

Imports

```
In [1]: import pandas as pd
import numpy as np
%matplotlib inline
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
import seaborn as sn
```

```
In [2]: data = pd.read_csv("Austin_Animal_Shelter_Dataset.csv")
data.size
```

Out[2]: 876848

```
In [3]: columns = data.columns.values.tolist()
print(columns)
```

```
['Animal ID', 'Name', 'Date of Birth', 'Intake Date', 'Intake Time', 'Intake Age in Days', 'Intake Age in Weeks', 'Intake Age in Months', 'Intake Age in Years', 'Outcome Date', 'Outcome Time', 'Outcome Age in Days', 'Outcome Age in Weeks', 'Outcome Age in Months', 'Outcome Age in Years', 'Length of Stay in Days', 'Found Location', 'Intake Type', 'Intake Condition', 'Animal Type', 'Sex at Intake', 'Outcome', 'Outcome Subtype', 'Sex at Outcome', 'Altered at Shelter', 'Original Breed', 'Collapsed Breed', 'Color']
```

Preparing Data

Our model only needs entries that have 'Adoption' or 'Euthanasia' as their outcome

```
In [4]: data1 = data[(data['Outcome']=='Adoption') ]
data2 = data[(data['Outcome'] == 'Euthanasia')]
pruned_data = [data1, data2]
pruned_data = pd.concat(pruned_data, sort=False)
pruned_data.size
```

Out[4]: 448336

Checking for missing values

```
In [5]: pruned_data.isna().sum()
```

Out[5]: Animal ID 0

```

Name          4371
Date of Birth      0
Intake Date        0
Intake Time        0
Intake Age in Days 0
Intake Age in Weeks 0
Intake Age in Months 0
Intake Age in Years 0
Outcome Date        0
Outcome Time        0
Outcome Age in Days 0
Outcome Age in Weeks 0
Outcome Age in Months 0
Outcome Age in Years 0
Length of Stay in Days 0
Found Location      0
Intake Type        0
Intake Condition      0
Animal Type        0
Sex at Intake        0
Outcome            0
Outcome Subtype    11044
Sex at Outcome        0
Altered at Shelter      0
Original Breed        0
Collapsed Breed        0
Color              0
dtype: int64

```

Deleting unneeded Columns

In [6]:

```

pruned_data.pop('Name')
pruned_data.pop('Intake Date')
pruned_data.pop('Intake Time')
pruned_data.pop('Intake Age in Days')
pruned_data.pop('Intake Age in Weeks')
pruned_data.pop('Outcome Date')
pruned_data.pop('Outcome Time')
pruned_data.pop('Outcome Age in Days')
pruned_data.pop('Outcome Age in Weeks')
pruned_data.pop('Outcome Age in Years')
pruned_data.pop('Found Location')

pruned_data.head()

```

Out[6]:

	Animal ID	Date of Birth	Intake Age in Months	Intake Age in Years	Outcome Age in Months	Length of Stay in Days	Intake Type	Intake Condition	Animal Type	Sex at Intake
8	A818975	5/19/2020	0	0	2	35.0	Stray	Normal	Cat	Intact Male
11	A760053	10/11/2015	24	2	24	4.0	Stray	Normal	Dog	Intact Male
12	A707375	1/11/2015	6	0	10	140.0	Stray	Normal	Dog	Intact Female
13	A696408	2/4/2013	24	2	27	113.0	Stray	Normal	Dog	Intact Female

Animal ID	Date of Birth	Intake Age in Months	Intake Age in Years	Outcome Age in Months	Length of Stay in Days	Intake Type	Intake Condition	Animal Type	Sex at Intake
16 A657188	6/24/1999	172	14	175	77.0	Owner Surrender	Normal	Cat	Neutered Male

One hot encoding

In [7]:

```
pruned_data = pd.get_dummies(pruned_data, columns = ['Intake Type'])
pruned_data = pd.get_dummies(pruned_data, columns = ['Animal Type'])
pruned_data = pd.get_dummies(pruned_data, columns = ['Sex at Outcome'])
pruned_data = pd.get_dummies(pruned_data, columns = ['Sex at Intake'])
pruned_data = pd.get_dummies(pruned_data , columns = ['Collapsed Breed'])

columns = pruned_data.columns.values.tolist()
print(columns)
```

```
['Animal ID', 'Date of Birth', 'Intake Age in Months', 'Intake Age in Years', 'Outcome Age in Months', 'Length of Stay in Days', 'Intake Condition', 'Outcome', 'Outcome Subtype', 'Altered at Shelter', 'Original Breed', 'Color', 'Intake Type_Abandoned', 'Intake Type_Euthanasia Request', 'Intake Type_Owner Surrender', 'Intake Type_Public Assist', 'Intake Type_Stray', 'Intake Type_Wildlife', 'Animal Type_Bird', 'Animal Type_Cat', 'Animal Type_Dog', 'Animal Type_Livestock', 'Animal Type_Other', 'Sex at Outcome_Intact Female', 'Sex at Outcome_Intact Male', 'Sex at Outcome_Neutered Male', 'Sex at Outcome_Spayed Female', 'Sex at Outcome_Unknown', 'Sex at Intake_Intact Female', 'Sex at Intake_Intact Male', 'Sex at Intake_Neutered Male', 'Sex at Intake_Spayed Female', 'Sex at Intake_Unknown', 'Collapsed Breed_Abyssinian', 'Collapsed Breed_Abyssinian Mix', 'Collapsed Breed_Affenpinscher Mix', 'Collapsed Breed_Afghan Hound Mix', 'Collapsed Breed_Airedale Terrier Mix', 'Collapsed Breed_Akbash Mix', 'Collapsed Breed_Akita', 'Collapsed Breed_Akita Mix', 'Collapsed Breed_Alaskan Husky', 'Collapsed Breed_Alaskan Husky Mix', 'Collapsed Breed_Alaskan Malamute', 'Collapsed Breed_Alaskan Malamute Mix', 'Collapsed Breed_American Bulldog', 'Collapsed Breed_American Bulldog Mix', 'Collapsed Breed_American Curl Shorthair Mix', 'Collapsed Breed_American Eskimo', 'Collapsed Breed_American Eskimo Mix', 'Collapsed Breed_American Foxhound Mix', 'Collapsed Breed_American Mix', 'Collapsed Breed_American Pit Bull Terrier', 'Collapsed Breed_American Pit Bull Terrier Mix', 'Collapsed Breed_American Shorthair', 'Collapsed Breed_American Shorthair Mix', 'Collapsed Breed_American Staffordshire Terrier', 'Collapsed Breed_American Staffordshire Terrier Mix', 'Collapsed Breed_Anatolian Shepherd', 'Collapsed Breed_Anatolian Shepherd Mix', 'Collapsed Breed_Angora Mix', 'Collapsed Breed_Angora-French Mix', 'Collapsed Breed_Armadillo Mix', 'Collapsed Breed_Australian Cattle Dog', 'Collapsed Breed_Australian Cattle Dog Mix', 'Collapsed Breed_Australian Kelpie', 'Collapsed Breed_Australian Kelpie Mix', 'Collapsed Breed_Australian Shepherd', 'Collapsed Breed_Australian Shepherd Mix', 'Collapsed Breed_Australian Terrier', 'Collapsed Breed_Australian Terrier Mix', 'Collapsed Breed_Balinese', 'Collapsed Breed_Balinese Mix', 'Collapsed Breed_Bantam Mix', 'Collapsed Breed_Basenji Mix', 'Collapsed Breed_Basset Hound', 'Collapsed Breed_Basset Hound Mix', 'Collapsed Breed_Bat', 'Collapsed Breed_Bat Mix', 'Collapsed Breed_Beagle', 'Collapsed Breed_Beagle Mix', 'Collapsed Breed_Bearded Collie', 'Collapsed Breed_Bauceron', 'Collapsed Breed_Bauceron Mix', 'Collapsed Breed_Bedlington Terrier', 'Collapsed Breed_Belgian Malinois', 'Collapsed Breed_Belgian Malinois Mix', 'Collapsed Breed_Belgian Sheepdog Mix', 'Collapsed Breed_Belgian Tervuren Mix', 'Collapsed Breed_Bengal', 'Collapsed Breed_Bengal Mix', 'Collapsed Breed_Bernese Mountain Dog Mix', 'Collapsed Breed_Beveren Mix', 'Collapsed Breed_Bichon Frise', 'Collapsed Breed_Bichon Frise Mix', 'Collapsed Breed_Black Mix', 'Collapsed Breed_Black Mouth Cur', 'Collapsed Breed_Black Mouth Cur Mix', 'Collapsed Breed_Bloodhound', 'Collapsed Breed_Bloodhound Mix', 'Collapsed Breed_Blue Lacy', 'Collapsed Breed_Blue Lacy Mix', 'Collapsed Breed_Bluebird Mix', 'Collapsed Breed_Bluetick Hound Mix', 'Collapsed Breed_Bobcat Mix', 'Collapsed Breed_Boerboel Mix', 'Collapsed Breed_Bombay Mix', 'Collapsed
```

sed Breed_Border Collie', 'Collapsed Breed_Border Collie Mix', 'Collapsed Breed_Border Terrier', 'Collapsed Breed_Border Terrier Mix', 'Collapsed Breed_Boston Terrier', 'Collapsed Breed_Boston Terrier Mix', 'Collapsed Breed_Boxer', 'Collapsed Breed_Boxer Mix', 'Collapsed Breed_Boykin Span Mix', 'Collapsed Breed_British Shorthair Mix', 'Collapsed Breed_Brittany Mix', 'Collapsed Breed_Bruss Griffon', 'Collapsed Breed_Bruss Griffon Mix', 'Collapsed Breed_Bull Terrier', 'Collapsed Breed_Bull Terrier Miniature', 'Collapsed Breed_Bull Terrier Miniature Mix', 'Collapsed Breed_Bull Terrier Mix', 'Collapsed Breed_Bulldog Mix', 'Collapsed Breed_Bullmastiff Mix', 'Collapsed Breed_Burmese', 'Collapsed Breed_Cairn Terrier', 'Collapsed Breed_Cairn Terrier Mix', 'Collapsed Breed_Californian', 'Collapsed Breed_Californian Mix', 'Collapsed Breed_Canaan Dog Mix', 'Collapsed Breed_Cane Corso Mix', 'Collapsed Breed_Cardigan Welsh Corgi', 'Collapsed Breed_Cardigan Welsh Corgi Mix', 'Collapsed Breed_Carolina Dog Mix', 'Collapsed Breed_Catahoula', 'Collapsed Breed_Catahoula Mix', 'Collapsed Breed_Cavalier Span', 'Collapsed Breed_Cavalier Span Mix', 'Collapsed Breed_Checkered Giant Mix', 'Collapsed Breed_Chesa Bay Retr Mix', 'Collapsed Breed_Chicken', 'Collapsed Breed_Chicken Mix', 'Collapsed Breed_Chihuahua Longhair', 'Collapsed Breed_Chihuahua Longhair Mix', 'Collapsed Breed_Chihuahua Shorthair', 'Collapsed Breed_Chihuahua Shorthair Mix', 'Collapsed Breed_Chinese Sharpei', 'Collapsed Breed_Chinese Sharpei Mix', 'Collapsed Breed_Chow Chow', 'Collapsed Breed_Chow Chow Mix', 'Collapsed Breed_Cinnamon', 'Collapsed Breed_Clumber Spaniel', 'Collapsed Breed_Clumber Spaniel Mix', 'Collapsed Breed_Cockatiel', 'Collapsed Breed_Cockatiel Mix', 'Collapsed Breed_Cocker Spaniel', 'Collapsed Breed_Cocker Spaniel Mix', 'Collapsed Breed_Cold Water', 'Collapsed Breed_Cold Water Mix', 'Collapsed Breed_Collie Rough Mix', 'Collapsed Breed_Collie Smooth', 'Collapsed Breed_Collie Smooth Mix', 'Collapsed Breed_Conure', 'Collapsed Breed_Conure Mix', 'Collapsed Breed_Cornish Rex Mix', 'Collapsed Breed_Coyote', 'Collapsed Breed_Coyote Mix', 'Collapsed Breed_Cymric Mix', 'Collapsed Breed_Dachshund', 'Collapsed Breed_Dachshund Longhair', 'Collapsed Breed_Dachshund Longhair Mix', 'Collapsed Breed_Dachshund Wirehair', 'Collapsed Breed_Dachshund Wirehair Mix', 'Collapsed Breed_Dalmatian Mix', 'Collapsed Breed_Dandie Dinmont Mix', 'Collapsed Breed_Devon Rex Mix', 'Collapsed Breed_Doberman Pinsch', 'Collapsed Breed_Doberman Pinsch Mix', 'Collapsed Breed_Dogo Argentino Mix', 'Collapsed Breed_Dogue De Bordeaux Mix', 'Collapsed Breed_Domestic Longhair', 'Collapsed Breed_Domestic Longhair Mix', 'Collapsed Breed_Domestic Medium Hair', 'Collapsed Breed_Domestic Medium Hair Mix', 'Collapsed Breed_Domestic Shorthair', 'Collapsed Breed_Domestic Shorthair Mix', 'Collapsed Breed_Dove', 'Collapsed Breed_Dove Mix', 'Collapsed Breed_Duck Mix', 'Collapsed Breed_Dutch', 'Collapsed Breed_Dutch Mix', 'Collapsed Breed_Dutch Shepherd', 'Collapsed Breed_Dutch Shepherd Mix', 'Collapsed Breed_Dwarf Hotot', 'Collapsed Breed_Eng Toy Spaniel Mix', 'Collapsed Breed_English Bulldog', 'Collapsed Breed_English Bulldog Mix', 'Collapsed Breed_English Cocker Spaniel Mix', 'Collapsed Breed_English Coonhound', 'Collapsed Breed_English Coonhound Mix', 'Collapsed Breed_English Foxhound', 'Collapsed Breed_English Foxhound Mix', 'Collapsed Breed_English Pointer', 'Collapsed Breed_English Pointer Mix', 'Collapsed Breed_English Setter Mix', 'Collapsed Breed_English Shepherd', 'Collapsed Breed_English Shepherd Mix', 'Collapsed Breed_English Spot', 'Collapsed Breed_English Spot Mix', 'Collapsed Breed_English Springer Spaniel Mix', 'Collapsed Breed_Feist Mix', 'Collapsed Breed_Ferre t', 'Collapsed Breed_Ferret Mix', 'Collapsed Breed_Field Spaniel Mix', 'Collapsed Breed_Finch Mix', 'Collapsed Breed_Finnish Spitz Mix', 'Collapsed Breed_Flat Coat Retriever Mix', 'Collapsed Breed_Fox', 'Collapsed Breed_Fox Mix', 'Collapsed Breed_French Bulldog Mix', 'Collapsed Breed_Gerbil', 'Collapsed Breed_German Pinscher Mix', 'Collapsed Breed_German Shepherd', 'Collapsed Breed_German Shepherd Mix', 'Collapsed Breed_German Shorthair Pointer', 'Collapsed Breed_German Shorthair Pointer Mix', 'Collapsed Breed_German Wirehaired Pointer Mix', 'Collapsed Breed_Glen Of Imaal Mix', 'Collapsed Breed_Golden Retriever Mix', 'Collapsed Breed_Gordon Setter Mix', 'Collapsed Breed_Grackle', 'Collapsed Breed_Grackle Mix', 'Collapsed Breed_Great Dane', 'Collapsed Breed_Great Dane Mix', 'Collapsed Breed_Great Pyrenees', 'Collapsed Breed_Great Pyrenees Mix', 'Collapsed Breed_Greater Swiss Mountain Dog Mix', 'Collapsed Breed_Greyhound Mix', 'Collapsed Breed_Guinea Pig', 'Collapsed Breed_Guinea Pig Mix', 'Collapsed Breed_Hamster', 'Collapsed Breed_Hamster Mix', 'Collapsed Breed_Harrier Mix', 'Collapsed Breed_Havana', 'Collapsed Breed_Havana Mix', 'Collapsed Breed_Havanese Mix', 'Collapsed Breed_Hawk', 'Collapsed Breed_Hawk Mix', 'Collapsed Breed_Himalayan', 'Collapsed Breed_Himalayan Mix', 'Collapsed Breed_Hotot', 'Collapsed Breed_Hotot Mix', 'Collapsed Breed_Hovawart Mix', 'Collapsed Breed_Ibizan Hound', 'Collapsed Breed_Ibizan Hound Mix', 'Collapsed Breed_Irish Setter Mix', 'Collapsed Breed_Irish Terrier', 'Collapsed Breed_Irish Terrier Mix', 'Collapsed Breed_Irish Wolfhound Mix', 'Collapsed Breed_Italian Greyhound Mix', 'Collapsed Breed_Jack Russell Terrier', 'Collapsed Breed_Jack Russell Terrier Mix', 'Collapsed Breed_Japanese Bobtail Mix', 'Collapsed Breed_Jindo Mix', 'Collapsed Breed_Keeshond Mix', 'Collapsed Breed_Labrador Retriever', 'Collapsed Breed_Labrador Retriever Mix', 'Collapsed Breed_Landseer', 'Collap

sed Breed_Landseer Mix', 'Collapsed Breed_Leonberger Mix', 'Collapsed Breed_Lhasa Apso', 'Collapsed Breed_Lhasa Apso Mix', 'Collapsed Breed_Lionhead', 'Collapsed Breed_Lionhead Mix', 'Collapsed Breed_Lop-Amer Fuzzy', 'Collapsed Breed_Lop-Holland', 'Collapsed Breed_Lop-Holland Mix', 'Collapsed Breed_Lop-Mini', 'Collapsed Breed_Lovebird Mix', 'Collapsed Breed_Maine Coon', 'Collapsed Breed_Maine Coon Mix', 'Collapsed Breed_Maltese', 'Collapsed Breed_Maltese Mix', 'Collapsed Breed_Manchester Terrier Mix', 'Collapsed Breed_Manx Mix', 'Collapsed Breed_Mastiff', 'Collapsed Breed_Mastiff Mix', 'Collapsed Breed_Mexican Hairless Mix', 'Collapsed Breed_Miniature Pinscher', 'Collapsed Breed_Miniature Pinscher Mix', 'Collapsed Breed_Miniature Poodle', 'Collapsed Breed_Miniature Poodle Mix', 'Collapsed Breed_Miniature Schnauzer', 'Collapsed Breed_Miniature Schnauzer Mix', 'Collapsed Breed_Mockingbird Mix', 'Collapsed Breed_Mouse Mix', 'Collapsed Breed_Munchkin Shorthair Mix', 'Collapsed Breed_Neapolitan Mastiff Mix', 'Collapsed Breed_Newfoundland', 'Collapsed Breed_Newfoundland Mix', 'Collapsed Breed_Norfolk Terrier', 'Collapsed Breed_Norfolk Terrier Mix', 'Collapsed Breed_Norwegian Forest Cat Mix', 'Collapsed Breed_Norwich Terrier Mix', 'Collapsed Breed_Nova Scotia Duck Tolling Retriever', 'Collapsed Breed_Nova Scotia Duck Tolling Retriever Mix', 'Collapsed Breed_Ocicat Mix', 'Collapsed Breed_Old English Bulldog Mix', 'Collapsed Breed_Opossum', 'Collapsed Breed_Opossum Mix', 'Collapsed Breed_Oriental Sh Mix', 'Collapsed Breed_Owl', 'Collapsed Breed_Owl Mix', 'Collapsed Breed_Papillon', 'Collapsed Breed_Papillon Mix', 'Collapsed Breed_Parakeet', 'Collapsed Breed_Parakeet Mix', 'Collapsed Breed_Parrot', 'Collapsed Breed_Parson Russell Terrier', 'Collapsed Breed_Parson Russell Terrier Mix', 'Collapsed Breed_Patterdale Terr Mix', 'Collapsed Breed_Pbgy', 'Collapsed Breed_Pbgy Mix', 'Collapsed Breed_Peafowl', 'Collapsed Breed_Peafowl Mix', 'Collapsed Breed_Pekingese Mix', 'Collapsed Breed_Pembroke Welsh Corgi', 'Collapsed Breed_Pembroke Welsh Corgi Mix', 'Collapsed Breed_Persian Mix', 'Collapsed Breed_Pharaoh Hound', 'Collapsed Breed_Pharaoh Hound Mix', 'Collapsed Breed_Picardy Sheepdog', 'Collapsed Breed_Picardy Sheepdog Mix', 'Collapsed Breed_Pig Mix', 'Collapsed Breed_Pigeon Mix', 'Collapsed Breed_Pit Bull', 'Collapsed Breed_Pit Bull Mix', 'Collapsed Breed_Pixiebob Shorthair Mix', 'Collapsed Breed_Plott Hound', 'Collapsed Breed_Plott Hound Mix', 'Collapsed Breed_Pointer', 'Collapsed Breed_Pointer Mix', 'Collapsed Breed_Polish Mix', 'Collapsed Breed_Pomeranian', 'Collapsed Breed_Pomeranian Mix', 'Collapsed Breed_Port Water Dog Mix', 'Collapsed Breed_Presa Canario Mix', 'Collapsed Breed_Pug Mix', 'Collapsed Breed_Quaker Mix', 'Collapsed Breed_Queensland Heeler', 'Collapsed Breed_Queensland Heeler Mix', 'Collapsed Breed_Rabbit Lh', 'Collapsed Breed_Rabbit Lh Mix', 'Collapsed Breed_Rabbit Sh', 'Collapsed Breed_Rabbit Sh Mix', 'Collapsed Breed_Raccoon', 'Collapsed Breed_Raccoon Mix', 'Collapsed Breed_Ragdoll', 'Collapsed Breed_Ragdoll Mix', 'Collapsed Breed_Rat', 'Collapsed Breed_Rat Mix', 'Collapsed Breed_Rat Terrier', 'Collapsed Breed_Rat Terrier Mix', 'Collapsed Breed_Redbone Hound', 'Collapsed Breed_Redbone Hound Mix', 'Collapsed Breed_Rex', 'Collapsed Breed_Rex Mix', 'Collapsed Breed_Rex-Mini', 'Collapsed Breed_Rex-Mini Mix', 'Collapsed Breed_Rhod Ridgeback', 'Collapsed Breed_Rhod Ridgeback Mix', 'Collapsed Breed_Rhode Island Mix', 'Collapsed Breed_Rottweiler', 'Collapsed Breed_Rottweiler Mix', 'Collapsed Breed_Saluki', 'Collapsed Breed_Saluki Mix', 'Collapsed Breed_Samoyed Mix', 'Collapsed Breed_Schipperke Mix', 'Collapsed Breed_Schnauzer Giant', 'Collapsed Breed_Schnauzer Giant Mix', 'Collapsed Breed_Scottish Terrier Mix', 'Collapsed Breed_Shetland Sheepdog Mix', 'Collapsed Breed_Shiba Inu Mix', 'Collapsed Breed_Shih Tzu', 'Collapsed Breed_Shih Tzu Mix', 'Collapsed Breed_Siamese', 'Collapsed Breed_Siamese Mix', 'Collapsed Breed_Siberian Husky', 'Collapsed Breed_Siberian Husky Mix', 'Collapsed Breed_Silky Terrier', 'Collapsed Breed_Silky Terrier Mix', 'Collapsed Breed_Skunk', 'Collapsed Breed_Skunk Mix', 'Collapsed Breed_Smooth Fox Terrier', 'Collapsed Breed_Smooth Fox Terrier Mix', 'Collapsed Breed_Snowshoe', 'Collapsed Breed_Snowshoe Mix', 'Collapsed Breed_Soft Coated Wheaten Terrier', 'Collapsed Breed_Soft Coated Wheaten Terrier Mix', 'Collapsed Breed_Spanish Water Dog', 'Collapsed Breed_Sparrow', 'Collapsed Breed_Squirrel', 'Collapsed Breed_Squirrel Mix', 'Collapsed Breed_St. Bernard Rough Coat Mix', 'Collapsed Breed_St. Bernard Smooth Coat Mix', 'Collapsed Breed_Staffordshire', 'Collapsed Breed_Staffordshire Mix', 'Collapsed Breed_Standard Poodle Mix', 'Collapsed Breed_Standard Schnauzer', 'Collapsed Breed_Standard Schnauzer Mix', 'Collapsed Breed_Sugar Glider', 'Collapsed Breed_Swedish Vallhund Mix', 'Collapsed Breed_Tibetan Spaniel Mix', 'Collapsed Breed_Tibetan Terrier Mix', 'Collapsed Breed_Tonkinese Mix', 'Collapsed Breed_Toy Fox Terrier Mix', 'Collapsed Breed_Toy Poodle', 'Collapsed Breed_Toy Poodle Mix', 'Collapsed Breed_Treeing Cur Mix', 'Collapsed Breed_Treeing Tennessee Brindle', 'Collapsed Breed_Treeing Walker Coonhound Mix', 'Collapsed Breed_Turkish Van Mix', 'Collapsed Breed_Turtle Mix', 'Collapsed Breed_Vizsla', 'Collapsed Breed_Vizsla Mix', 'Collapsed Breed_Vulture', 'Collapsed Breed_Vulture Mix', 'Collapsed Breed_Weimaraner Mix', 'Collapsed Breed_Welsh Springer Spaniel Mix', 'Collapsed Breed_Welsh Terrier', 'Collapsed Breed_Welsh Terrier Mix', 'Collapsed Breed_West Highland', 'Collapsed Breed_West Highland Mix', 'Collapsed Breed_Whippet Mix', 'Collap

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sed Breed_Wire Hair Fox Terrier', 'Collapsed Breed_Wire Hair Fox Terrier Mix', 'Collapsed Breed_Yorkshire Terrier', 'Collapsed Breed_Yorkshire Terrier Mix']
```

Specific Features used for model Uncomment to see different results

In [8]:

```
intake_type_cols = ['Intake Type_Abandoned', 'Intake Type_Euthanasia Request', 'Intake animal_type_cols = ['Animal Type_Bird', 'Animal Type_Cat', 'Animal Type_Dog', 'Animal T sex_out_cols = ['Sex at Outcome_Intact Female', 'Sex at Outcome_Intact Male' , 'Sex at sex_in_cols = ['Sex at Intake_Intact Female', 'Sex at Intake_Intact Male' , 'Sex at Int cols = ['Length of Stay in Days'] + intake_type_cols  
#cols = ['Length of Stay in Days']  
#cols = sex_in_cols + intake_type_cols  
print(cols)
```

```
['Length of Stay in Days', 'Intake Type_Abandoned', 'Intake Type_Euthanasia Request', 'Intake Type_Owner Surrender', 'Intake Type_Public Assist', 'Intake Type_Stray', 'Intake Type_Wildlife']
```

Need to fix some length of stay to be positive since income and outcome where swapped

In [9]:

```
pruned_data.head()
```

Out[9]:

	Animal ID	Date of Birth	Intake Age in Months	Intake Age in Years	Outcome Age in Months	Length of Stay in Days	Intake Condition	Outcome	Outcome Subtype	Altered at Shelter
8	A818975	5/19/2020	0	0	2	35.0	Normal	Adoption	Foster	Y
11	A760053	10/11/2015	24	2	24	4.0	Normal	Adoption	NaN	Y
12	A707375	1/11/2015	6	0	10	140.0	Normal	Adoption	NaN	Y
13	A696408	2/4/2013	24	2	27	113.0	Normal	Adoption	Foster	Y
16	A657188	6/24/1999	172	14	175	77.0	Normal	Adoption	Foster	N

5 rows × 443 columns



In [10]:

```
def to_abs( row):  
    row['Length of Stay in Days'] = abs(row['Length of Stay in Days'])  
    return row  
#print(row['Length of Stay in Days'], abs(row['Length of Stay in Days']))  
  
def delete_negatives (row):  
    if row['Length of Stay in Days'] >= 0 :  
        return row  
  
pruned_data = pruned_data.apply(to_abs, axis =1 )  
  
# adopted_pets = adopted_pets.apply(to_abs, axis =1 )  
# euthanized_pets = euthanized_pets.apply(to_abs, axis =1 )
```

```
In [11]: pruned_data = pruned_data.loc[pruned_data['Intake Age in Months'] != '#NUM!']
pruned_data['Intake Age in Months'] = pd.to_numeric(pruned_data['Intake Age in Months'])
pruned_data = pruned_data.loc[pruned_data['Outcome Age in Months'] != '#NUM!']
pruned_data['Outcome Age in Months'] = pd.to_numeric(pruned_data['Outcome Age in Months'])
pruned_data['Outcome Age in Months'].unique()
```

```
Out[11]: array([ 2,  24,  10,  27, 175,   5,  55,  48,  42,   6,  96,   3,  12,
       4,  91,  22,  19,  13,  36,  25,  26,   7,   1,  46,  28,  60,
       8, 106,  52,  74,  14,  71,  61,  18,  11,   9,  72, 111,  17,
      29,  64,  84, 133,  38,  32,  66,  53,  75,  31, 121,  37,  21,
     116,  43,  62,  47,  15,  49,  95,  41,  33,  39, 120,  16,  81,
      54, 185,  23,  98,  73, 156,  34,  79, 186, 102,  57, 104, 180,
    136,  76,  20,  89, 181, 112,  30,  78,  35, 107, 141, 110,  90,
      45, 108, 144, 114, 105,  88,  51, 135,  69, 192, 117,  87,  77,
    130,  50, 143, 124,  40,  63, 166, 161, 137, 204, 177, 147, 109,
      97, 119, 132,  86,  70,  80, 125,  85,  83, 196,  56, 101,  59,
      65, 122, 123,  58, 149, 193, 163, 113,  44,  99,  67, 155, 126,
    146, 150, 168,  94, 103, 179, 169, 134, 115, 127, 157, 128, 218,
    145, 189,  92, 165, 176, 170,  93, 159, 100,   0,  68, 158, 154,
    178,  82, 191, 148, 142, 138, 190, 131, 129, 162, 139, 173, 164,
    151, 225, 174, 231, 216, 199, 201], dtype=int64)
```

Separating outcome as our target

```
In [12]: pruned_target = pruned_data['Outcome']
pruned_features = pruned_data[cols]
```

```
In [13]: pruned_features.head()
```

	Length of Stay in Days	Type_Abandoned	Intake Type_Euthanasia Request	Intake Type_Owner Surrender	Intake Type_Public Assist	Intake Type_Stray	Intake Type_Wildlife
8	35.0	0	0	0	0	1	0
11	4.0	0	0	0	0	1	0
12	140.0	0	0	0	0	1	0
13	113.0	0	0	0	0	1	0
16	77.0	0	0	1	0	0	0

Data visualization

Comparing Length of Stay to outcome

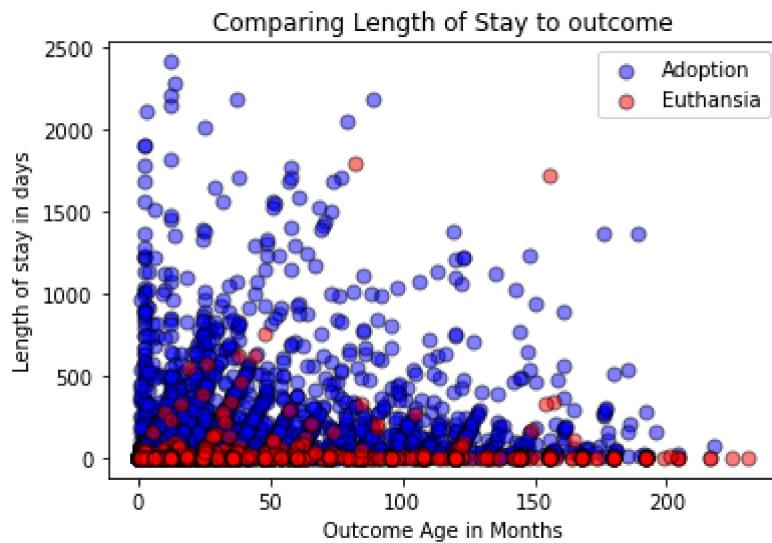
```
In [14]: adopted_pets = pruned_data[ (pruned_data['Outcome'] == 'Adoption')]
euthanized_pets = pruned_data[ (pruned_data['Outcome'] == 'Euthanasia')]
```

```
In [15]: plt.scatter(adopted_pets['Outcome Age in Months'], adopted_pets['Length of Stay in Days'])
plt.scatter(euthanized_pets['Outcome Age in Months'], euthanized_pets['Length of Stay in Days'])
```

```

plt.ylabel('Length of stay in days')
plt.xlabel('Outcome Age in Months')
plt.legend(['Adoption', 'Euthanasia'], loc="best")
plt.title('Comparing Length of Stay to outcome')
plt.show()

```



```

In [16]: print(adopted_pets['Length of Stay in Days'].mean())
print(euthanized_pets['Length of Stay in Days'].mean())

print()

print(adopted_pets['Outcome Age in Months'].mean())
print(euthanized_pets['Outcome Age in Months'].mean())

```

57.587435841827514
9.090529247910863

20.896624015036508
29.686629526462397

Running model 25 times and storing euthanasia precision

```

In [17]: accuracies = []
for runs in range( 0 , 25):
    x_train,x_test,y_train,y_test = train_test_split( pruned_features, pruned_target, test_size=0.2)
    model = KNeighborsClassifier(n_neighbors= 20)
    model.fit(x_train,y_train)
    pred = model.predict(x_test)
    accuracy_count = 0
    euthanasia_count = 0
    euthanasia_actual = 0

    y_test_as_list = y_test.to_list()

    for i in range(len(y_test_as_list)):
        if y_test_as_list[i] == 'Euthanasia':
            euthanasia_actual +=1

```

```

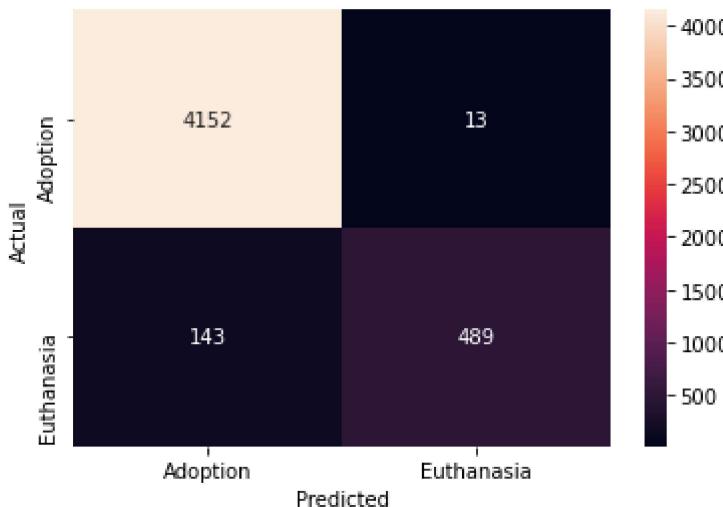
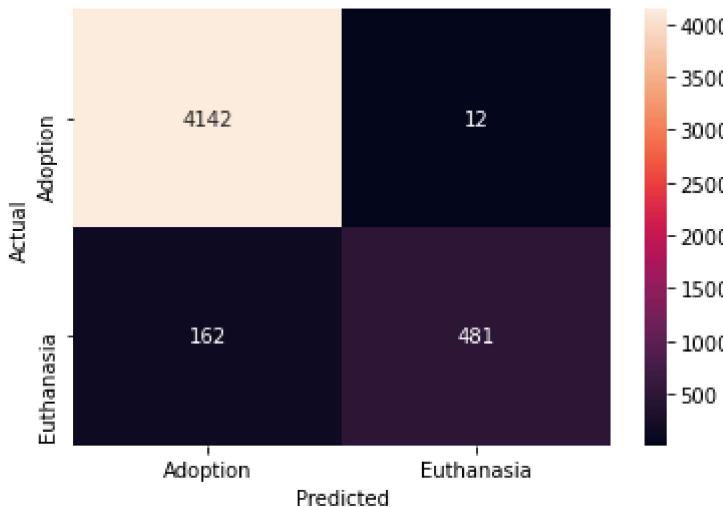
for i in range(len(pred)):
    if pred[i] == y_test_as_list[i]:
        accuracy_count += 1
    if pred[i] == 'Euthanasia':
        euthanasia_count += 1
accuracies.append(euthanasia_count/euthanasia_actual)
confusion_data = {
    'y_Actual': y_test_as_list,
    'y_Predicted': pred
}

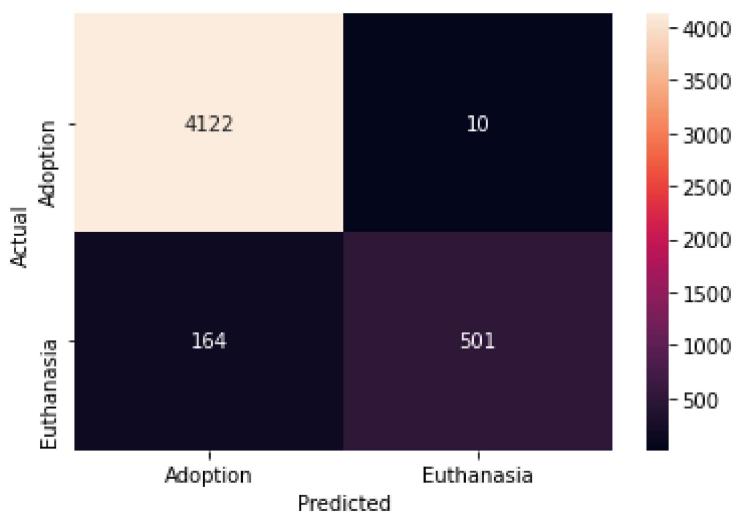
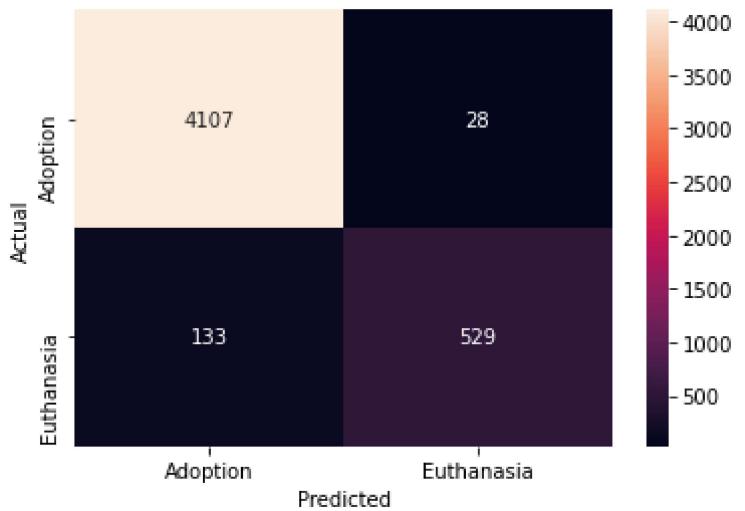
confusion_df = pd.DataFrame(confusion_data, columns=['y_Actual','y_Predicted'])

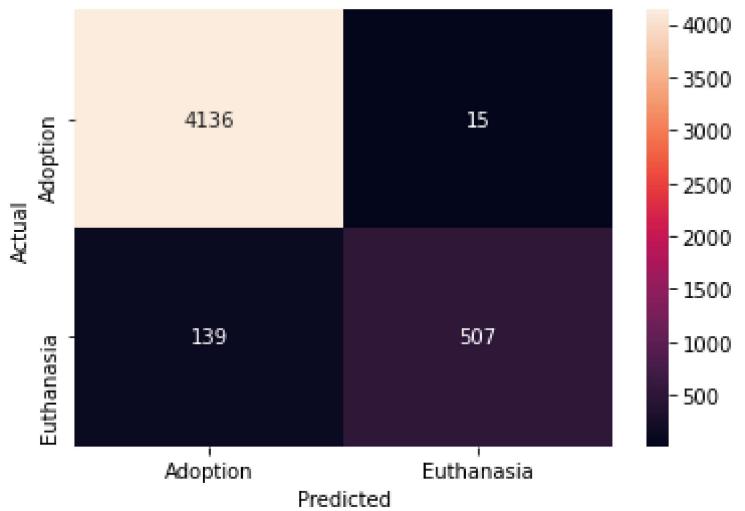
confusion_matrix = pd.crosstab(confusion_df['y_Actual'], confusion_df['y_Predicted'],
sn.heatmap(confusion_matrix, annot=True, fmt='d')
plt.show()

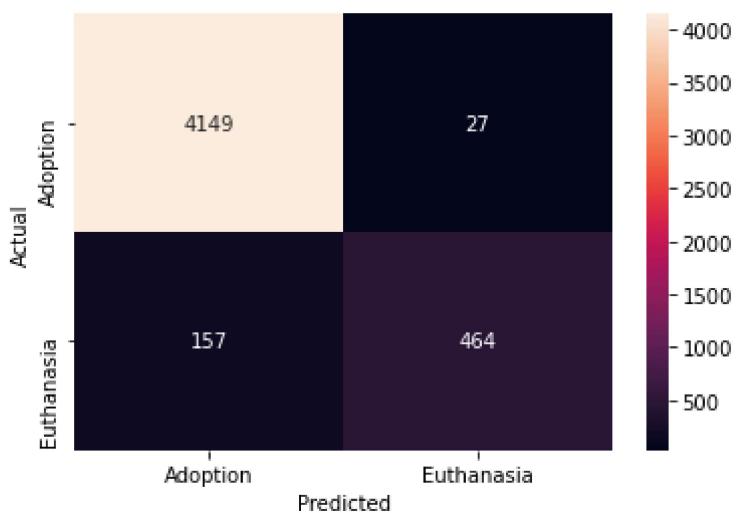
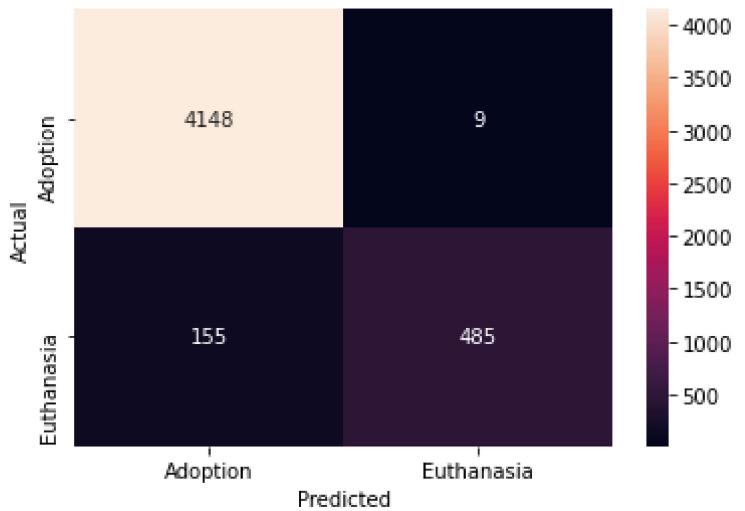
print("List of each run's precision: ", accuracies)
print("mean precision:", (sum(accuracies) / len(accuracies)) )

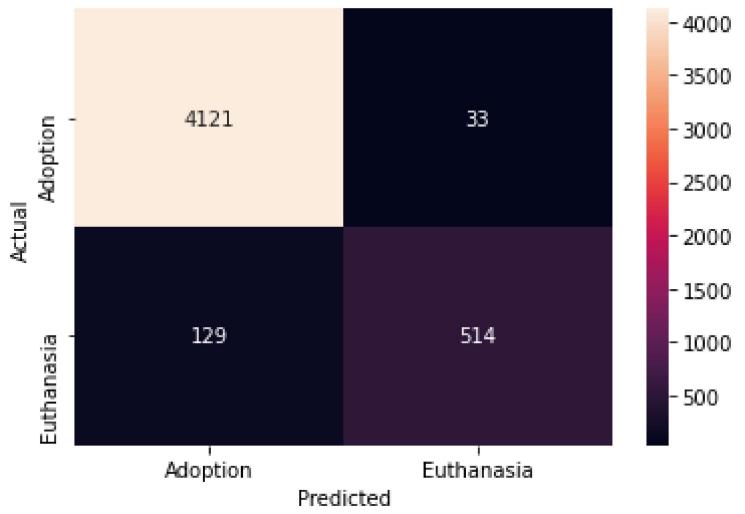
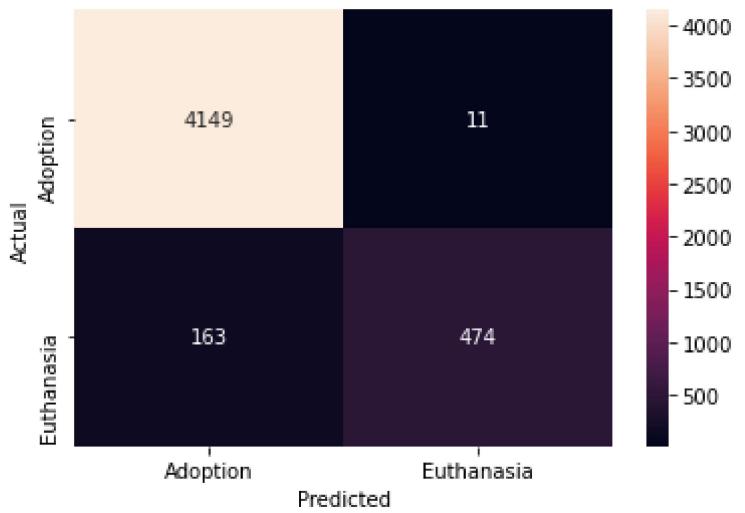
```

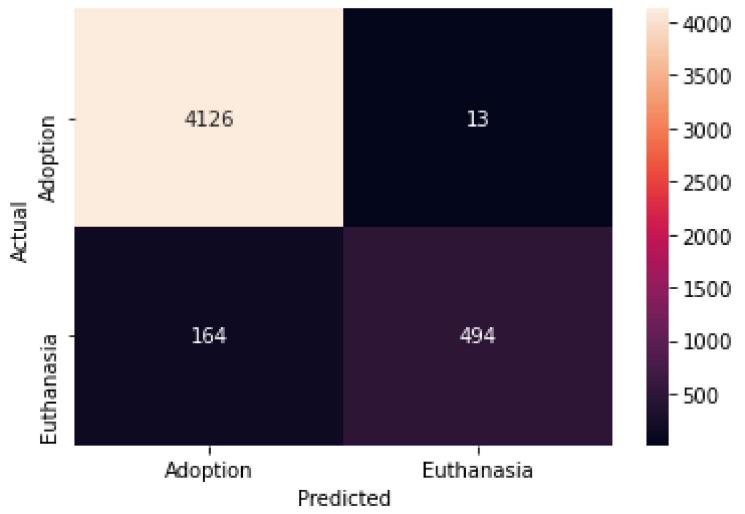
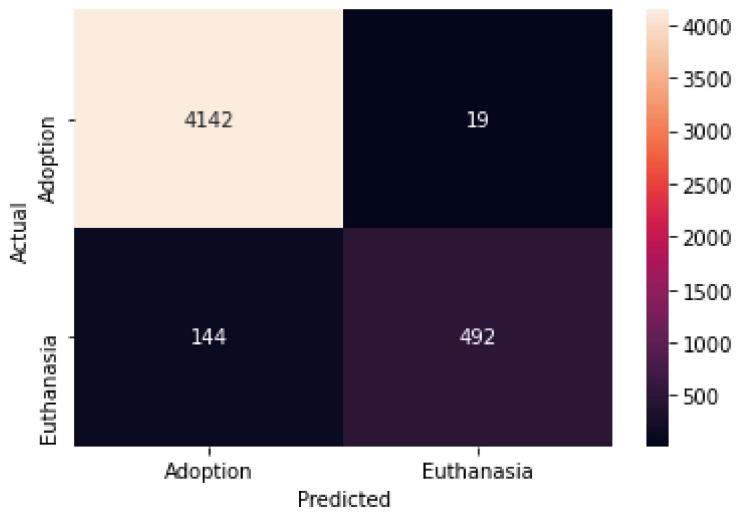
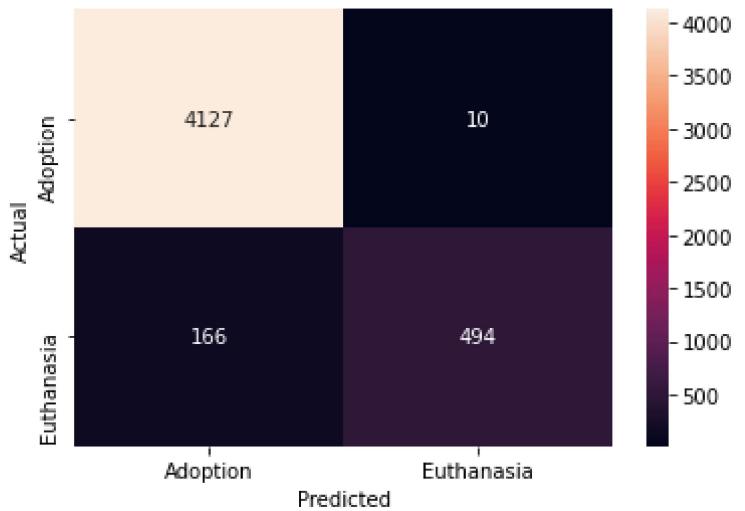


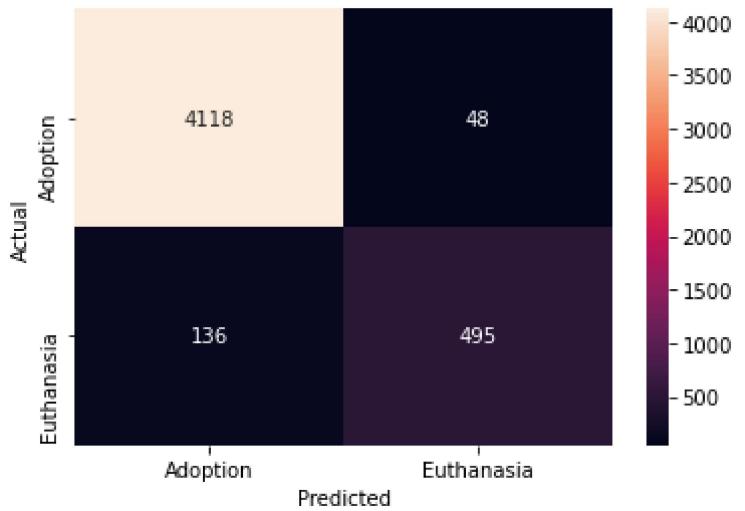
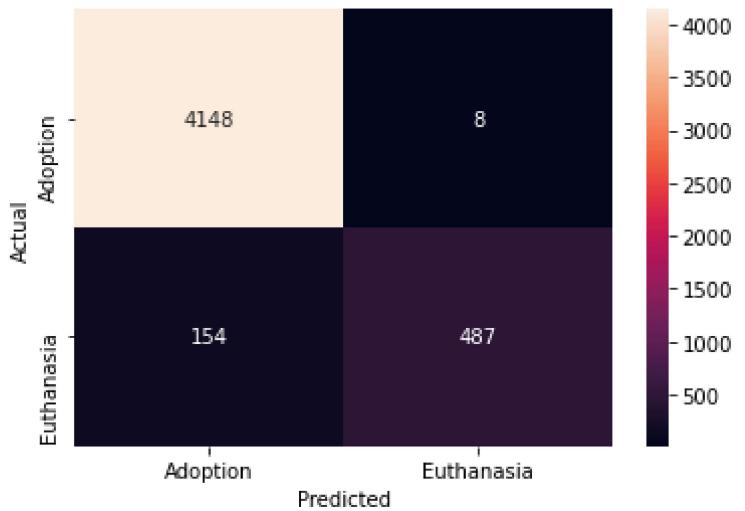


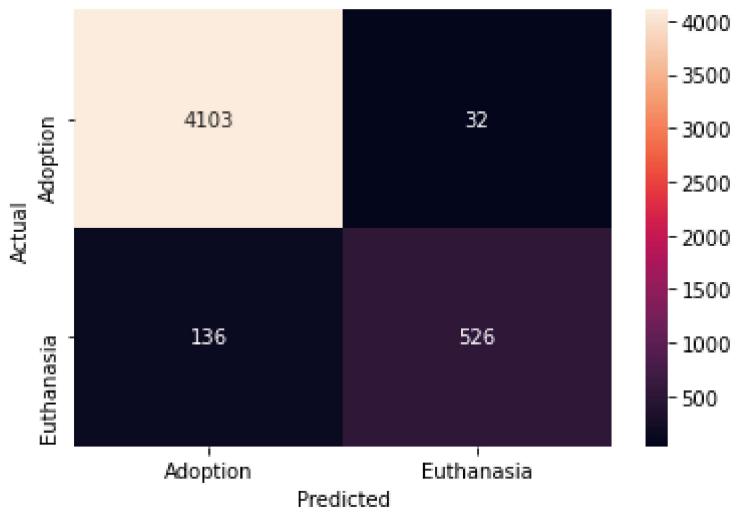
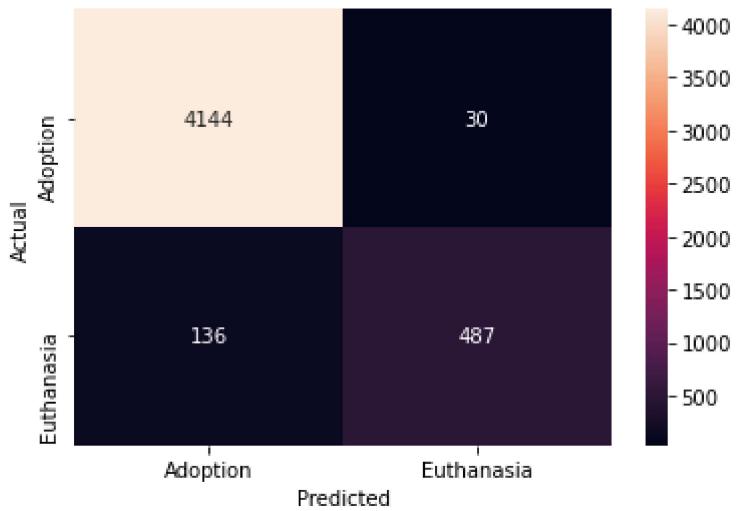


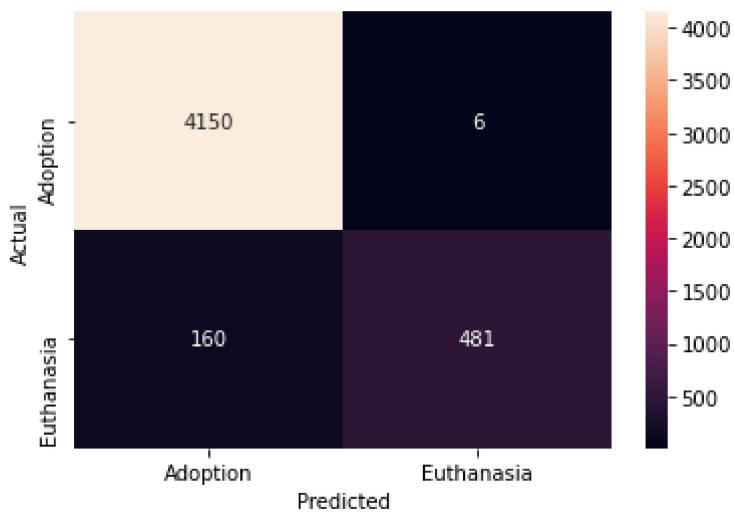












List of each run's precision: [0.7480559875583204, 0.7737341772151899, 0.7990936555891238, 0.7533834586466165, 0.7603686635944701, 0.7848297213622291, 0.762043795620438, 0.7671451355661882, 0.7578125, 0.7471819645732689, 0.7604501607717041, 0.799079754601227, 0.7441130298273155, 0.7993779160186625, 0.7484848484848485, 0.7735849056603774, 0.7507598784194529, 0.7597503900156006, 0.7587301587301587, 0.7844690966719493, 0.7817014446227929, 0.7945619335347432, 0.7537190082644628, 0.7332268370607029, 0.750390015600624]
mean precision: 0.7658419375204185

Sources

<https://www.askpython.com/python/examples/split-data-training-and-testing-set#:~:text=%20How%20to%20split%20training%20and%20testing%20data,2%20Split%20the%20data%>