

SEOUL

19.09.26

DEV DAY



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모두를 위한 컴퓨터 비전 딥러닝 툴킷, GluonCV 따라하기

2-2. GluonCV Overview

강지양 딥러닝 아키텍트
Amazon Machine Learning Solutions Lab

GluonCV: A Vision Toolkit

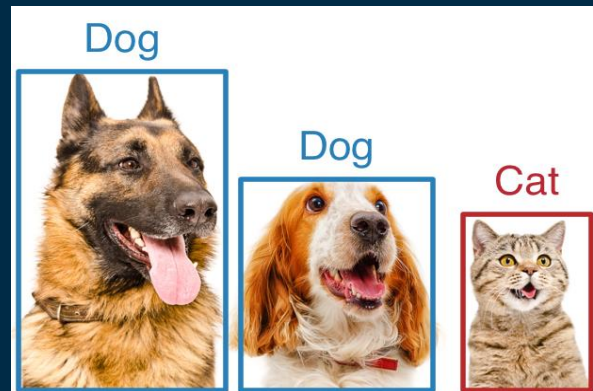
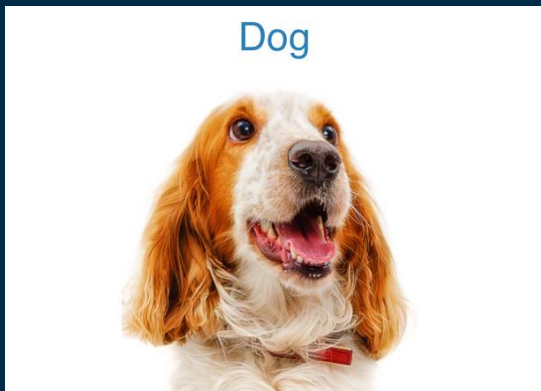
- State-of-the-Art Models
- Fast Development
- Easy Deployment
- Official Maintenance

The Best Open-Source Choice

- Pretrained Models with the Best Accuracy
- Most Comprehensive Model Zoo

Models

- Classification
- Detection
- Segmentation



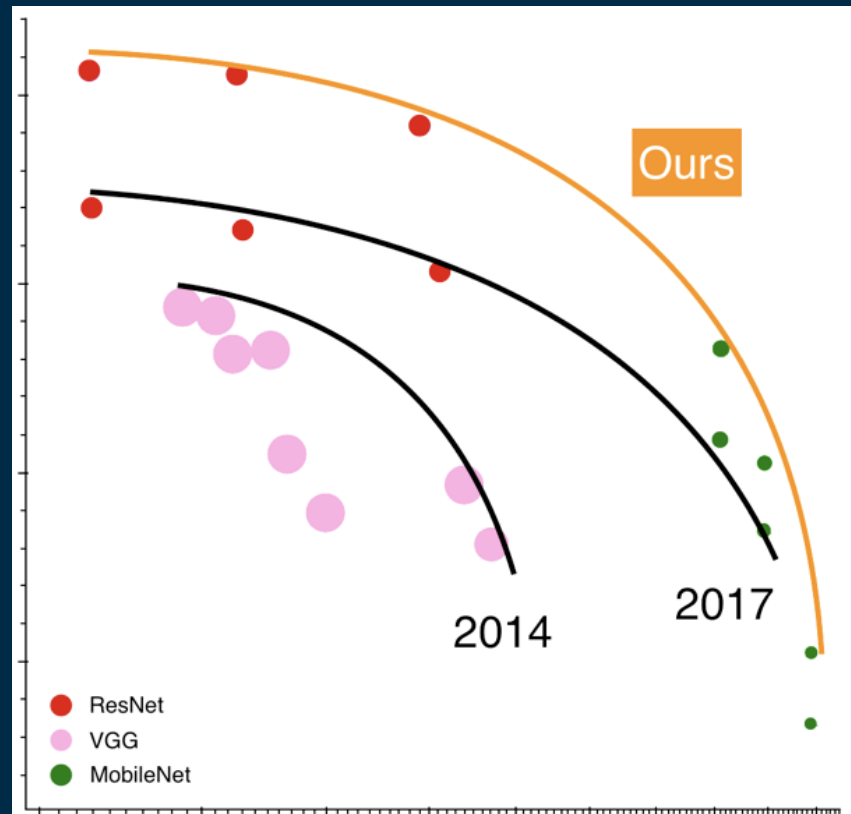
Models

- Classification

Model	Ours	Reference
ResNet-50	79.2%	76.2%
ResNet-101	80.5%	77.4%
MobileNet	73.3%	70.9%

Models

- Classification



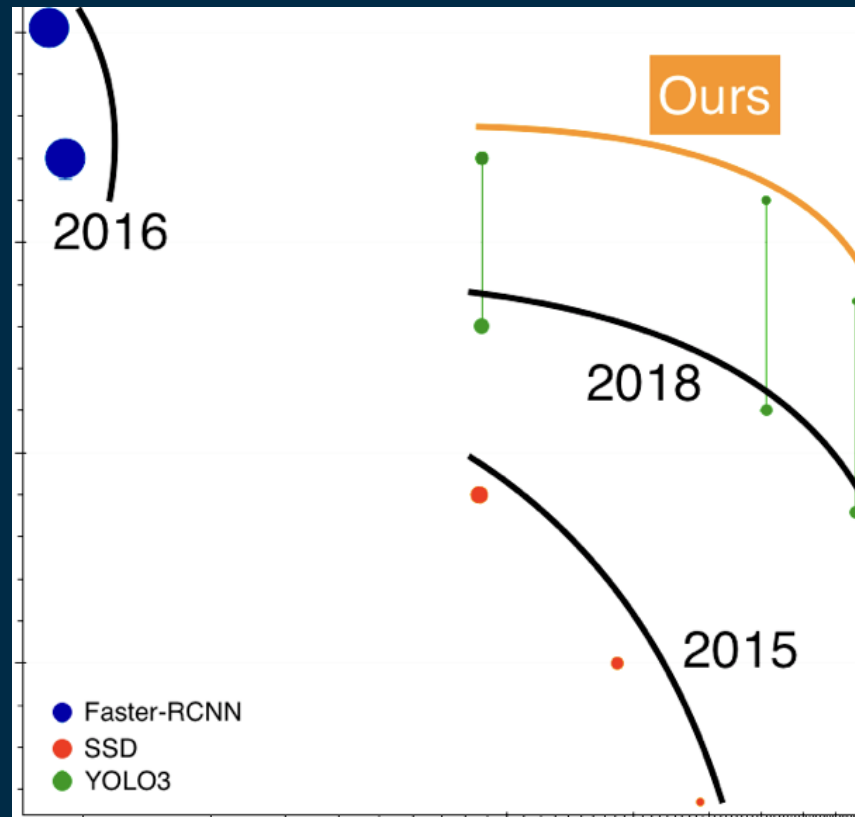
Models

- Detection

Model	Ours	Reference
Faster-RCNN	40.1%	39.6%
YOLOv3	37.0%	33.0%

Models

- Detection



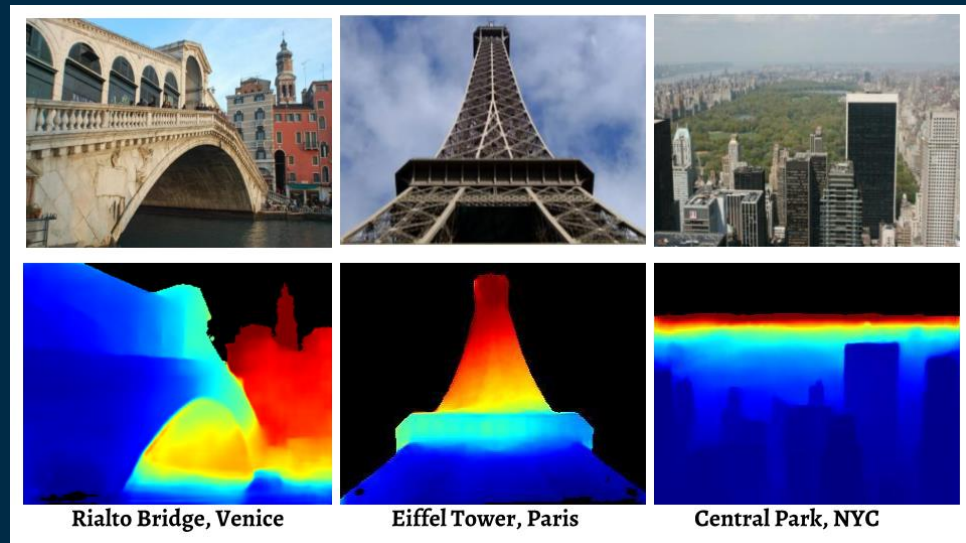
Models

- Segmentation

Model	Ours	Reference
Mask-RCNN	33.1%	32.8%
DeepLab-v3	86.7%	85.7%

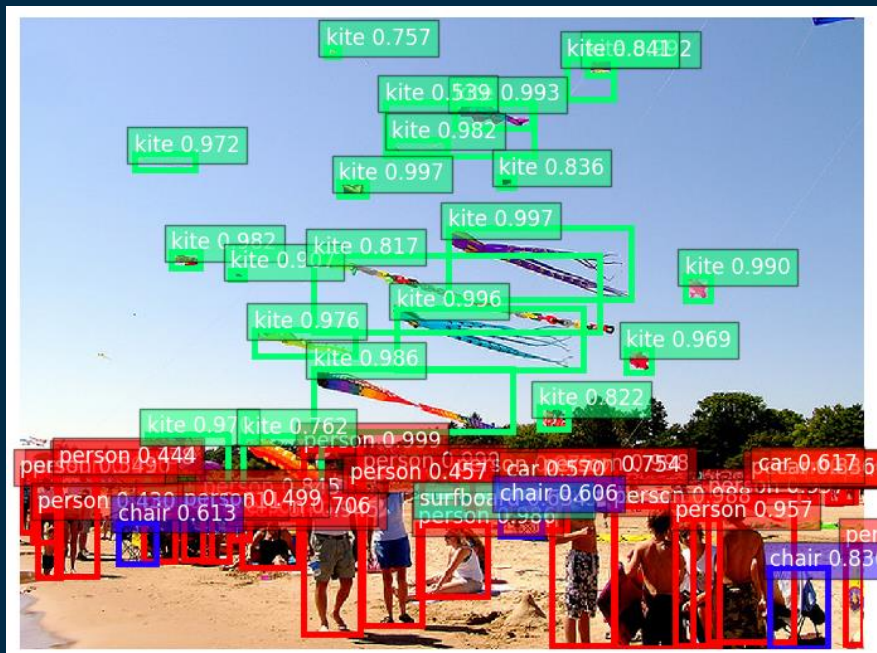
Models

- Available
 - Classification
 - Detection
 - Segmentation
 - Re-ID
 - GAN
- In-Development
 - Keypoint detection
 - Depth prediction



Demo

- Detection

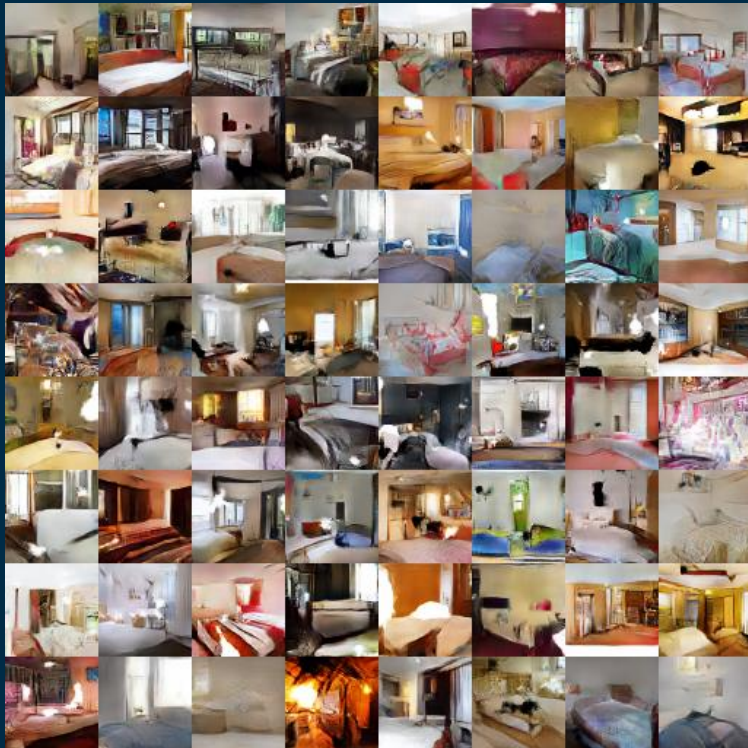


- Segmentation



Demo

- WGAN



- Person Re-ID



Getting Started

- Gluon CV: <https://gluon-cv.mxnet.io>
- Gluon NLP: <https://gluon-nlp.mxnet.io>
- MXNet: <http://beta.mxnet.io/>
- Deep Learning Book: <http://diveintodeeplearning.org>

Classification with GluonCV

Classification with GluonCV

Model Zoo

- Pre-trained models
- Can be transferred or directly applied

Classification with GluonCV

GluonCV Model Zoo

- Comprehensive selection
 - AlexNet
 - VGG
 - ResNet
 - MobileNet
 - NASNet
 - ...
- One of the most accurate open-sourced libraries
- Reproducible

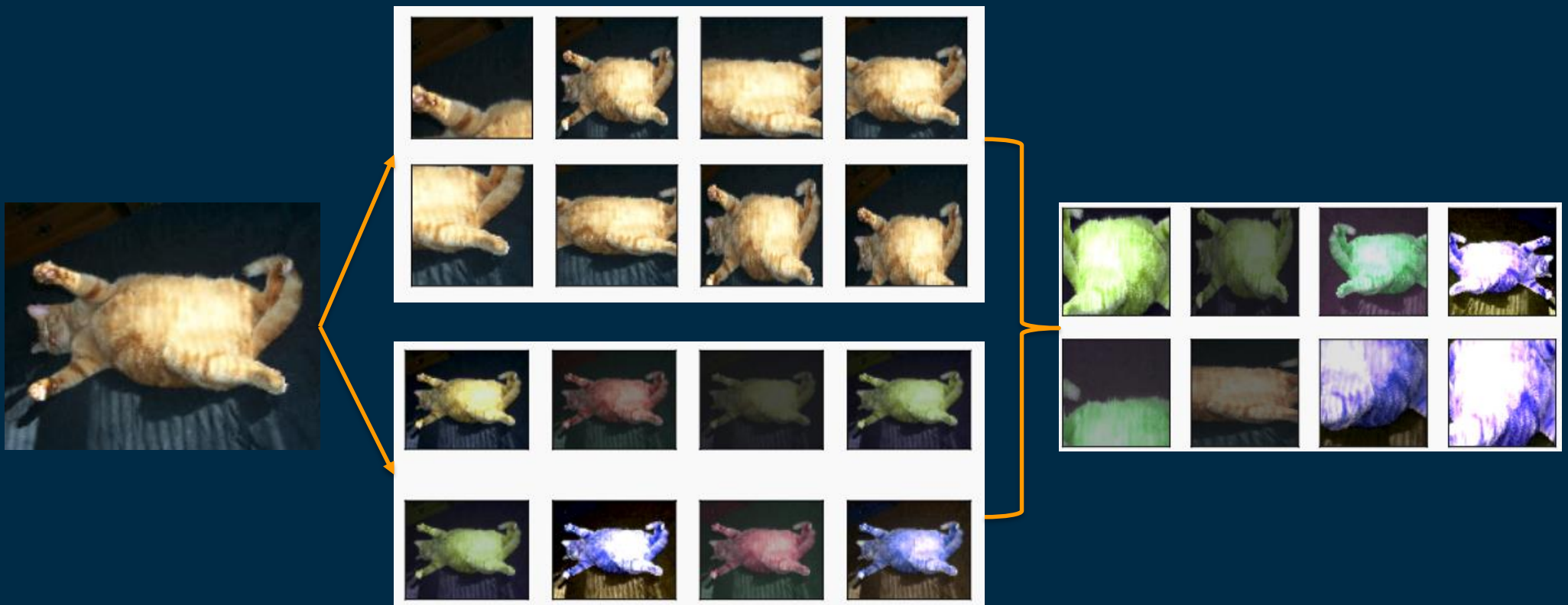
Classification with GluonCV

Training Essentials

- Data Preprocessing
- Network architecture definition
- Optimizer
- Loss
- Metric
- GPU Acceleration

Classification with GluonCV

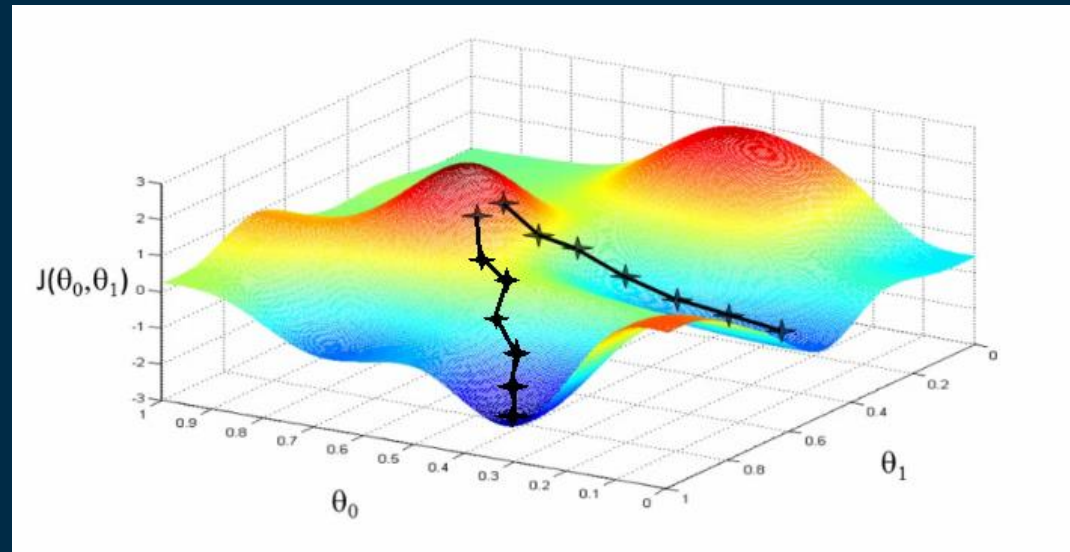
Data Preprocessing



Classification with GluonCV

Optimizers

- SGD
- Adam
- RMSProp
- ...



Classification with GluonCV

Advanced Tricks

- Label smoothing
- Learning rate schedule
- Mix-Up
- Knowledge Distillation

Classification with GluonCV

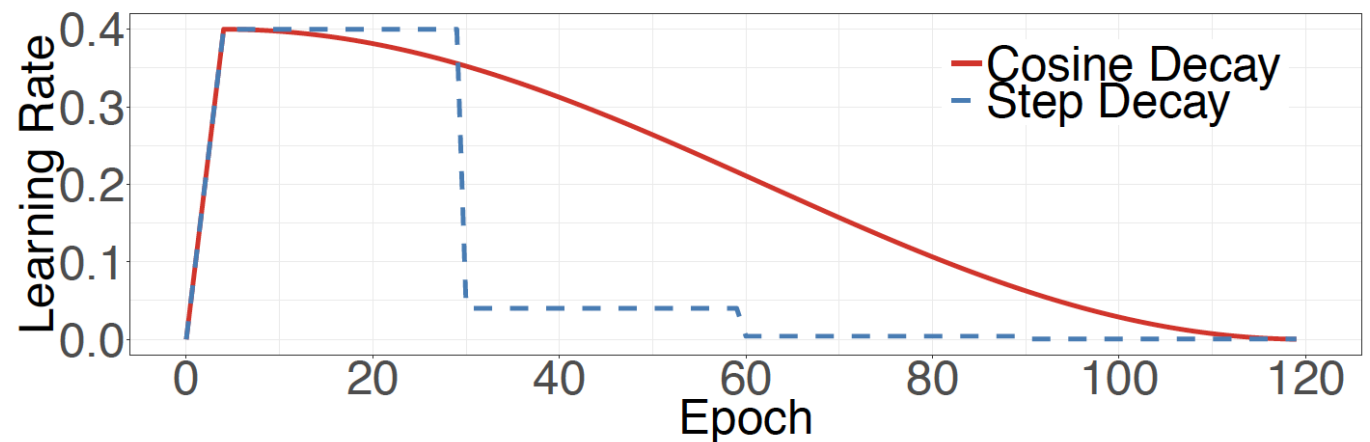
Label Smoothing

- One hot: (0, 1, 0, 0, 0)
- Smoothed: (0.01, 0.96, 0.01, 0.01, 0.01)
- Prevent overfitting!

Classification with GluonCV

Learning Rate Schedule

- Step
- Cosine
- Poly

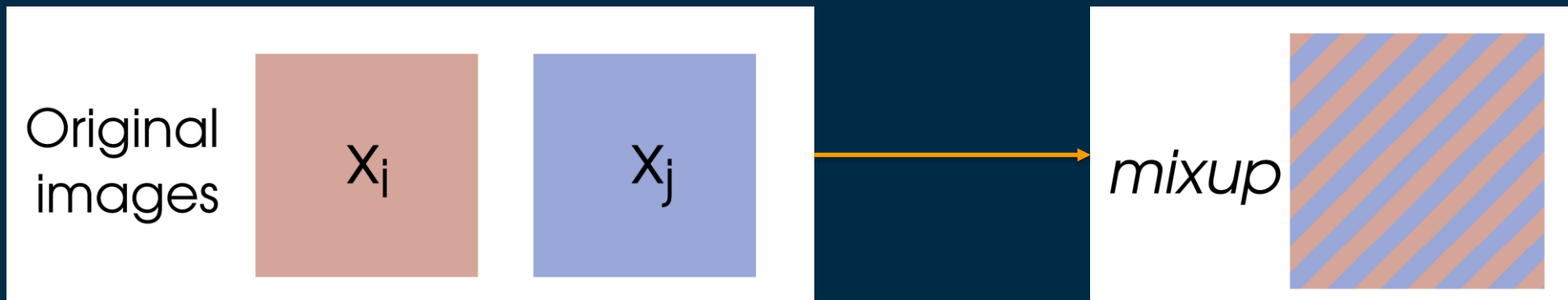


(a) Learning Rate Schedule

Classification with GluonCV

Mix-Up

- Linear mapping
- $f(ax_i + bx_j) = af(x_i) + bf(x_j)$



Classification with GluonCV

Knowledge Distillation

- Dark Knowledge
 - Dog vs Cat
 - Dog vs Car

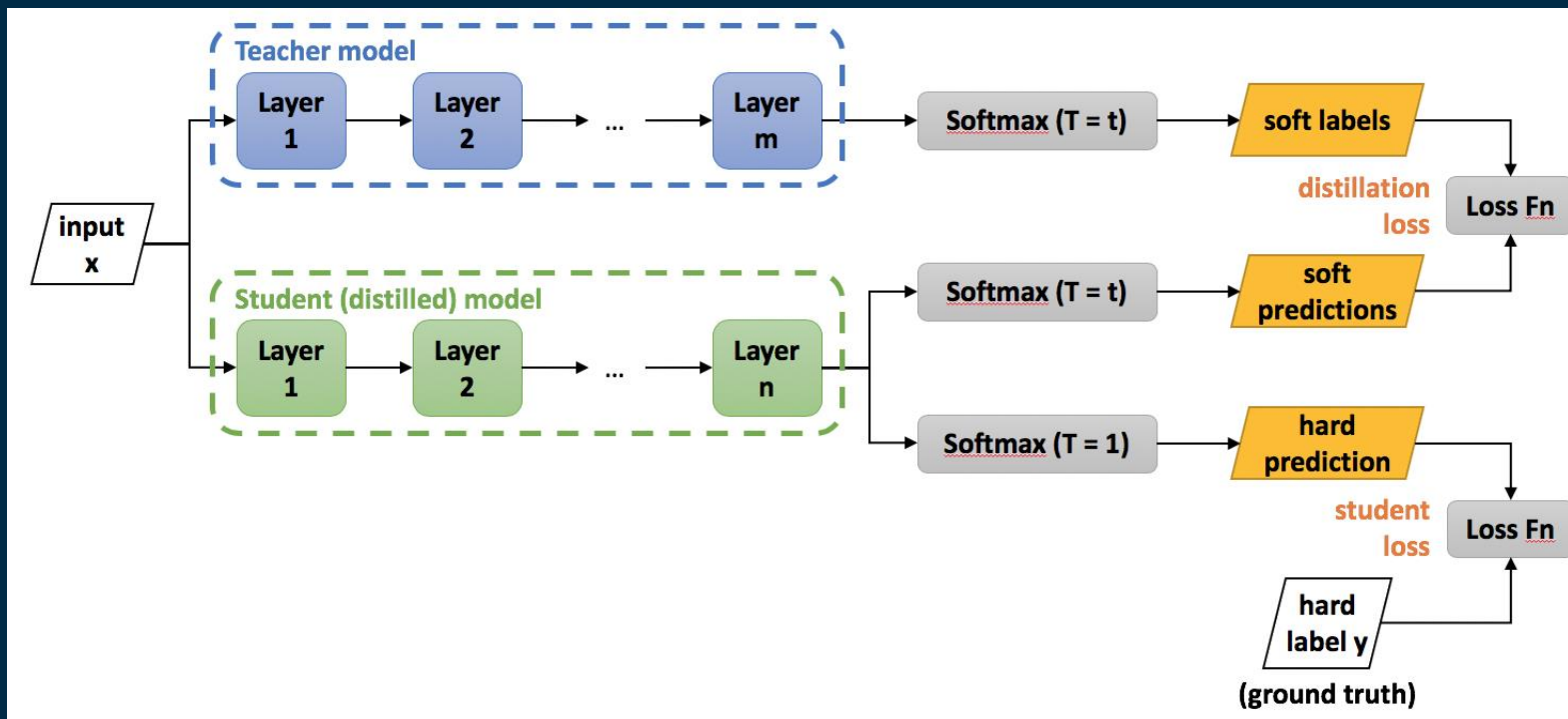
cow	dog	cat	car	original hard targets
0	1	0	0	

cow	dog	cat	car	output of geometric ensemble
10^{-6}	.9	.1	10^{-9}	

cow	dog	cat	car	softened output of ensemble
.05	.3	.2	.005	

Classification with GluonCV

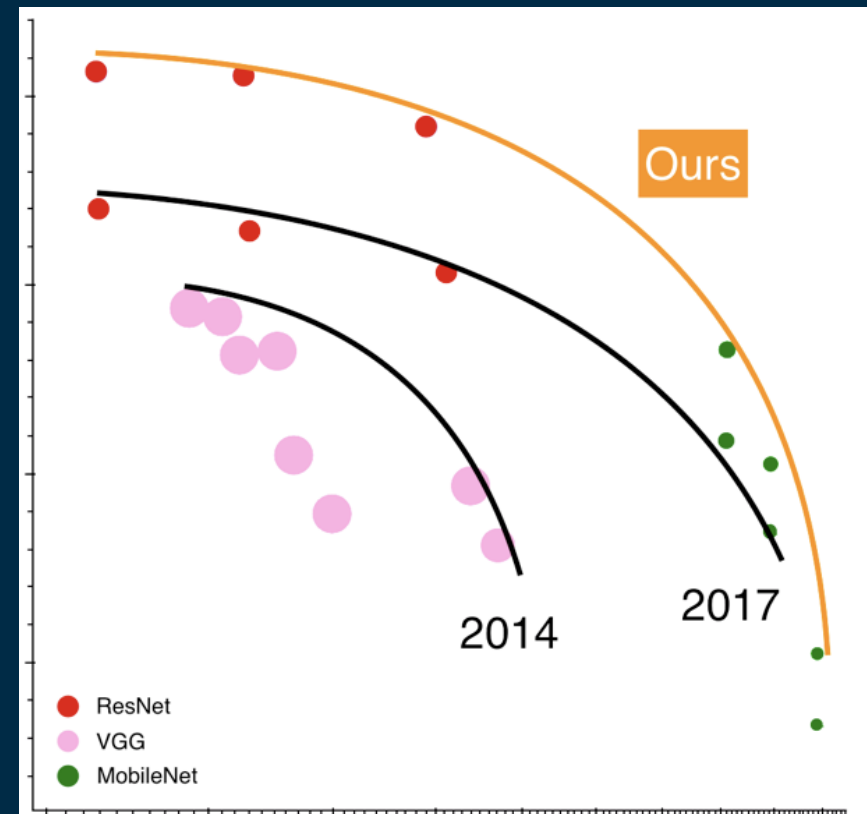
Knowledge Distillation



Classification with GluonCV

GluonCV Model Zoo

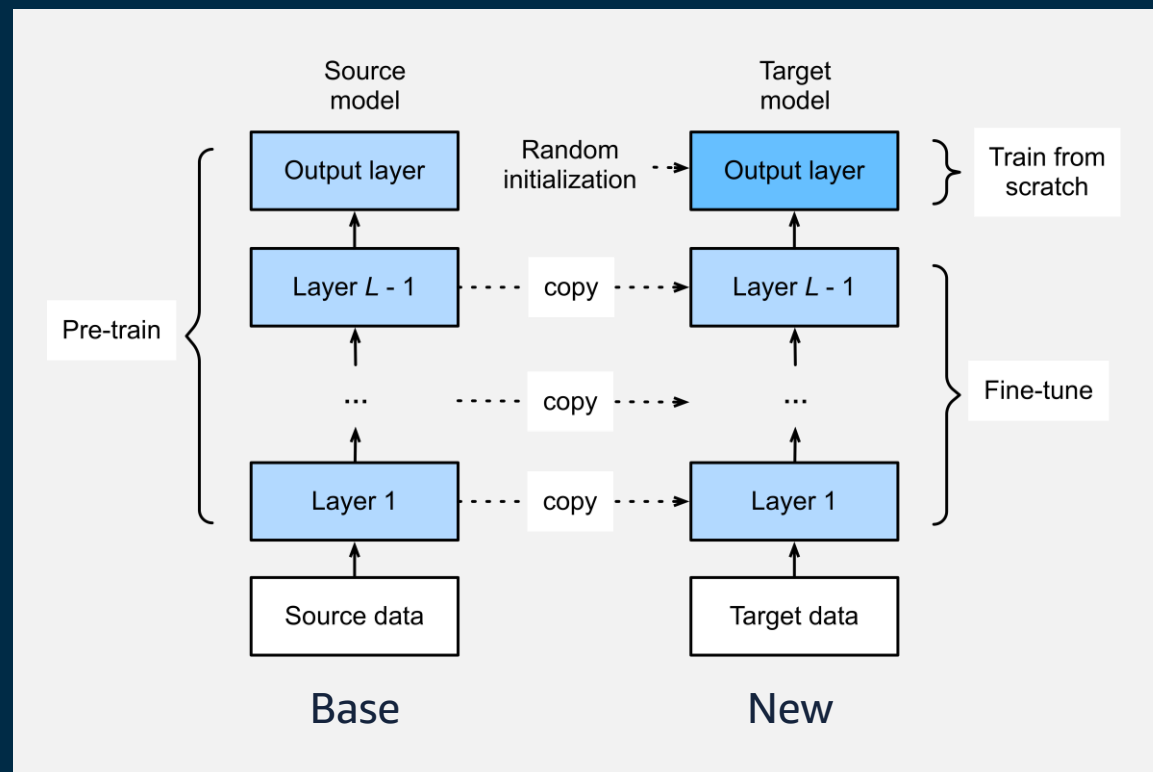
He, Tong, et al. "Bag of Tricks for Image Classification with Convolutional Neural Networks" arXiv preprint arXiv:1812.01187 (2018).



Classification with GluonCV

Transfer learning

- Based on a pre-trained model
- Re-define the output layer



Classification with GluonCV

Resources:

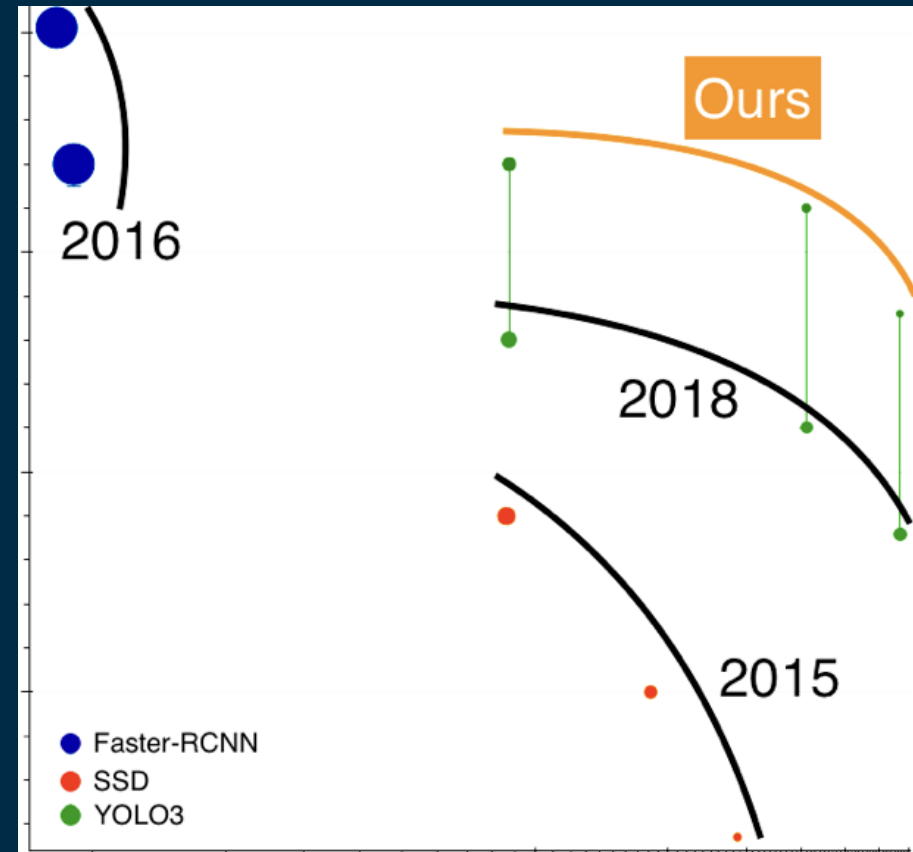
- Model Zoo: https://gluon-cv.mxnet.io/model_zoo/classification.html
- Tutorials: https://gluon-cv.mxnet.io/build/examples_classification/index.html
- Deep Learning Book: <http://diveintodeeplearning.org/>

Object Detection with GluonCV

Object Detection with GluonCV

Model Zoo

Paper under review, to
be released soon



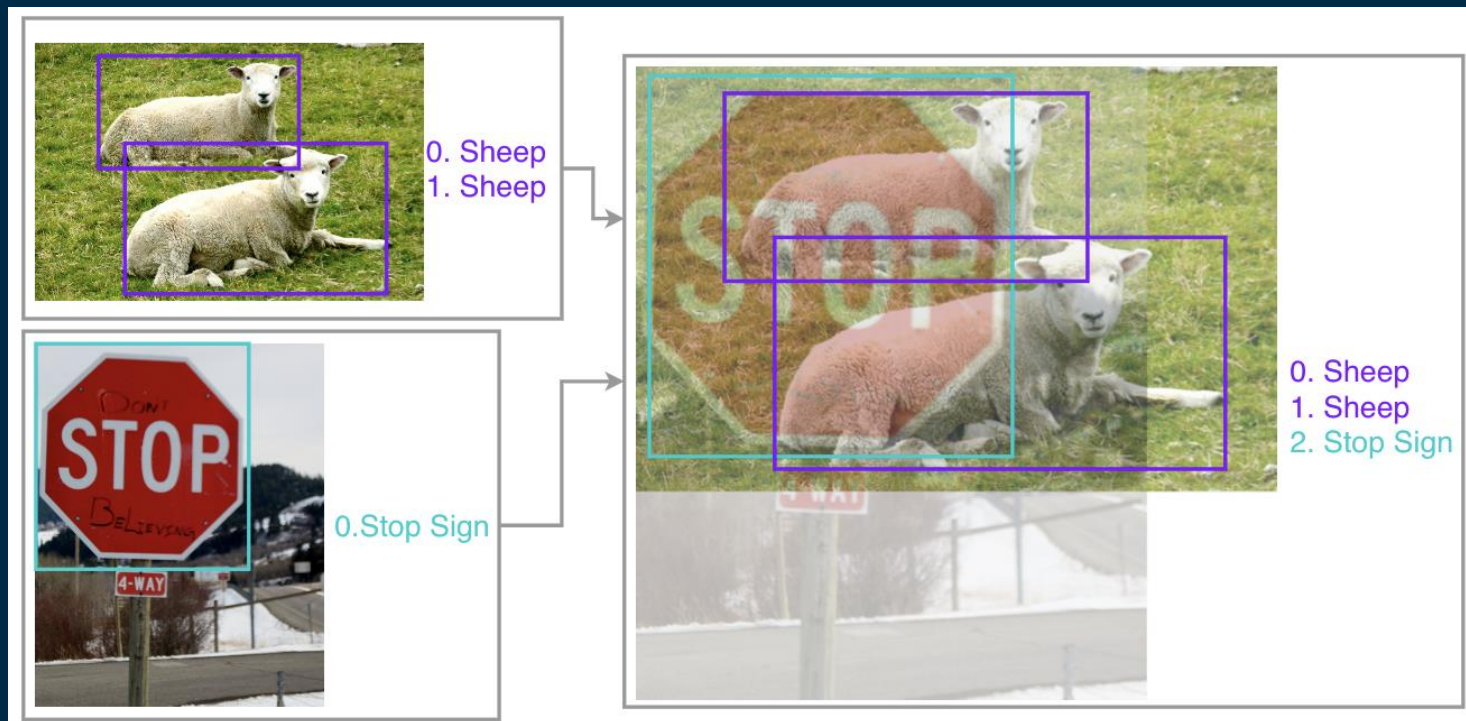
Object Detection with GluonCV

Advanced Training

- Learning rate schedule
- Mix-up
- Label smoothing

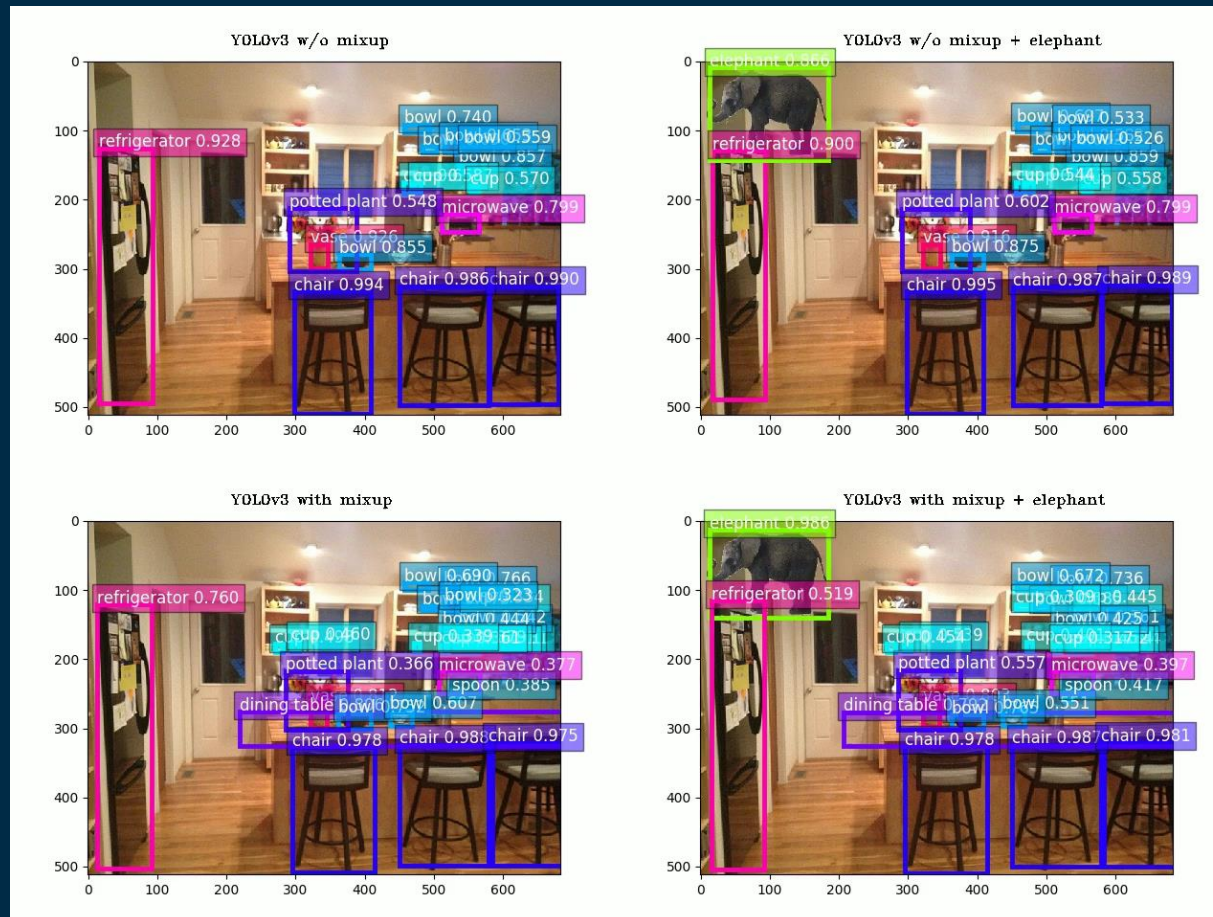
Object Detection with GluonCV

Mix-Up



Object Detection with GluonCV

Elephant-in-the-Room



Object Detection with GluonCV

Resources:

- Model Zoo: https://gluon-cv.mxnet.io/model_zoo/detection.html
- Tutorials: https://gluon-cv.mxnet.io/build/examples_detection/index.html
- Deep Learning Book: <http://en.diveintodeeplearning.org/>

Object Detection with GluonCV

Hands On!

Segmentation with GluonCV

Segmentation with GluonCV

Our Office in E Palo Alto, California



Segmentation with GluonCV

Model Zoo

<u>DeepLab-v3</u>	mIoU on VOC	86.7%	85.7% (<u>paper</u>)
<u>Mask-RCNN</u>	mask AP on COCO	33.1%	32.8% (<u>Detectron</u>)

Segmentation with GluonCV

Advanced Training

- Learning Rate Schedule
- Multi-Transfer Learning
 - MS COCO -> Pascal VOC Augmented -> Pascal VOC

Segmentation with GluonCV

Multi-Transfer Learning

- DeepLab V3
 - MS COCO -> Pascal VOC Augmented -> Pascal VOC

Segmentation with GluonCV

Resources:

- Model Zoo: https://gluon-cv.mxnet.io/model_zoo/segmentation.html
- Tutorials: https://gluon-cv.mxnet.io/build/examples_segmentation/index.html
- Deep Learning Book: <http://en.diveintodeeplearning.org/>

Segmentation with GluonCV

Hands On!

Data Collection

Data Collection

- Format
- Label
- Directory Structure

Data Collection

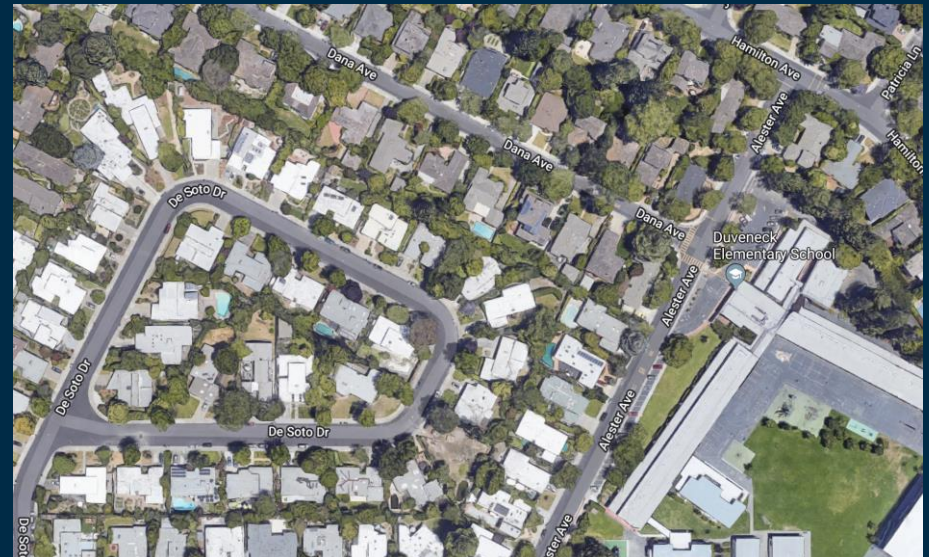
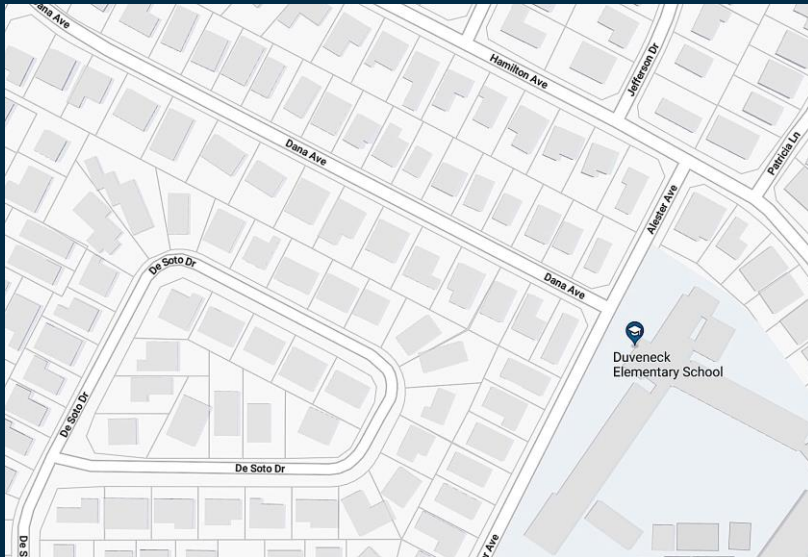
- Format: Task Specific
 - Classification: the label
 - Detection: the boxes, and labels
 - Segmentation: the masks, and labels

Data Collection

- Labeling
 - Manual
 - Accurate, Expensive
 - Automatic
 - Somewhat accurate, cheap
 - [SageMaker Ground Truth](#)

Data Collection

- Labeling



Data Collection

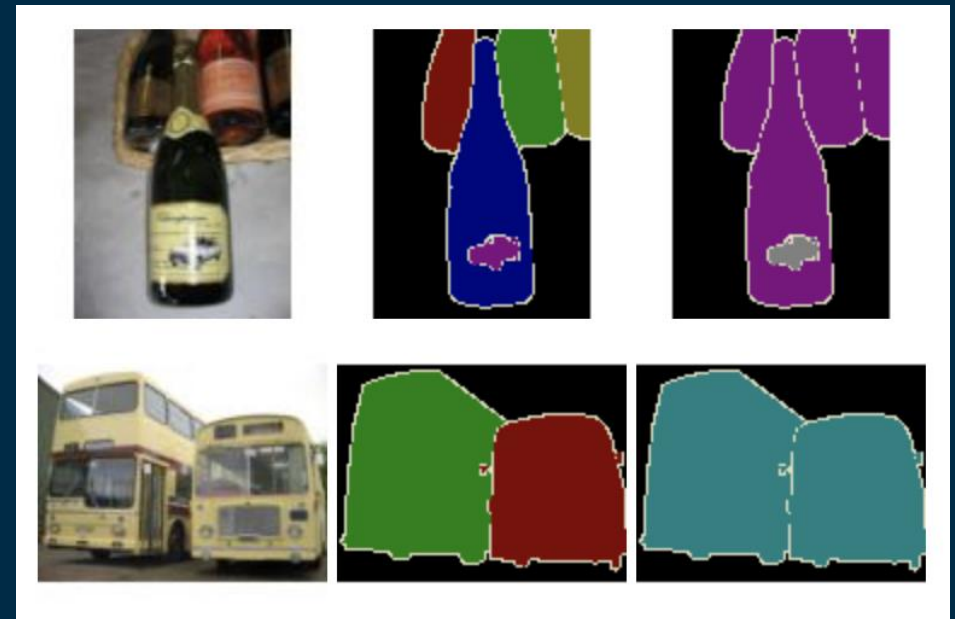
- Classification Directory Structure
 - ImageNet-Train/
 - Cat/
 - 001.jpg
 - 002.jpg
 - ...
 - Dog/
 - ...

Data Collection

- Detection Directory Structure
 - Pascal VOC/
 - Images
 - 001.jpg
 - 002.jpg
 - ...
 - Annotation
 - 001.xml
 - ...

Data Collection

- Segmentation Directory Structure
 - Pascal VOC/
 - Images
 - 001.jpg
 - Object Segmentation
 - 001.jpg
 - Class Segmentation
 - 001.jpg



Data Loading with GluonCV

Data Loading with GluonCV

- GluonCV Interface
 - DataSet
 - Input: images, labels
 - Output: Arrays of images and labels in memory
 - Transformation
 - Data augmentation
 - DataLoader
 - Scheduling
 - Multi-threading

Data Loading with GluonCV

- DataSet
 - Task/Structure Dependent
 - Preset functions for certain structures
 - Very flexible
 - Class `VisionDataset()`
 - Users can override the class

Data Loading with GluonCV

- Transformation
 - Augmentation
 - Abundant choices
 - Flexible interface
 - Stack in sequence

```
transform_train = transforms.Compose([
    transforms.RandomResizedCrop(input_size),
    transforms.RandomFlipLeftRight(),
    transforms.RandomColorJitter(brightness=jitter_param, contrast=jitter_param,
                                saturation=jitter_param),
    transforms.RandomLighting(lightning_param),
    transforms.ToTensor(),
    normalize
])
```

Data Loading with GluonCV

- DataLoader
 - Load Schedule
 - Pool of threads
 - Pre-fetch
 - Training/Testing specific
 - Data Shuffling
 - Batch size

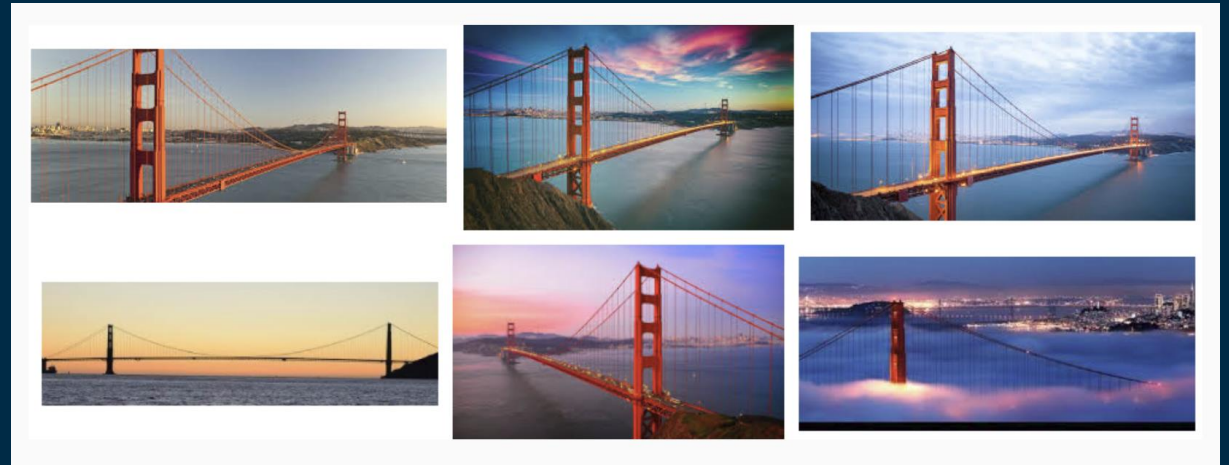
Data Loading with GluonCV

- GluonCV Interface
 - Pipeline
 - File -> Dataset -> Transformation -> DataLoader

Data Transformation with GluonCV

Data Transformation with GluonCV

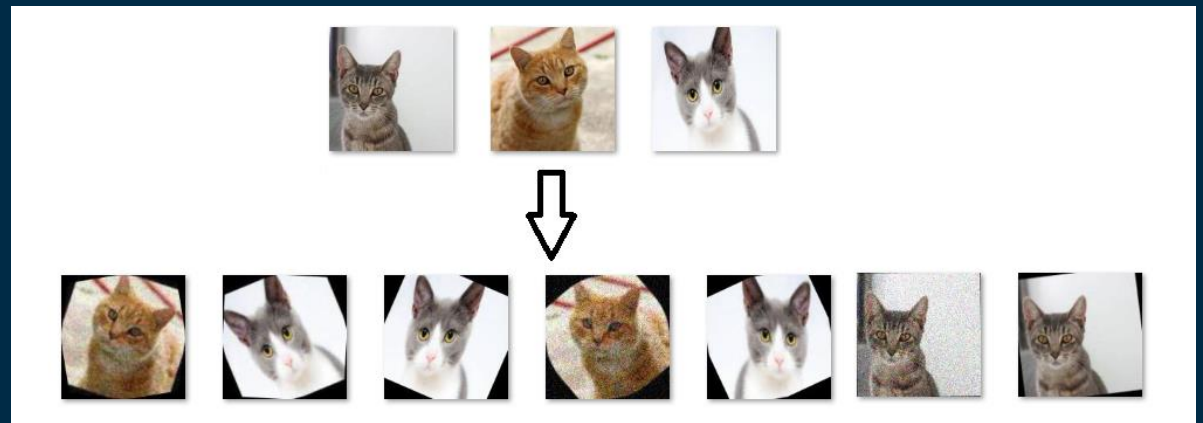
- Why Transformation?
 - Resize to fit model
 - Prevent overfitting
 - Enrich the dataset



Data Transformation with GluonCV

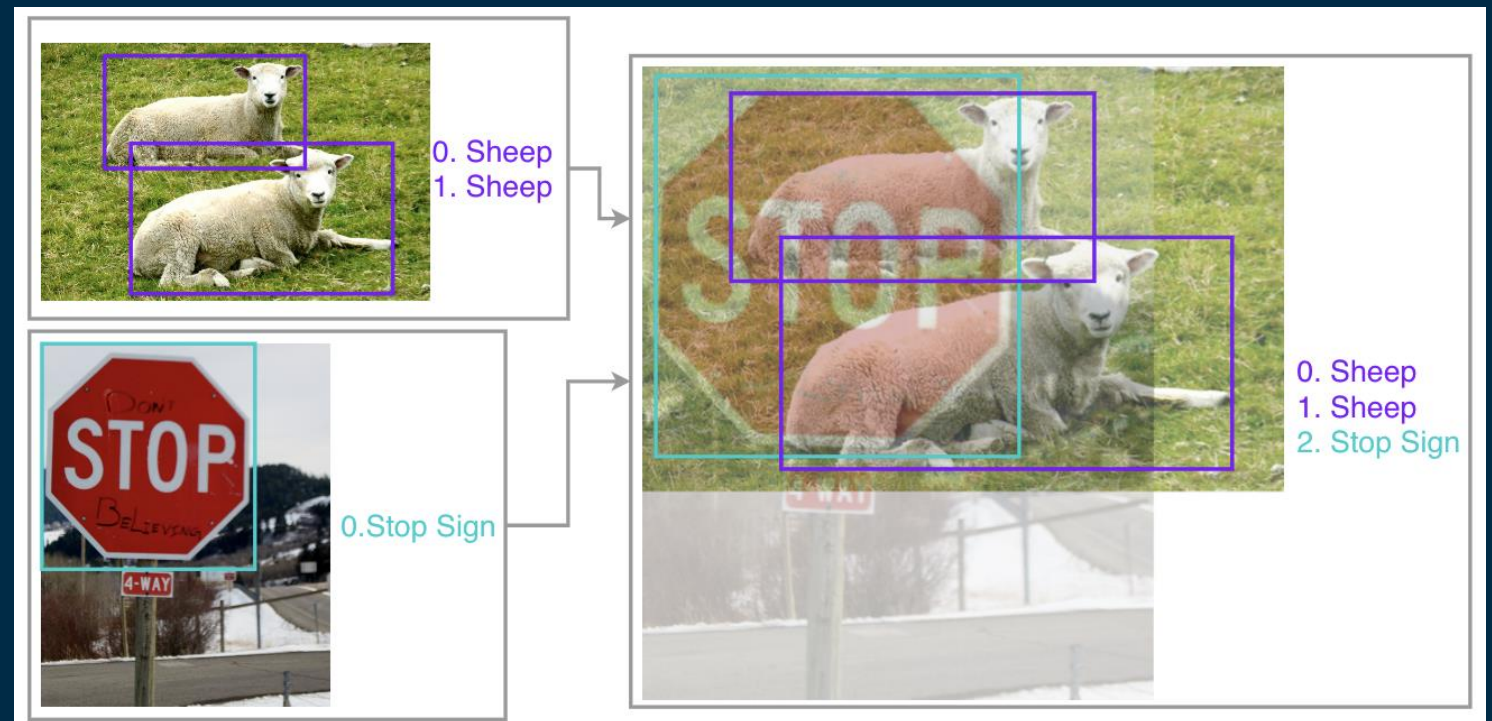
- Popular Transformation

- Resize
- Crop
- Flip
- Rotation
- Adding Noise
- Normalization



Data Transformation with GluonCV

- Advanced Transformation
 - Mix-Up



Data Transformation with GluonCV

- Transformation for Inference
 - Crop
 - Normalization
 - No Randomization

Fast IO in GluonCV

Fast IO in GluonCV

- Hardware
 - RAM Disk > SSD >> HDD
 - ImageNet dataset: 140GB
 - RAM of p3.16xlarge: 768GB

Fast IO in GluonCV

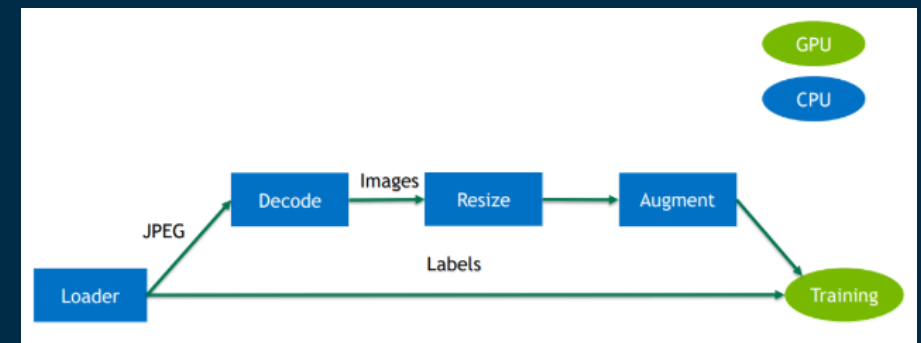
- Image Format: Raw Image
 - Support any kind of tasks
 - Read through DataLoader
 - Slow
 - Need to unzip on each new machine

Fast IO in GluonCV

- Image Format: RecordIO
 - Support classification and detection
 - Read through DataLoader or ImageRecordIter
 - Fast
 - One-time packing

Fast IO in GluonCV

- Interface: ImageRecordIter
 - One function call for
 - DataSet
 - Transform
 - DataLoader
 - Less flexible
 - Very Fast



DEV DAY

Thank you!



여러분의 피드백을 기다립니다!



강연 평가 및 설문 조사

QR 코드를 통해 AWS DEV DAY SEOUL에 대한 여러분의 의견을 공유해주세요.
강연 평가 및 설문 조사에 참여해 주신 분께는 등록데스크에서 특별한 기념품을 드립니다.



강연 영상

AWS DEV DAY SEOUL 강연 영상은 행사 종료 후 메일로 공유드릴 예정입니다.



#AWSDEVDAYSEOUL

소셜미디어에 행사 참여 소감을 공유해주세요!

