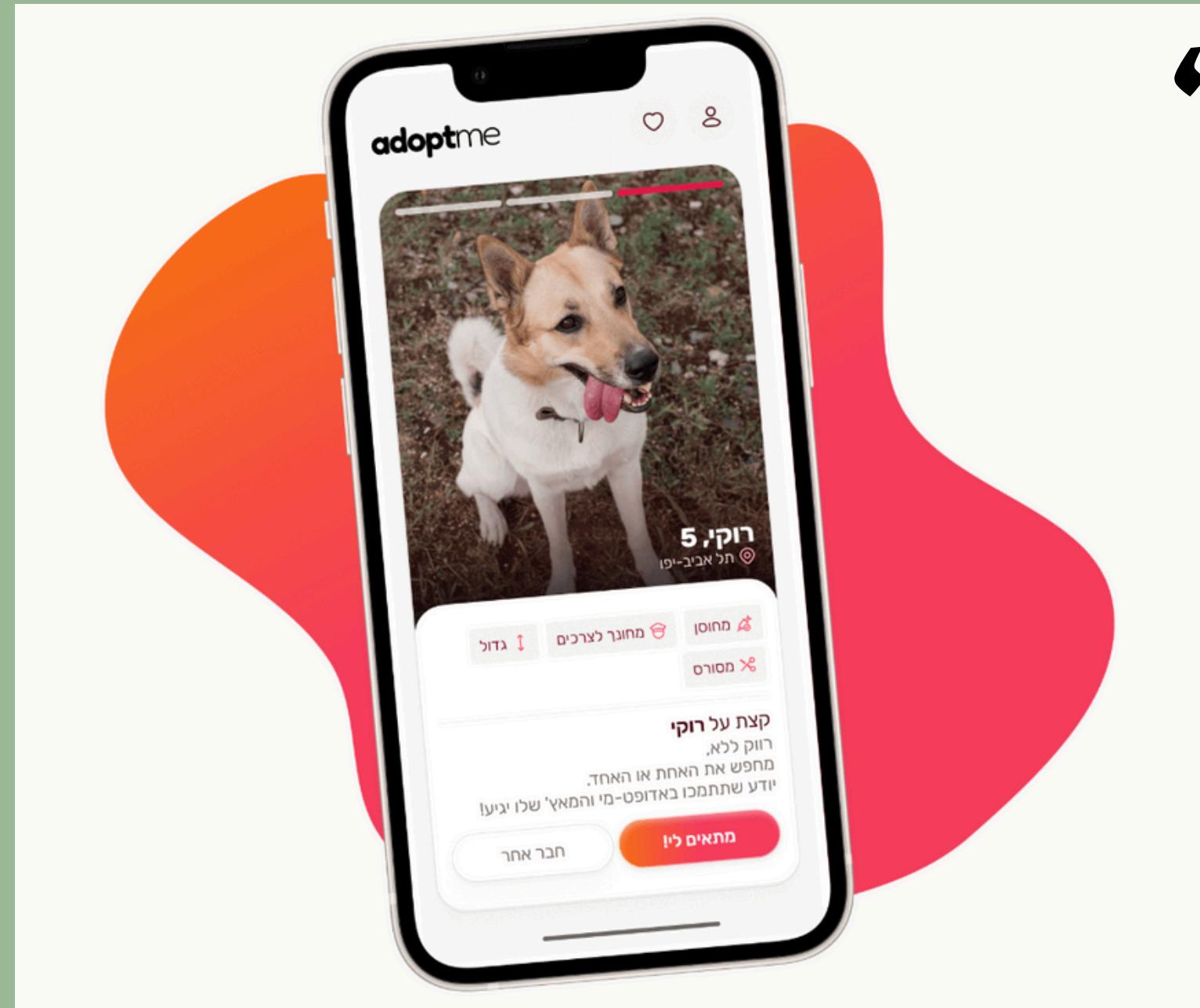
Age Distribution by Outcome



Adoption Share by Health Status







“I always thought colour mattered—turns out age and health scream louder.”

**Let's use these findings to drive real
change in shelters**

Limitations

What's next?











Data can save lives

Age and health outshine color

Color bias? Mostly a myth

Help more pets go home