
PetFinder

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OUTLINE

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- Conclusion

PROBLEM SUMMARY

A lot of stray animals either end up on the streets or are euthanized at animal shelter.

If people are more enticed to adopt these animals, more of these precious lives can be saved.

BACKGROUND

PetFinder.my has been Malaysia's leading animal welfare platform since 2008, with a database of more than 150,000 animals.

Animal adoption rates are strongly correlated to the metadata associated with their online profiles, such as descriptive text and photo characteristics

DATASET

- **PetID** - Unique hash ID of pet profile
- **AdoptionSpeed** - Categorical speed of adoption. Lower is faster. This is the value to predict. See below section for more info.
- **Type** - Type of animal (*1 = Dog, 2 = Cat*)
- **Sterilized** - Pet has been spayed / neutered (*1 = Yes, 2 = No, 3 = Not Sure*)
- **Health** - Health Condition (*1 = Healthy, 2 = Minor Injury, 3 = Serious Injury, 0 = Not Specified*)
- **Quantity** - Number of pets represented in profile
- **Fee** - Adoption fee (*0 = Free*)
- **State** - State location in Malaysia (*Refer to StateLabels dictionary*)
- **RescuerID** - Unique hash ID of rescuer
- **VideoAmt** - Total uploaded videos for this pet
- **PhotoAmt** - Total uploaded photos for this pet
- **Description** - Profile write-up for this pet. The primary language used is English, with some in Malay or Chinese.
- **Vaccinated** - Pet has been vaccinated (*1 = Yes, 2 = No, 3 = Not Sure*)
- **Dewormed** - Pet has been dewormed (*1 = Yes, 2 = No, 3 = Not Sure*)

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RELATED LITERATURE

- The determinants for adoption in cats are age, sex, coat color, and reason for relinquishment while the same goes for dogs with the addition of breed, purebred status and injury status [1].
- Other predictors of adoption for dogs include size, being a stray, youth, not having a primarily black coat, medium hair and being female [2].
- Puppies were more likely to be adopted than their older counterparts. Dogs with grey, blond, merle, chocolate and tricolored coats have good outcomes as such with toy and hound breeds [2].
- For adult dogs, purebreds, small, young, strays, not black medium-haired and female have higher chances of being adopted [2].

[1] M. Lepper, P. H. Kass and L. A. Hart, "Prediction of Adoption Versus Euthanasia Among Dogs and Cats in a California Animal Shelter," *Journal of Applied Animal Welfare Science*, vol. 5, no. 1, 2002.

[2] J. L. Deleeuw, "Animal Shelter Dogs: Factors Predicting Adoption Versus Euthanasia," Department of Psychology, Graduate School of Wichita State University, 2010.

RELATED LITERATURE

- The following qualitative comments were given by adopters of cats and dogs for selecting specific animals [3]:
 - Dogs
 - Companionship (20.4%), “I have always wanted a dog as a companion” [3]
 - Dog Personality (15.5%) , “Nice temperament”, “Good with kids” [3]
 - Physical Characteristics (14.1%), “Small, perfect for us and our house”, “She is beautiful, friendly, trainable” [3]
 - BreedrRelated (13.3%), “Had 3 previous Border Collies, very good personality”, “I love huskies” [3]

RELATED LITERATURE

- Cats
 - Affectionate (29.6%), “Affectionate and playful”, “very loving”
 - Cat personality (11.1%) “Is cute and friendly”, “Gentle, sweet, good with kids” [3]
 - Companionship (4.9%), “Looking for new indoor companion”, “Is my companion and family number” [3]
 - Something about family (4.3%), “Seems very family friendly”, “is part of the family” [3]

FEATURE ENGINEERING

Image Features:

- Extracting image prediction from a pretrained network
- The pretrained network is taken from network outputs 256 image features from for each PetID from a batch of images
- Using **latent semantic analysis**, SVD is then used to reduce dimension from 256 to 32.

Parsing sentiment:

(Sentiment - contains magnitude and score of each description provided by Google's Natural Language API)

- Extracted magnitude and score
- Calculated the sum, mean, and variance of each

FEATURE ENGINEERING

Parsing metadata:

(Metadata - provides analysis on Face Annotation, Label Annotation, Text Annotation and Image Properties predicted by Google's Vision API)

Extracted the mean values of the following:

- annots_score
- color_score
- color_pixelfrac
- crop_conf
- crop_importance
- annots_top_desc

FEATURE ENGINEERING

Some other important features:

- Breed1
- Breed2
- Length of Main Description, Metadata Top Description, Sentiment Entities

FEATURE ENGINEERING

TfidfVectorizer:

- convert a collection of raw documents to a matrix of TF-IDF features

1. Term Frequency (Tf):

How many times a particular word appears in a single doc

2. Inverse Document Frequency (idf):

Frequency and rarity of words, calculated by the log of the number of words divided by the number of docs this word is present

$$\text{tfidf} = \text{tf} * \text{idf}$$

- We use Tfidf on Length of Main Description, Metadata Top Description, Sentiment Entities. Then, we then use SVD to reduce the dimensions to 16.

FEATURE ENGINEERING

Other important features:

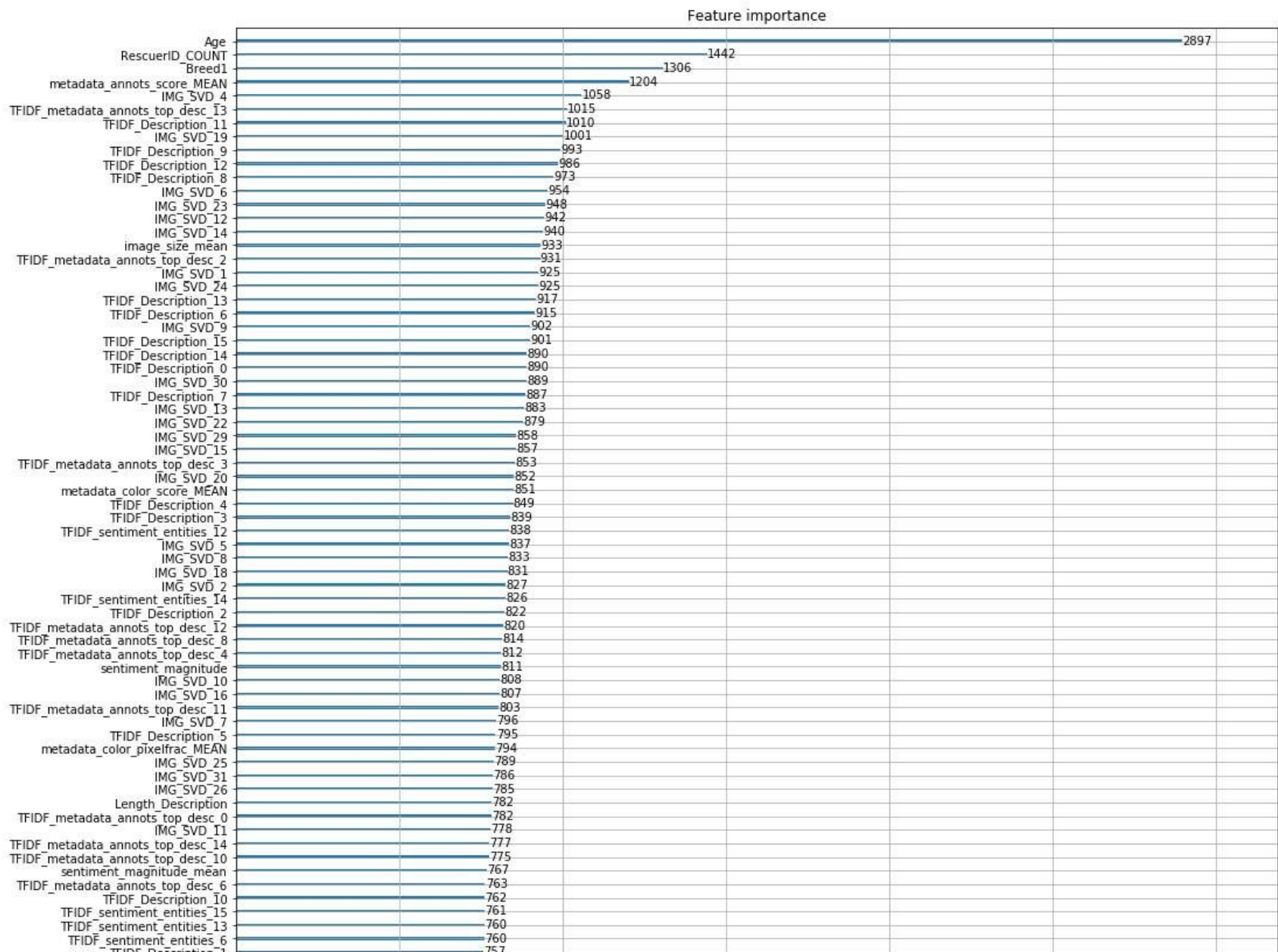
- Sum, mean, and variance of image file size, height, and width

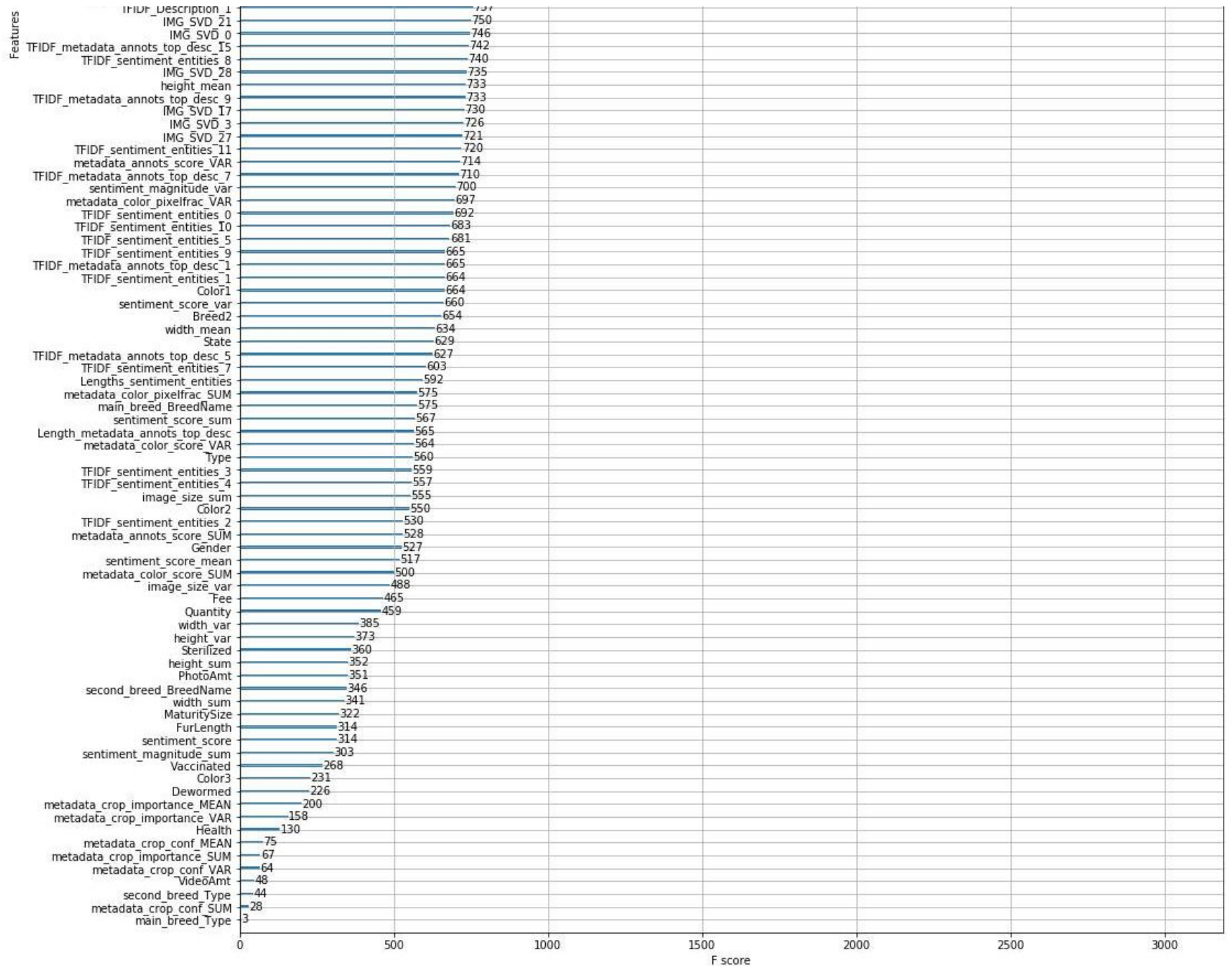
Dropped columns:

- 'PetID', 'Name', 'RescuerID'

	Type	Age	Breed1	Breed2	Gender	Color1	Color2	Color3	MaturitySize	FurLength	...	IMG_SVD_31	image_size_sum	image_size_mean
0	2	3	299	0	1	1	7	0	1	1	...	-0.000642	24638.0	24638.000000
1	2	1	265	0	1	1	2	0	2	2	...	-0.000642	41860.0	20930.000000
2	1	1	307	0	1	2	7	0	2	2	...	-0.000642	122199.0	17457.000000
3	1	4	307	0	2	1	2	0	2	1	...	-0.000642	166859.0	20857.375000
4	1	1	307	0	1	1	0	0	2	1	...	-0.000642	91296.0	30432.000000
5	2	3	266	0	2	5	6	0	2	1	...	-0.000642	63624.0	31812.000000

	length	...	IMG_SVD_31	image_size_sum	image_size_mean	image_size_var	width_sum	width_mean	width_var	height_sum	height_mean	height_var
1	...		-0.000642	24638.0	24638.000000	NaN	360.0	360.000000	NaN	480.0	480.000000	NaN
2	...		-0.000642	41860.0	20930.000000	4.474580e+07	699.0	349.500000	4900.500000	777.0	388.500000	264.500000
2	...		-0.000642	122199.0	17457.000000	1.195168e+07	2500.0	357.142857	2857.142857	2400.0	342.857143	2857.142857
1	...		-0.000642	166859.0	20857.375000	3.528980e+06	3000.0	375.000000	2142.857143	2600.0	325.000000	2142.857143
1	...		-0.000642	91296.0	30432.000000	1.390560e+08	1550.0	516.666667	45633.333333	1334.0	444.666667	936.333333
1	...		-0.000642	63624.0	31812.000000	1.098162e+06	720.0	360.000000	0.000000	960.0	480.000000	0.000000
3	...		-0.000642	40365.0	13455.000000	7.000432e+06	1200.0	400.000000	0.000000	900.0	300.000000	0.000000





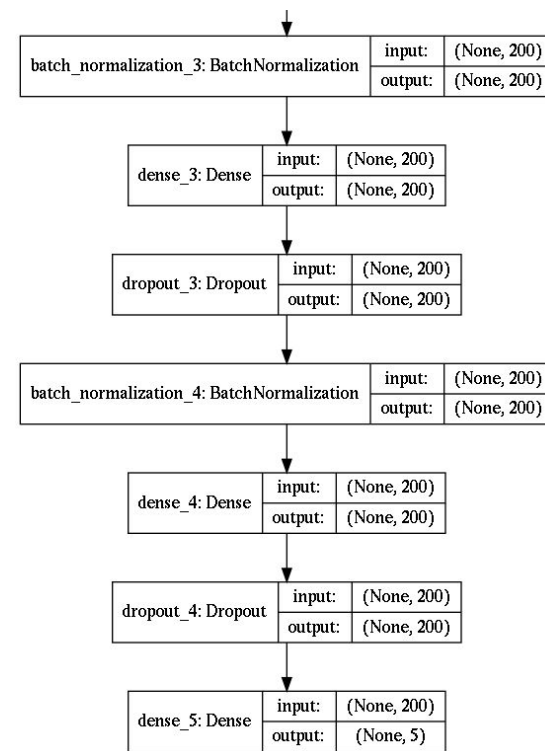
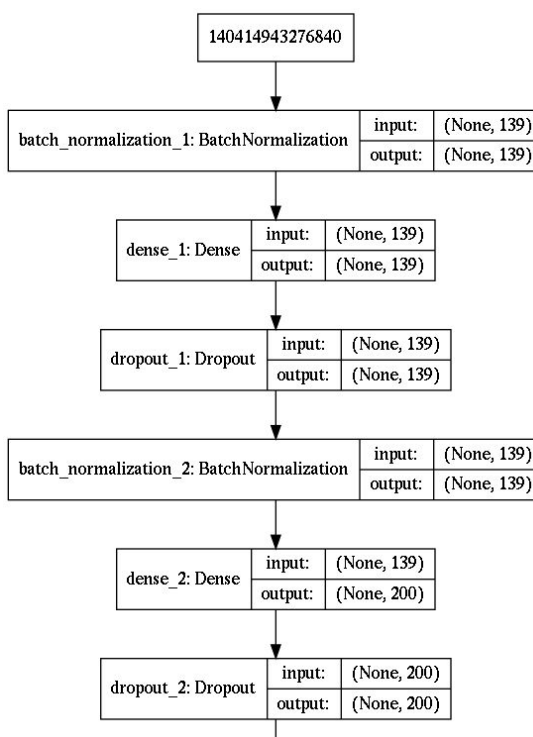
SOME EXPERIMENTS

- Standard MLP
- XGBoost

Standard MLP

MLP 4-Layer:

- Dense-Dropout-Batchnorm with accuracy as metric
- Cross Valid QWK = 0.33866061924592417



XGBoost

- is an open-source software library which provides a gradient boosting framework
- this produces a prediction model in the form of an ensemble of weak prediction models, typically decision trees

Some important hyperparameters:

```
'eval_metric': 'rmse',  
'seed': 4534,  
'eta': 0.01,  
'max_depth': 7,  
'subsample': 0.8,  
'colsample_bytree': 0.80,  
'tree_method': 'gpu_hist',  
'device': 'gpu',  
'silent': 1,  
'n_gpus': 1,  
'gamma': 1,
```

10% training-test set split


















































XGBoost

Results:

- Cross-Validation QWK = 0.482499011421059
- Leaderboards QWK = 0.453

Leaderboards Rankings

https://www.kaggle.com/c/petfinder-adoption-prediction/leaderboard

Overview	Data	Kernels	Discussion	Leaderboard	Rules	Team	My Submissions	Submit Predictions
432	hachi	   	+4	0.453	10	5h		
433	Fayzur	 		0.453	1	3d		
434	li	  		0.453	2	3d		
435	Philip Popien	   		0.453	1	3d		
436	ABFKS	  		0.453	3	3d		
437	sridhark8	   		0.453	14	6h		
438	Eli Mazurkas	  		0.453	7	2d		
439	ararabo	  		0.453	1	2d		
440	EEE298Team10	   		0.453	5	6h		
Your Best Entry ↑								
Your submission scored 0.443, which is not an improvement of your best score. Keep trying!								
441	Neha	  		0.453	2	2d		
442	kaorulego5x	   		0.453	4	1d		
443	Austin-Phirates	    		0.453	78	2d		
444	Geoff	   		0.453	2	2d		
445	Stanislav Demchenko	  		0.453	1	2d		

Some other experiments being tested:

Pretrained Model	Cross-Validation QWK
DenseNet 121	0.4797
DenseNet 169	0.4789
ResNet 50	0.47915
Xception	0.48166
InceptionResNetV2	0.47849
NASNETLarge	0.46

Although Xception performed better in the CV QWK, it suffered from poor LB QWK. Same goes with other shallower layers, such as the ResNet50. DenseNet 121 still remains a top LB scorer.

CONCLUSION

- More layers or less layers does not necessarily enhance the pretrained function of the original specified DenseNet pretrained network
- A lot of features that give importance are the Pet's images and description human's usually based their understanding about animal companionship and friendliness with its Picture and Descriptive comments.