PUPPY MASTER

DATA SCIENCE II / TU DARMSTADT

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2 Data collection and augmentation

3 Model

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TEAM STRUCTURE

Johannes Wowra
Supervisor

DATA COLLECTION

DATA AUGMENTATION

MODEL TRAINGING

MODEL EVALUATION

UI IMPLEMENTATION

PROJECT IMPLEMENTATION

Jian Jiang

Haoyue Zhu

Keren Zhou

Ruize Xia

Xiaoyan Xue

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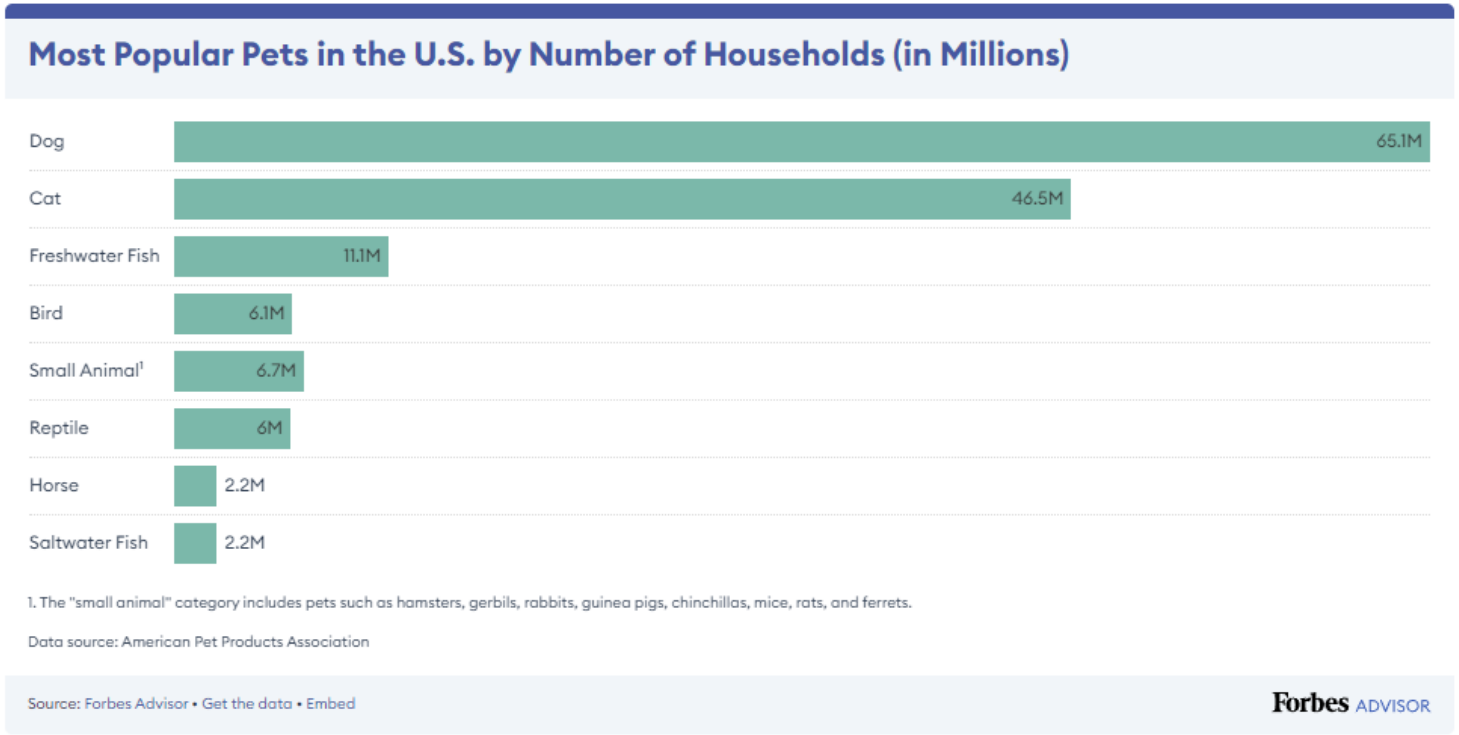
PROJECT OVERVIEW

- **DOGS: MOST POPULAR PETS**
- Dogs are the most popular pet in the U.S. (65.1 million U.S. households own a dog)
- Essential dog expenses cost an average of $1,533 annually.
- 42% of dog owners got their pets from a store, while 38% of dog owners got their pets from an animal shelter or rescue.



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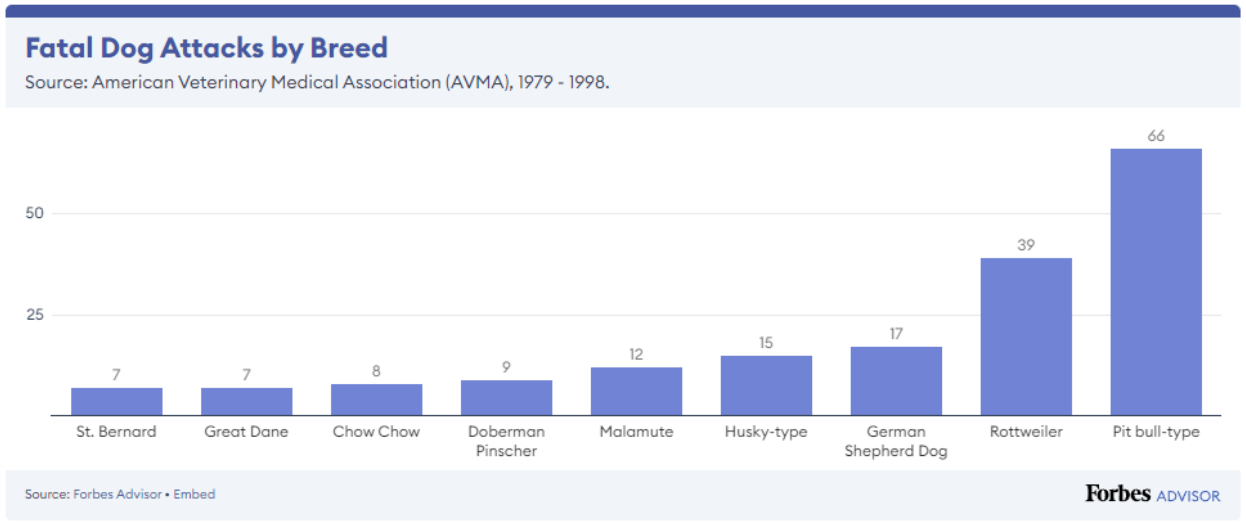
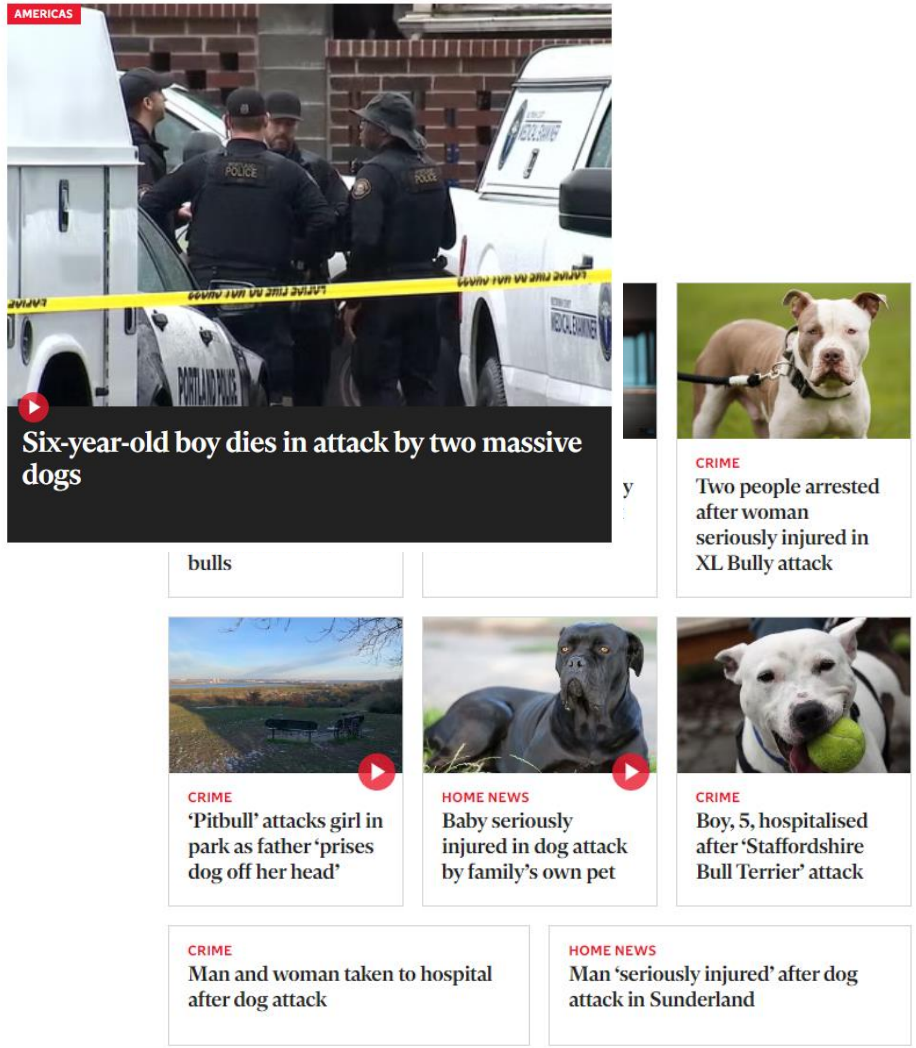
PROJECT OVERVIEW

- **DOGS BITING: POTENTIAL RISK AROUND YOU**

- Every year, an estimated 4.5 million people are bitten by dogs in the United States.
- 15.55% of dog bites were committed by stray dogs rather than pets.





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PROJECT OVERVIEW

What?

A system that offers a quick and simple classification tool for breeds of the dogs.

Why?

Get the breed information as soon as possible to prevent from the dog attack accidents.

Whom?

- Dog owners that not sure the breeds of their dogs.
- Anyone who finds a dog nearby and worries about the potential risk of biting.

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DATA COLLECTION & AUGMENTATION

Haoyue Zhu
Jian Jiang

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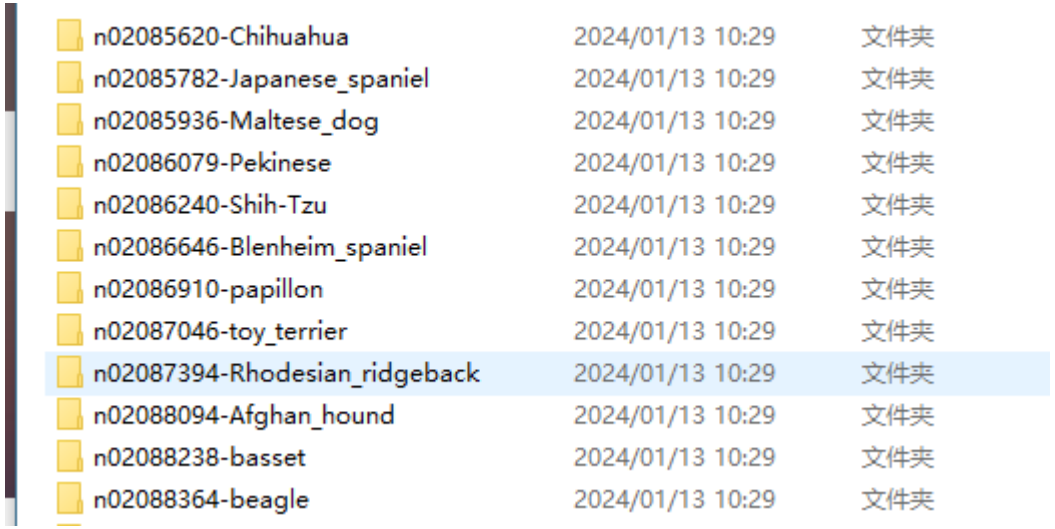
DATA COLLECTION

Original Dataset: Stanford Dogs Dataset

Images of 120 breeds of dogs from around the world.

- **Number of categories: 120**
- **~150 images per class**
- **Total images: 20,580**
- **Annotations: Class labels, Bounding boxes**



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DATA AUGMENTATION

· Why?

Data augmentation can improve the generalization and robustness of the deep learning model.

· How?

We can apply various transformations to the existing images.

Rotation, Flip, Contrast Adjustment, Color Jittering, Gaussian Noise, Sharpen...

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DATA AUGMENTATION

· Problem we have:

The dataset contains more than 20,000 images.

Processing the images one by one is impossible.

· How can we solve it?

We choose to use Image Batch Processor in MATLAB,

which can use the functions to process thousands

of images simultaneously.

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DATA AUGMENTATION

Functions decided to use:

- Gray
- Reduce the Contrast
- Flip
- Mirror
- Gaussian Noise
- Sharpen

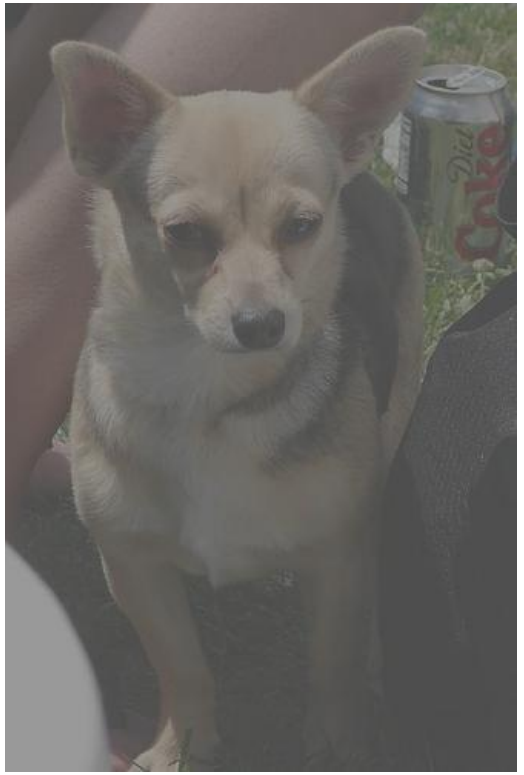
- Augmented dataset:
- 20K*6 = 120K images for training!

DATA AUGMENTATION

Original

Stanford Dogs Dataset
http://vision.stanford.edu/aditya86/ImageNetDogs/

Gray



Reduce the Contrast

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DATA AUGMENTATION

Original

Mirror

Flip

Stanford Dogs Dataset
http://vision.stanford.edu/aditya86/ImageNetDogs/

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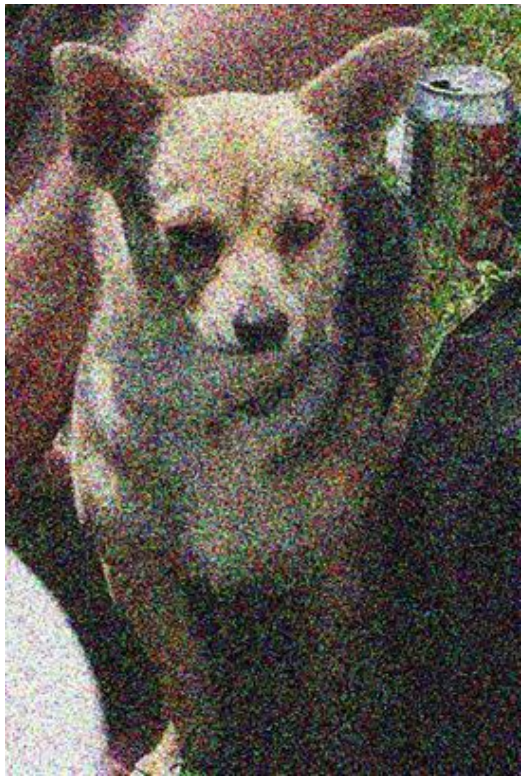
DATA AUGMENTATION

Original

Stanford Dogs Dataset
http://vision.stanford.edu/aditya86/ImageNetDogs/



Gaussian Noise

Sharpen

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DATA AUGMENTATION

Example:
Gray function

- 20,000 images for more than 1 hour
- Takes a lot of time But acceptable!

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MODEL TRAINING & EVALUATION

Keren Zhou

Ruize Xia

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1 What is resnet

2 Why Resnet50

3 Work Flow

4 Building a Model

5 TRAINING

6 Visualizing The Metrics Curves

7 Prediction

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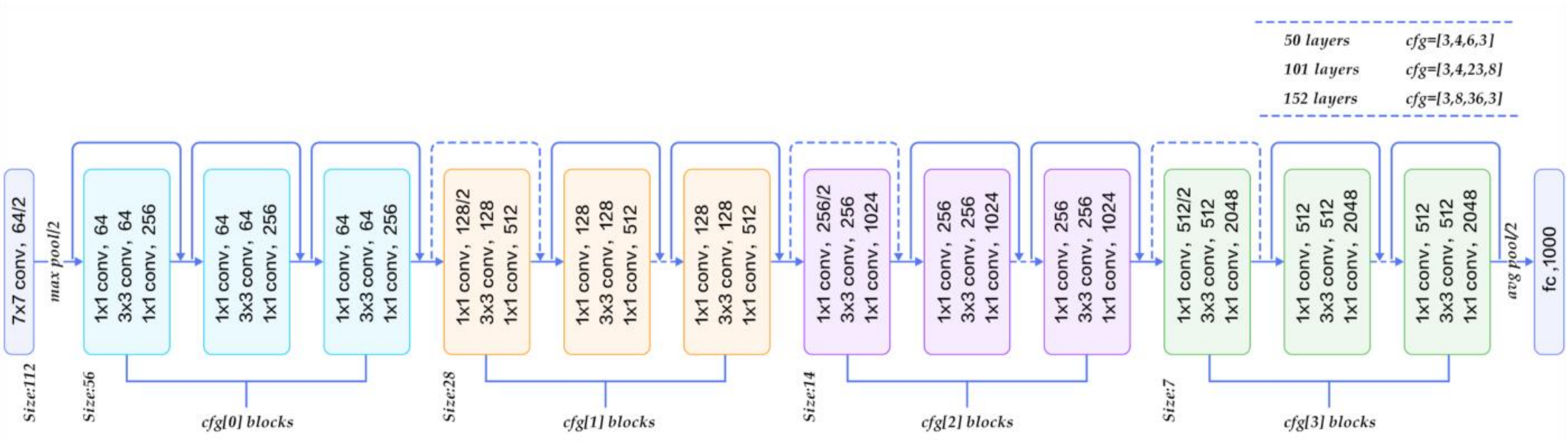
WHAT IS RESNET

- Short for Residual Networks, is a classical convolutional CNN architecture for deep learning.
- Composed of residual blocks. Each block contains a shortcut connection that skips one or more layers.



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WHY RESNET50

- Addressing Gradient Issues
- Deeper Networks
- Alleviating Degradation Issues
- Efficient Model Training
- Transfer Learning
- Widespread Applicability









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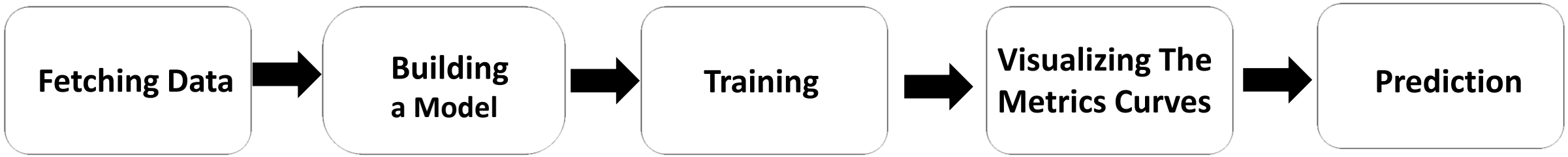
WORK FLOW



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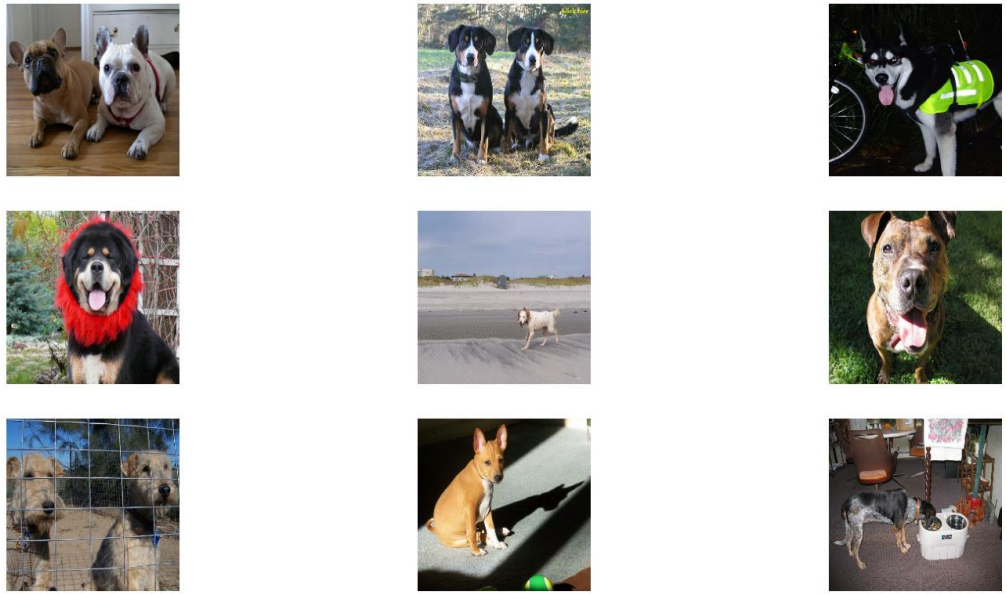
BUILDING A MODEL

- Rescaling Layer
- Pre-trained Model
- Dense Layer
- Adam Optimizer



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TRAINING

- We will add 3 Very Important Callbacks for our model
- ModelCheckpoint: This callback saves the model weights after every epoch if the validation loss improves.
- EarlyStopping: This callback stops the training process if the validation loss doesn't improve for a certain number of epochs.
- ReduceLROnPlateu: This callback monitors a quantity and if no improvement is seen for a 'patience' number of epochs, the learning rate is reduced.

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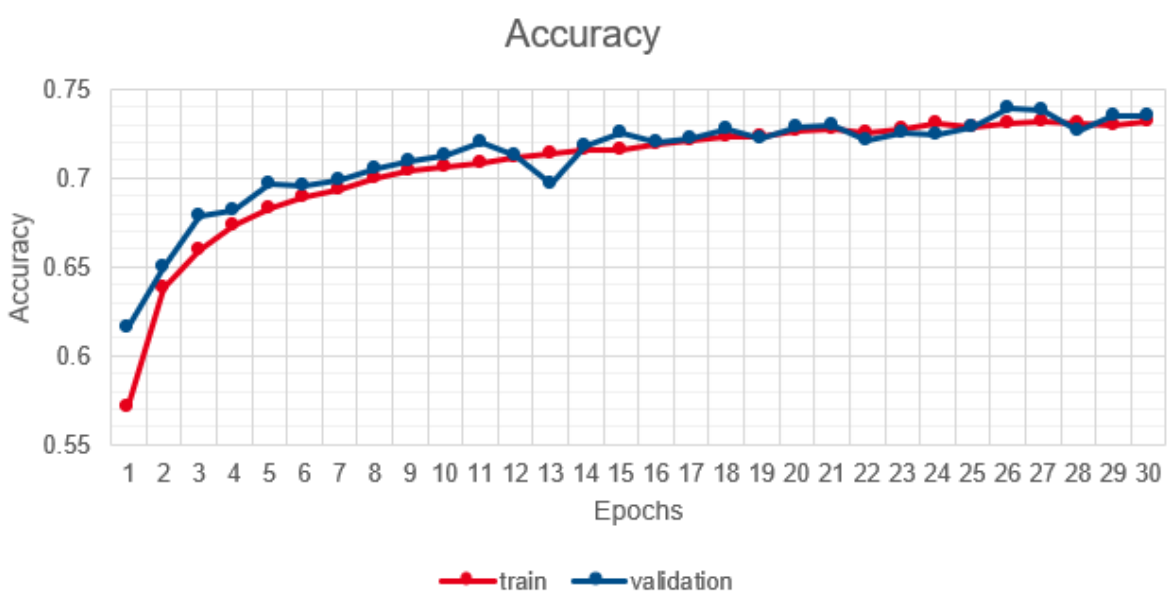
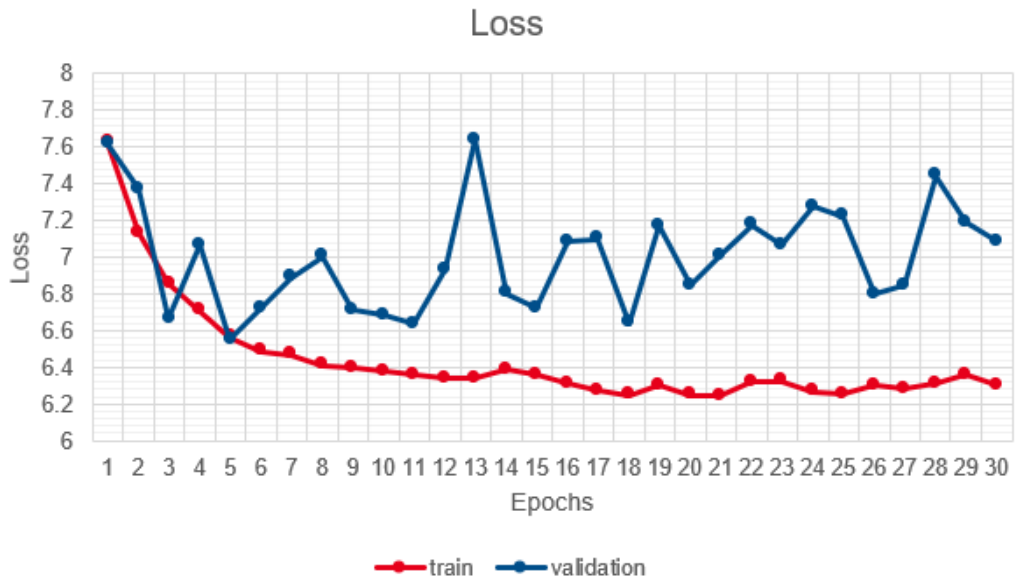
VISUALIZING THE METRICS CURVES

- After the cross-validation, we can see……





- Epochs: 30
- Multi-class balanced accuracy: 0.732 (train) / 0.734 (validation)

- Epochs: 30
- Loss function:6.303 (train) / 7.083 (validation)

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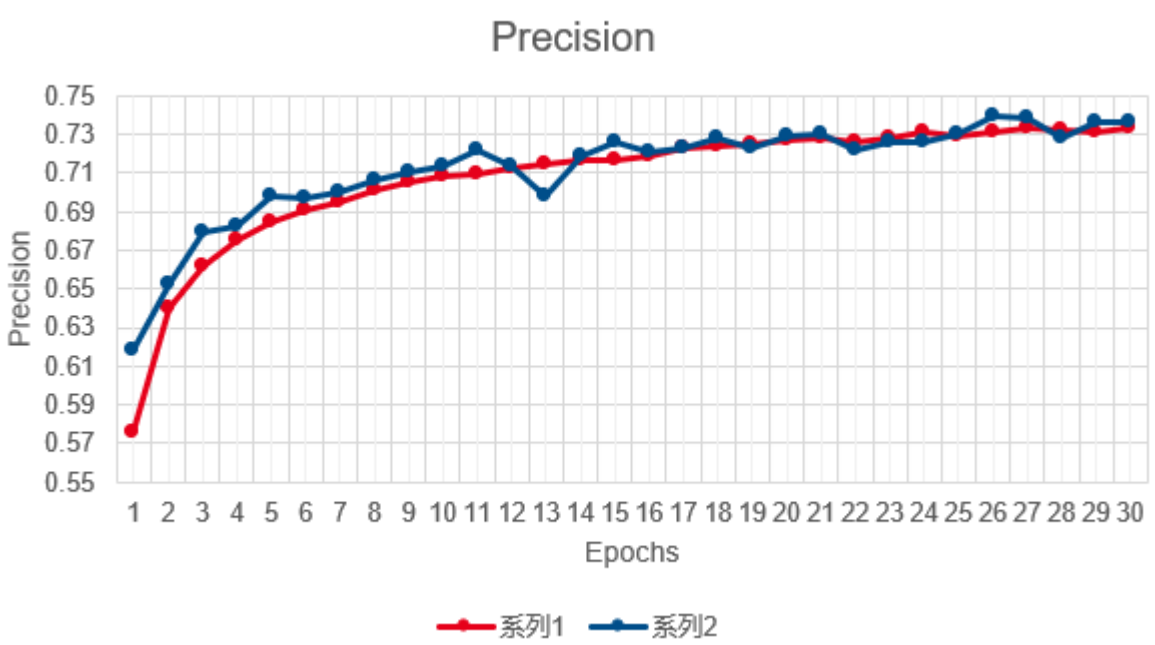
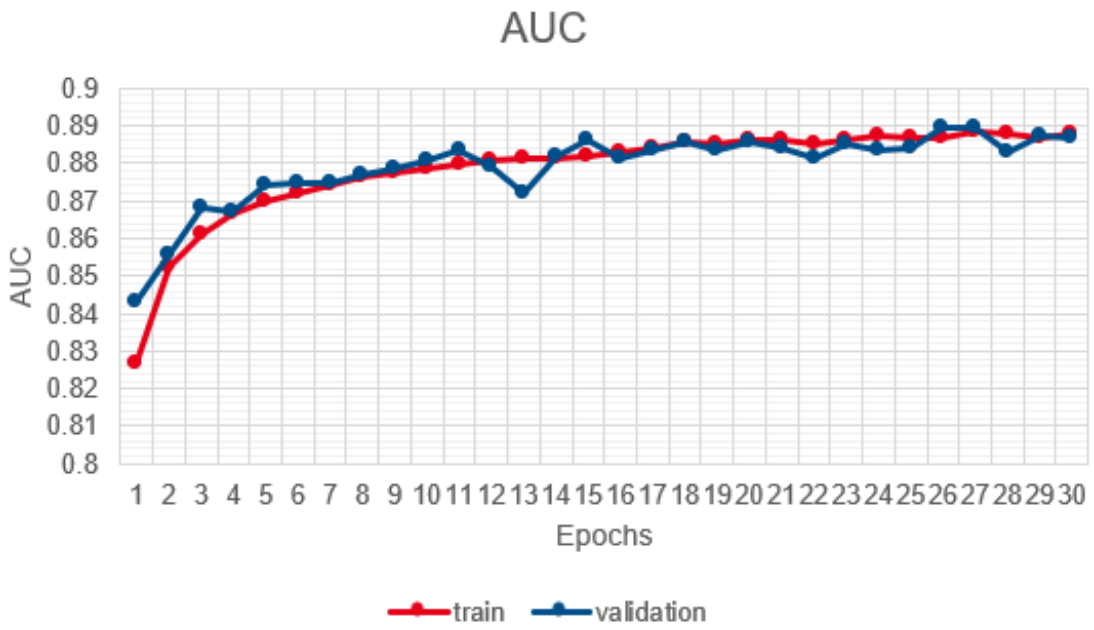
VISUALIZING THE METRICS CURVES





- Epochs: 30
- Precision: 0.732 (train) / 0.735 (validation)

- Epochs: 30
- AUC(Area under curve):0.888 (train) / 0.887 (validation)

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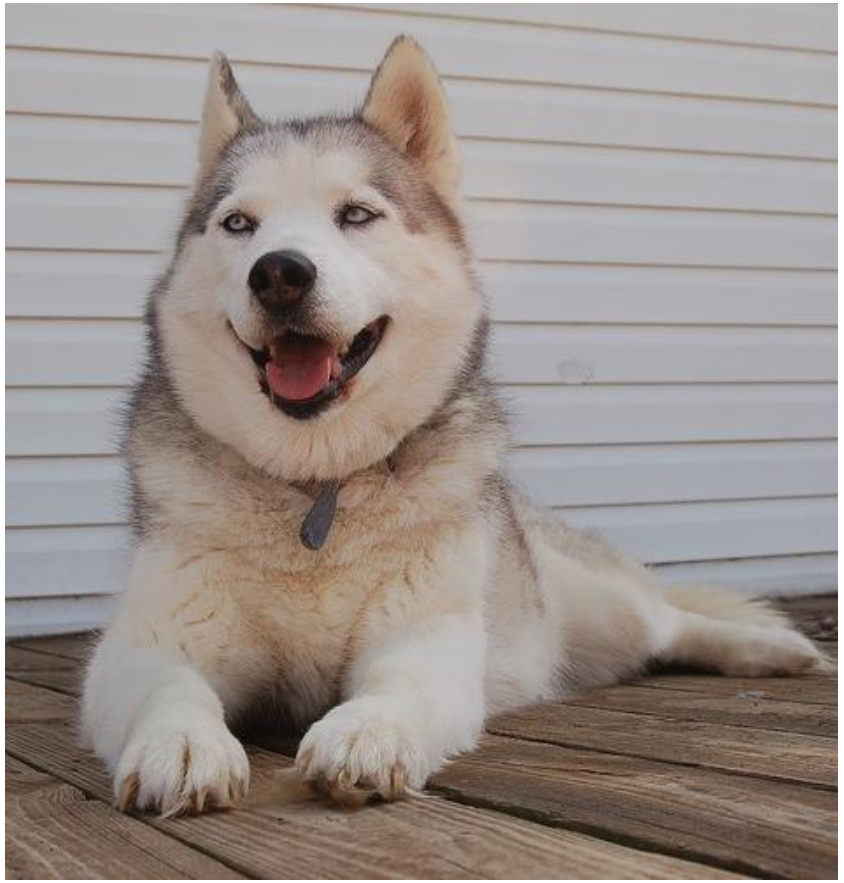
PREDICTION



```
Top-5 probabilities index: [97, 73, 72, 2, 1, 44, 99]
Eskimo_dog 0.6243399
groenendael 0.21147579
schipperke 0.114172645
Maltese_dog 0.018629553
Japanese_spaniel 0.012133966
Boston_bull 0.0037243296
Siberian_husky 0.003451676
```

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PREDICTION

```
Top-5 probabilities index: [101, 22, 99, 115, 7, 72, 21]
basenji 0.35082543
Ibizan_hound 0.313001
Siberian_husky 0.16691078
standard_poodle 0.14125994
toy_terrier 0.017830562
schipperke 0.0029041918
whippet 0.0026659945
```

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USER INTERFACE & PROJECT IMPLEMENTATION

Xiaoyan Xue

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PROJECT STRUCTURE

TECH STACKS

DATABASE

MYSQL

- Breed
- Record
- Prediction
- User

BACK-END

JAVA

- Swagger
- Redis
- SpringBoot
- MyBatis

Python

- Tensorflow
- Numpy
- Matplotlib
- Scikit-learn

FRONT-END

- HTML5
- CSS3

JavaScript

- React
- Node
- Umi
- Ant Design

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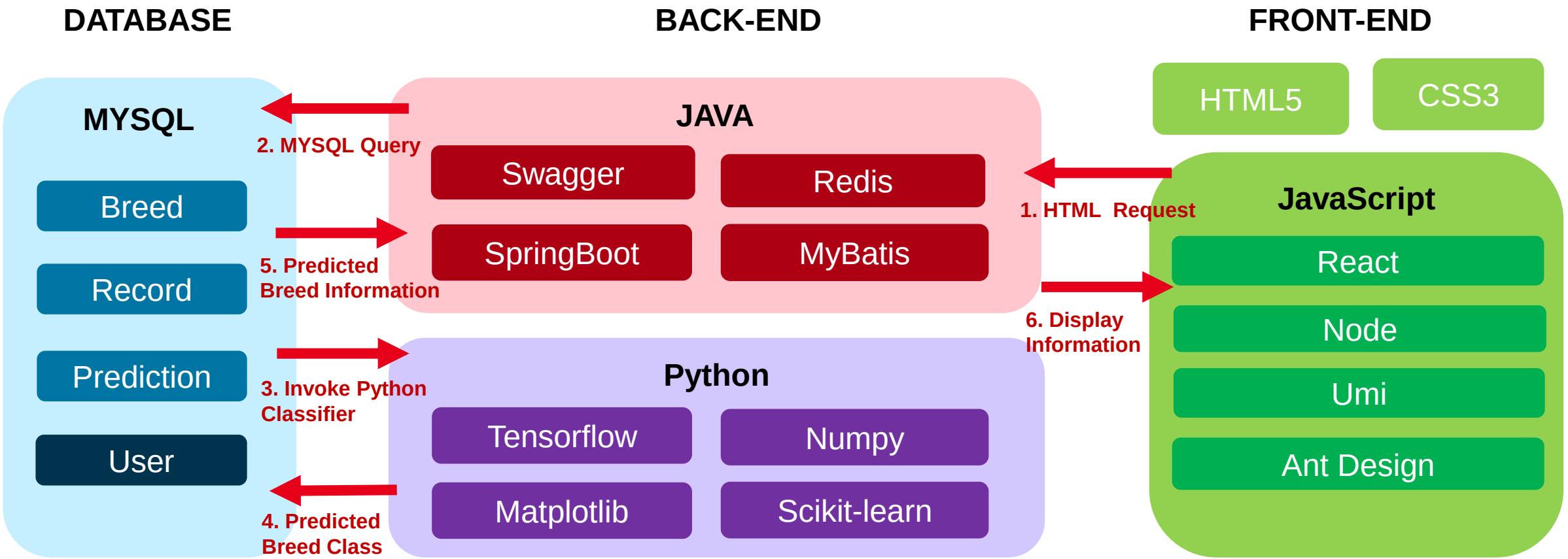
PROJECT STRUCTURE

DATA FLOW



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PROJECT STRUCTURE

DATABASE

Breed Information

breed

Fields

Field	Type
id	int
name	varchar(50)
annotation	char(10)
origin	varchar(30)
height	varchar(50)
weight	varchar(50)
coat	varchar(50)
colour	varchar(50)
life_span	varchar(50)
link	varchar(256)
image_name	varchar(30)

Prediction Information

prediction

Fields

Field	Type
id	int
record_id	int
breed_id	int

Record Information

record

Fields

Field	Type
id	int
name	varchar(30)
height	varchar(30)
weight	varchar(30)
coat	varchar(50)
colour	varchar(50)
age	varchar(30)
image_name	varchar(256)

PROJECT STRUCTURE

BACKEND

BreedController|Breed information Controller Breed Controller

- GET `/breed/{id}` Query breed information by breed id
- GET `/breed/all` Fuzzy query all matches breeds

DogImageController|Python util controller Dog Image Controller

- POST `/python/py` Run python file

PredictionController|Prediction information controller Prediction Controller

- POST `/prediction` Add a new prediction
- GET `/prediction/{id}` Query by prediction id
- GET `/prediction/all` Fuzzy query all matches predictions

RecordController|Record information controller Record Controller

- POST `/record` Add a new record
- GET `/record/{id}` Query by record id
- DELETE `/record/{id}` Delete a record by id
- GET `/record/all` Fuzzy query all matches records
- POST `/record/attachment` Upload record image

UI DISPLAY

FRONTEND

DEMO DISPLAY!

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RELATED WORK

RELATED WORK

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Data

- Dataset: More high quality dataset for model training
- Augmentation: Clip object position to have better annotations

Model

- Training: More variety of model such as resnet-152
- Training: More Epochs, different hypermeters research such as MC dropout

UI

- More user-friendly functionalities: archives, alarms, etc.
- More platforms supported

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THANKS FOR WATCHING!

Any questions?

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