Pawpularity

Predicting Engagement with a Pet's Profile Based on Profile Picture

DATASCI 207 Presentation

Members:

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- Brett Brandom
- Maria Jose Healey
- Yidai Yao

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Introduction

- In the world of animal welfare, the power of a single image serves as a potential lifeline. PetFinder.my is Malaysia's leading animal welfare platform that currently analyzes factors used to rank images of animals that are up for adoption.

- Through the "Pawpularity" project, our goal is to predict the appeal of photographs by analyzing raw images and metadata in the hopes to increase adoption rates.

- The dataset was obtained from Kaggle and contains both images and metadata in tabular format.

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Introduction

- The photos in the dataset are of the form {id}.jpg, where {id} is a unique Pet Profile ID corresponding to the photo's file name.

- Each row in the metadata includes a photo ID, twelve features, and the photo’s Pawpularity score.

- The Pawpularity Score is derived from each pet profile's page view statistics at the listing pages. An algorithm that normalizes the traffic data across different platforms and metrics is employed to generate scores that range from 1 to 100.

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Data Loading

9912 images - Metadata (IDs, 12 features and target label)

	Id	Subject Focus	Eyes	Face	Near	Action	Accessory	Group	Collage	Human	Occlusion	Info	Blur	Pawpularity
0	0007de18844b0dbbb5e1f607da0606e0	0	1	1	1	0	0	1	0	0	0	0	0	63
1	0009c66b9439883ba2750fb825e1d7db	0	1	1	0	0	0	0	0	0	0	0	0	42
2	0013fd999caf9a3efe1352ca1b0d937e	0	1	1	1	0	0	0	0	1	1	0	0	28
3	0018df346ac9c1d8413cfcc888ca8246	0	1	1	1	0	0	0	0	0	0	0	0	15
4	001dc955e10590d3ca4673f034feeef2	0	0	0	1	0	0	1	0	0	0	0	0	72
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9907	ffbfa0383c34dc513c95560d6e1fdb57	0	0	0	1	0	0	0	0	0	0	0	1	15
9908	ffcc8532d76436fc79e50eb2e5238e45	0	1	1	1	0	0	0	0	0	0	0	0	70
9909	ffdf2e8673a1da6fb80342fa3b119a20	0	1	1	1	0	0	0	0	1	1	0	0	20
9910	fff19e2ce11718548fa1c5d039a5192a	0	1	1	1	0	0	0	0	1	0	0	0	20
9911	fff8e47c766799c9e12f3cb3d66ad228	0	1	1	1	0	0	0	0	0	0	0	0	30

9912 rows × 14 columns

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Exploratory Data Analysis

Image dimensions (m,n,3)

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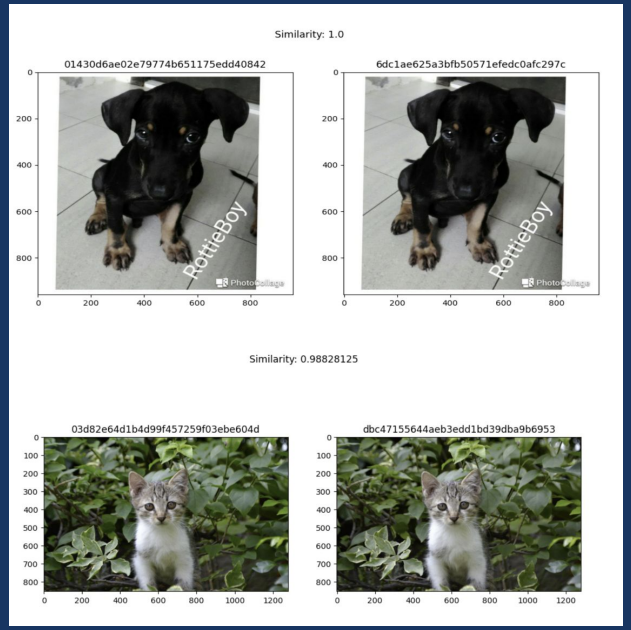
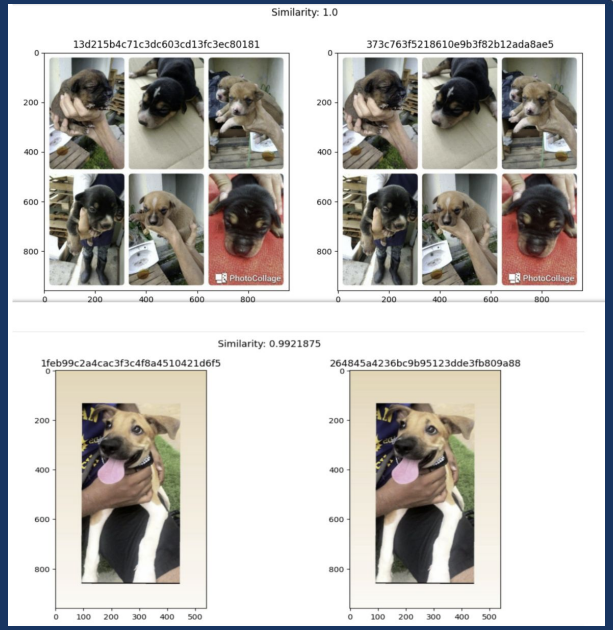
Exploratory Data Analysis

27 duplicate images





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Exploratory Data Analysis

Creating a new Dataset without duplicate images:

- Duplicate images removed from list of image paths
- Duplicate image Ids dropped from metadata

	Id	Subject Focus	Eyes	Face	Near	Action	Accessory	Group	Collage	Human	Occlusion	Info	Blur	Pawpularity
0	0007de18844b0dbbb5e1f607da0606e0	0	1	1	1	0	0	1	0	0	0	0	0	63
1	0009c66b9439883ba2750fb825e1d7db	0	1	1	0	0	0	0	0	0	0	0	0	42
2	0013fd999caf9a3efe1352ca1b0d937e	0	1	1	1	0	0	0	0	1	1	0	0	28
3	0018df346ac9c1d8413cfcc888ca8246	0	1	1	1	0	0	0	0	0	0	0	0	15
4	001dc955e10590d3ca4673f034feeef2	0	0	0	1	0	0	1	0	0	0	0	0	72
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9907	ffbfa0383c34dc513c95560d6e1fdb57	0	0	0	1	0	0	0	0	0	0	0	1	15
9908	ffcc8532d76436fc79e50eb2e5238e45	0	1	1	1	0	0	0	0	0	0	0	0	70
9909	ffdf2e8673a1da6fb80342fa3b119a20	0	1	1	1	0	0	0	0	1	1	0	0	20
9910	fff19e2ce11718548fa1c5d039a5192a	0	1	1	1	0	0	0	0	1	0	0	0	20
9911	fff8e47c766799c9e12f3cb3d66ad228	0	1	1	1	0	0	0	0	0	0	0	0	30

9885 rows × 14 columns

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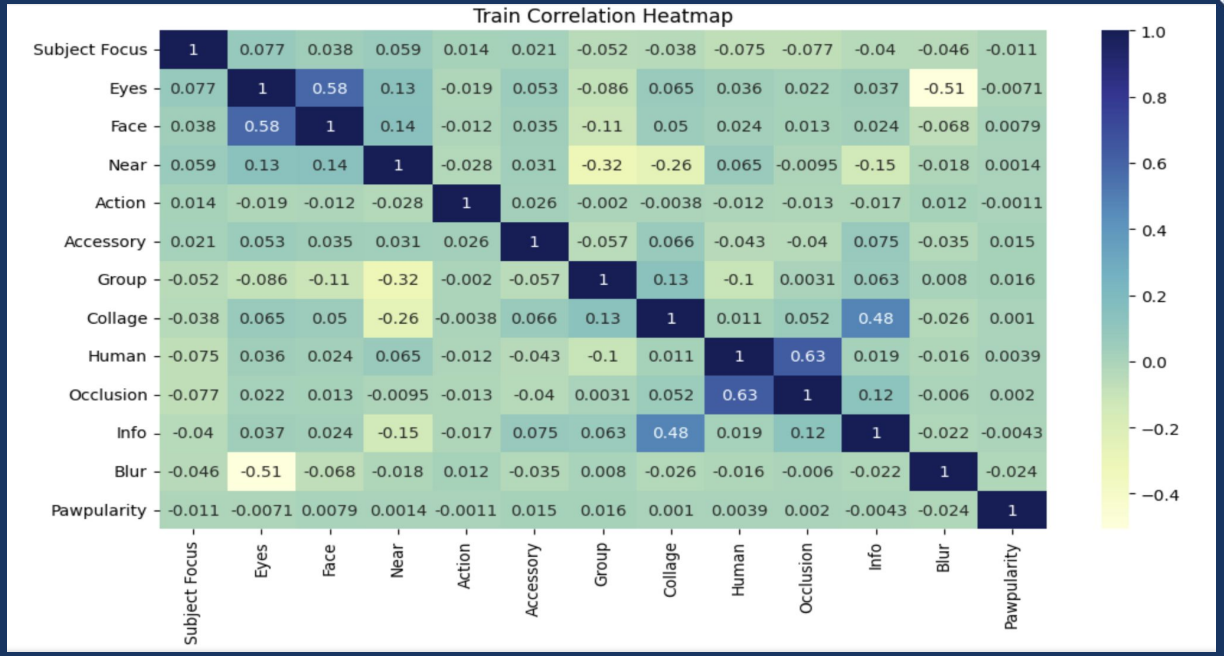
Exploratory Data Analysis

Correlation Matrix



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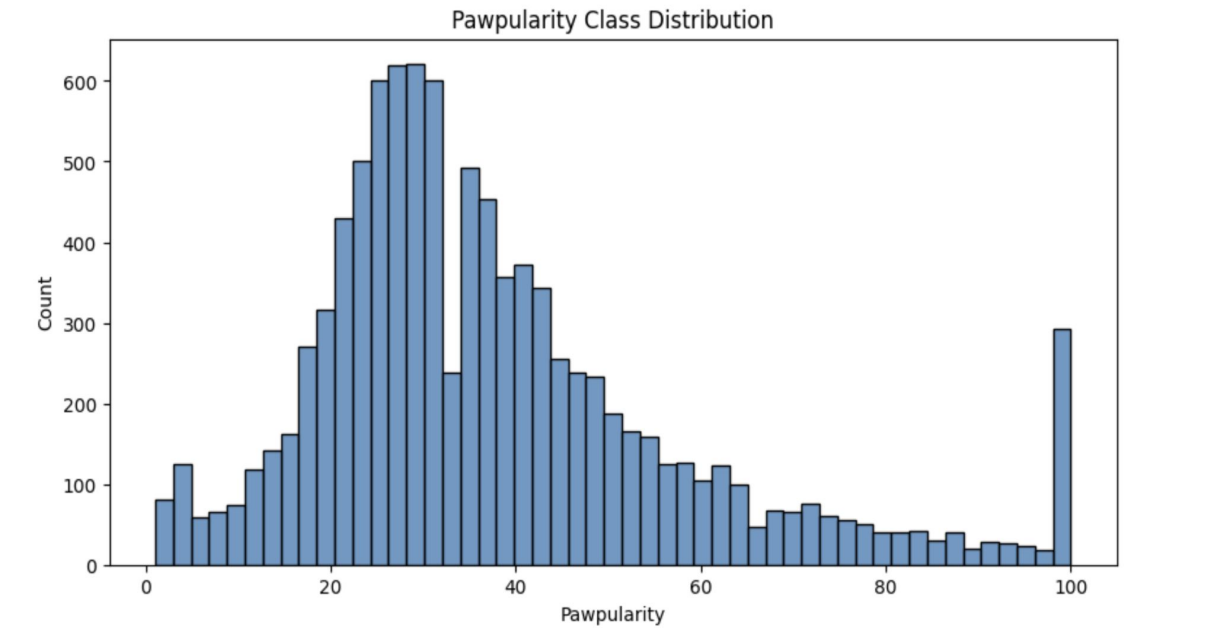
Exploratory Data Analysis

Class distribution



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Data Pre-processing

- Creation of train, validation, and test data
  - 60-20-20 split
- Data transformation and augmentation
  - Image resizing
  - Applied on training set only
    - Augmentation techniques to each each image such as:
      - Adjusting brightness
      - Contrast
      - Saturation
      - Random_flip_left_right
      - Random_flip_up_down
  - Rescaling images
  - Rescaling labels
- Performance optimizations
  - Cache - Keep data in memory
  - Shuffle - Randomize selections
  - Batch - Group processing into batches

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Base Model

- Dummy Regressor
  - Return mean Pawpularity score in training set
- Evaluation metric
  - Root Mean Squared Error (RMSE)
- 10-Fold CV results
  - Mean RMSE: **20.59**
  - Standard Deviation RMSE: **0.52**
- Top Kaggle scores **~17** RMSE

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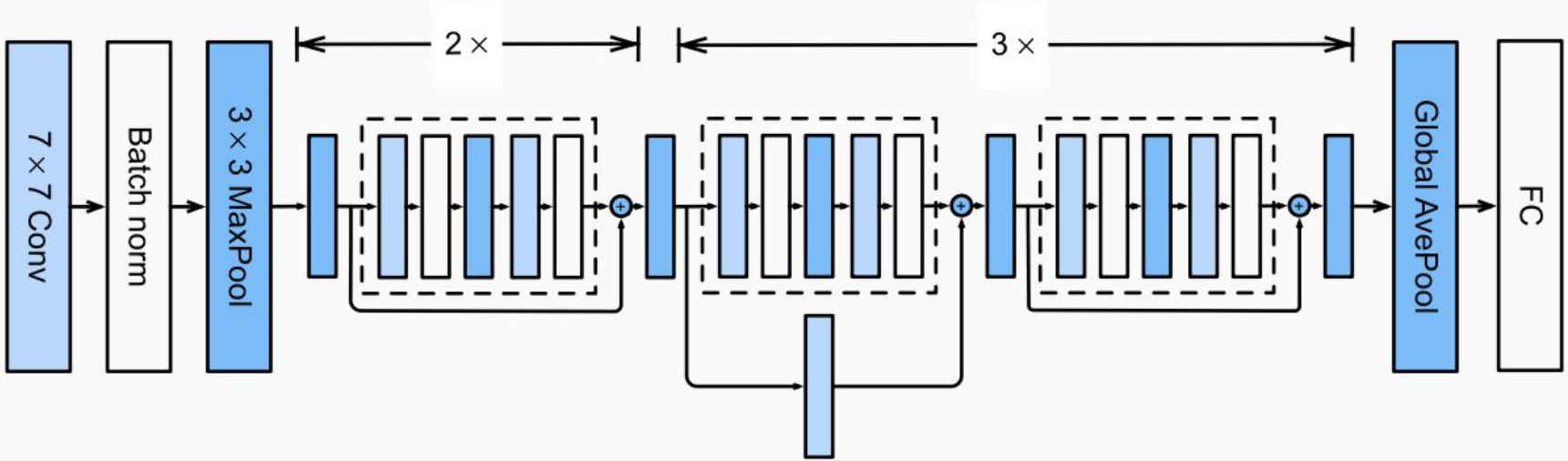
Modeling Approach

ResNet (Residual Neural Network)



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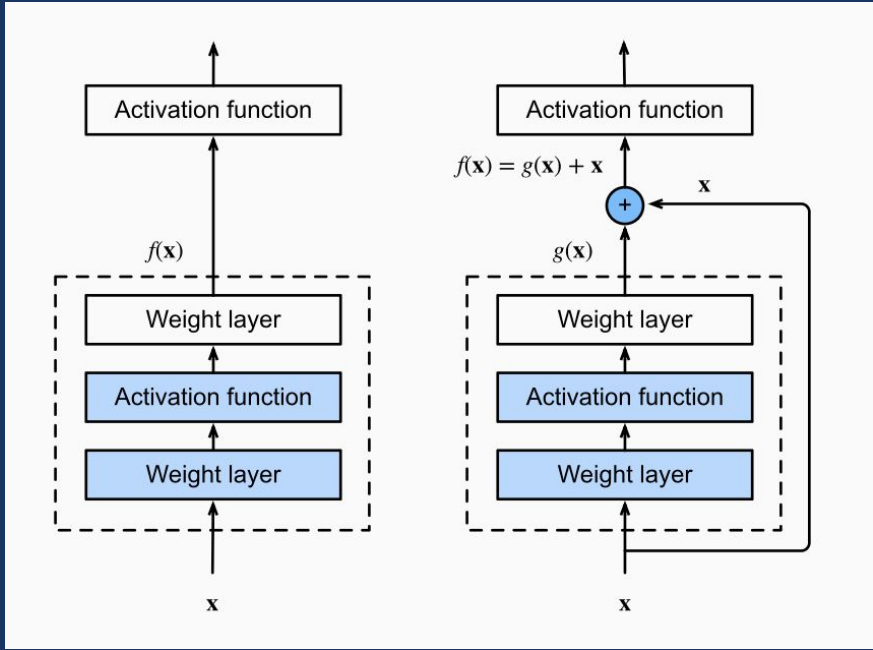
ResNet: Skip Connections



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Final Results (ResNet)

Hyperparameter Tuning Table 1

EXP #	DECAY TYPE	INITIAL LEARNING RATE	DECAY STEP	DECAY RATE / POWER	TRAIN RMSE	VAL RMSE	TEST RMSE
1	Exponential	0.005	99	0.95	20.59	20.67	20.47
2	Exponential	0.001	99	0.95	15.53	23.21	20.63
3	Exponential	0.005	50	0.95	20.77	20.87	20.59
4	Exponential	0.005	99	0.75	20.63	20.65	20.44
5	Exponential	0.0011	50	0.75	19.57	20.73	20.57
6	Polynomial	0.005	99	0.5	20.64	20.71	20.55
7	Polynomial	0.001	99	0.5	15.66	23.31	20.39
8	Polynomial	0.005	50	0.5	20.75	20.72	20.53
9	Polynomial	0.005	99	0.1	21.24	20.65	20.46

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Final Results (ResNet with Metadata)

Hyperparameter Tuning Table 2

EXP #	# of NEURONS IN LAST LAYER	ACTIVATION FUNCTION	DECAY TYPE	INITIAL LEARNING RATE	TRAIN RMSE	VAL RMSE	TEST RMSE
1	512	tanh	Cosine	0.0000001	19.04	21.95	21.19
2	128	tanh	Cosine	0.0000001	19.32	21.92	21.59
3	512	ReLU	Cosine	0.0000001	18.72	22.09	21.64
4	512	tanh	Cosine	0.000001	18.53	21.74	21.48
5	512	tanh	Exponential	0.0000001	20.70	21.56	21.45
6	128	tanh	Exponential	0.0000001	22.13	22.01	21.86
7	512	ReLU	Exponential	0.0000001	21.02	21.96	21.76
8	512	tanh	Exponential	0.000001	19.17	21.71	21.50

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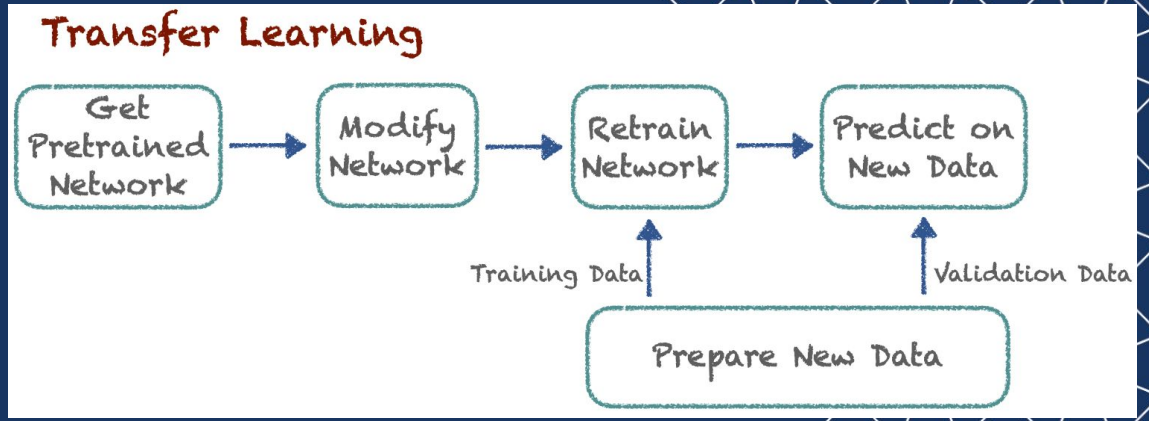
Explore Transfer Learning Model

- Used transfer learning with pre-trained conv net
  - Base Model: EfficientNetB0 trained on ImageNet
- Marginal improvement
  - Test RMSE **19.43**



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Final Thoughts

- Seemingly low signal to noise ratio
- Room for improvement nonetheless
  - Larger backbone model
  - More sophisticated head
- Next steps: Interpret model

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Thank You For Listening!

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References

1. https://www.kaggle.com/competitions/petfinder-pawpularity-score

2. https://www.kaggle.com/code/schulta/petfinder-identify-duplicates-and-share-findings

3. https://d2l.ai/chapter_convolutional-modern/resnet.html

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Contributions

- Maria Jose Healey - EDA and Data Cleaning
- Scott Abramson - Preprocessing and Data Augmentation
- Brett Brandom - Model Architecture Design
- Yidai Yao - Experiments

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NeurIPS Checklist

1. Our project is based on a Kaggle competition
   a. https://www.kaggle.com/competitions/petfinder-pawpularity-score/overview
   b. Since our subjects are pets, we would consult with organizations such as PETA and The Humane Society on the ethics of our project
2. Our results are not theoretical
3. Our experiments are summarized in tables 1 and 2
   a. The submitted repo contains our code, data and instructions
   b. Training details are in the same notebook
   c. We did not report error bars
   d. We did not include compute or resource information as we all ran experiments in our own environments
4. We are using data from the Kaggle competition
5. We did not use crowdsourcing or human subjects

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