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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

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GluonCV: A Vision Toolkit

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

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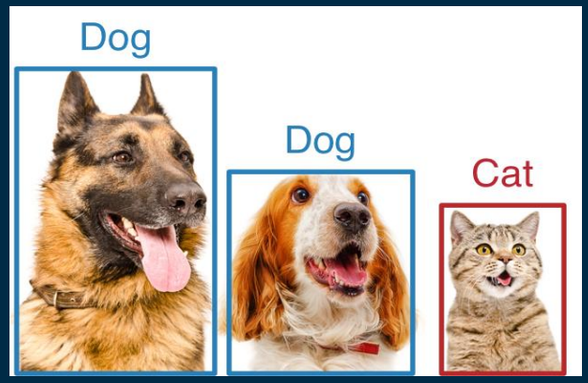
The Best Open-Source Choice

- 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%

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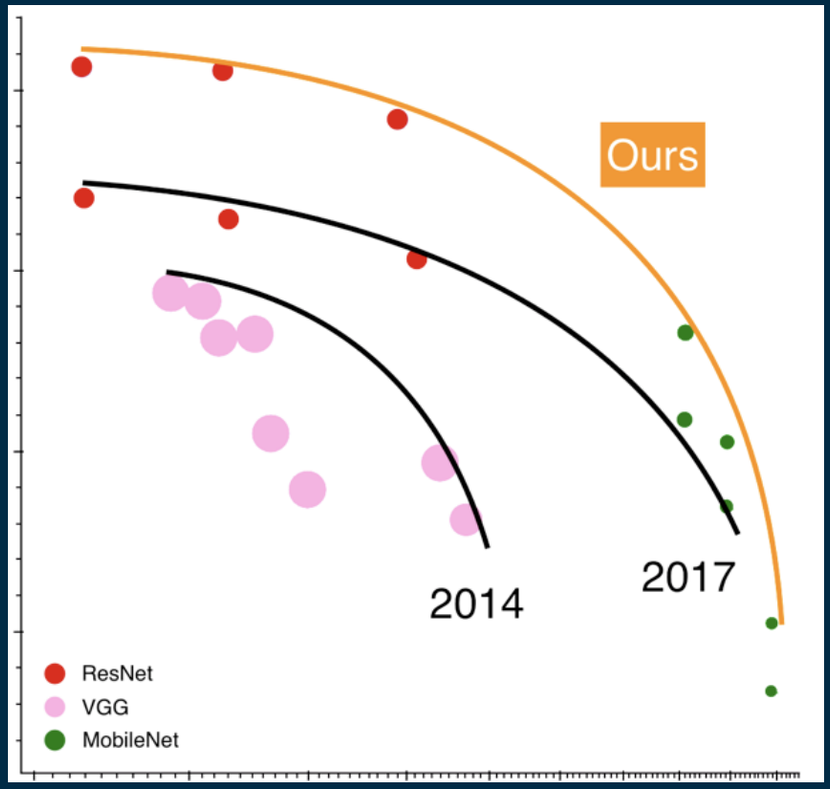
Models

- Classification



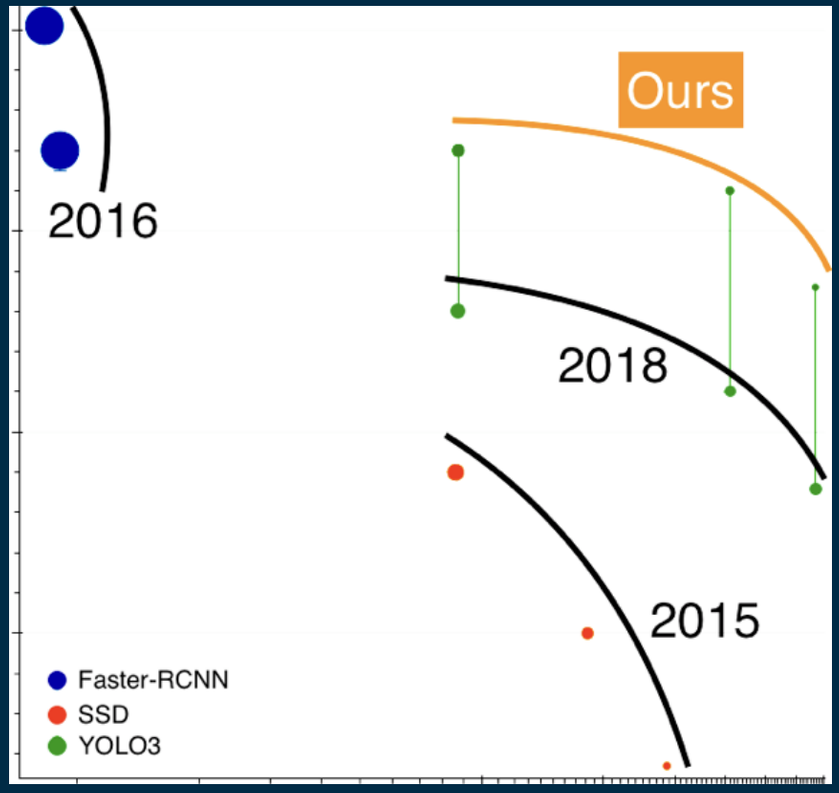
Models

- Detection

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

Models

- Detection



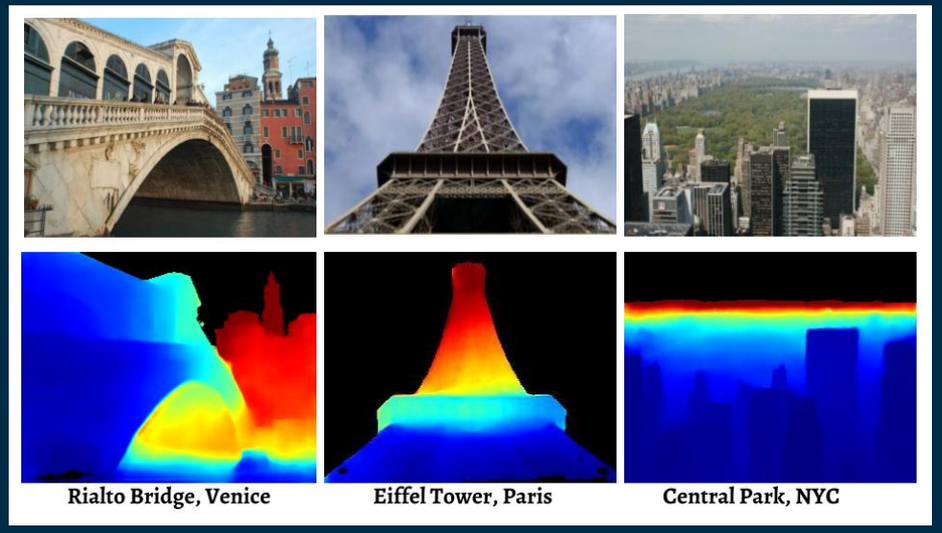
Models

- Segmentation

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

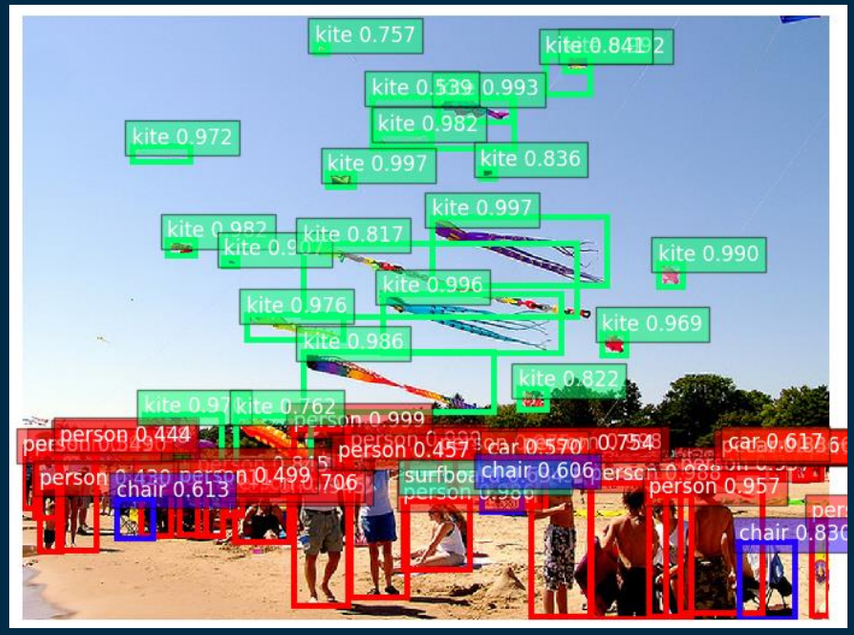
Models

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



Demo

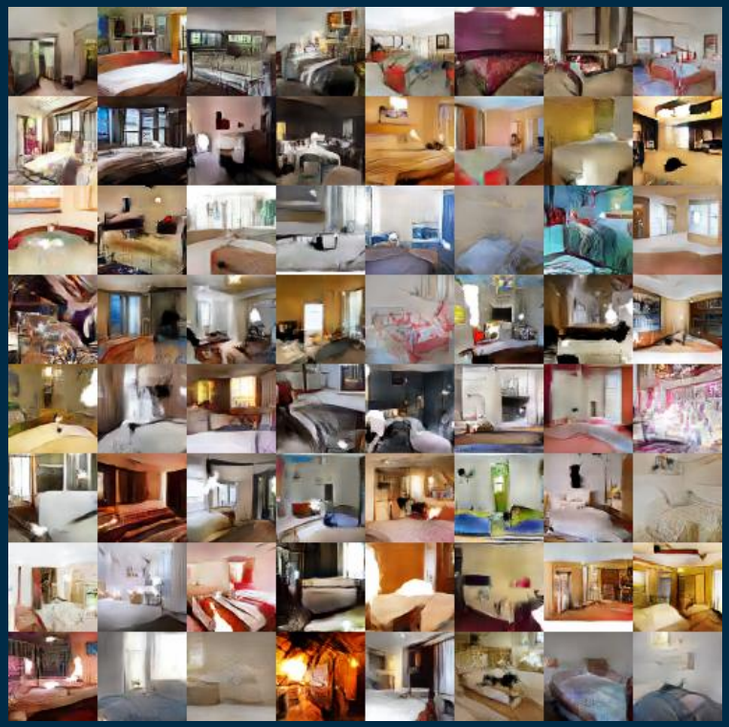
- Detection



- 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

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Classification with GluonCV

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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

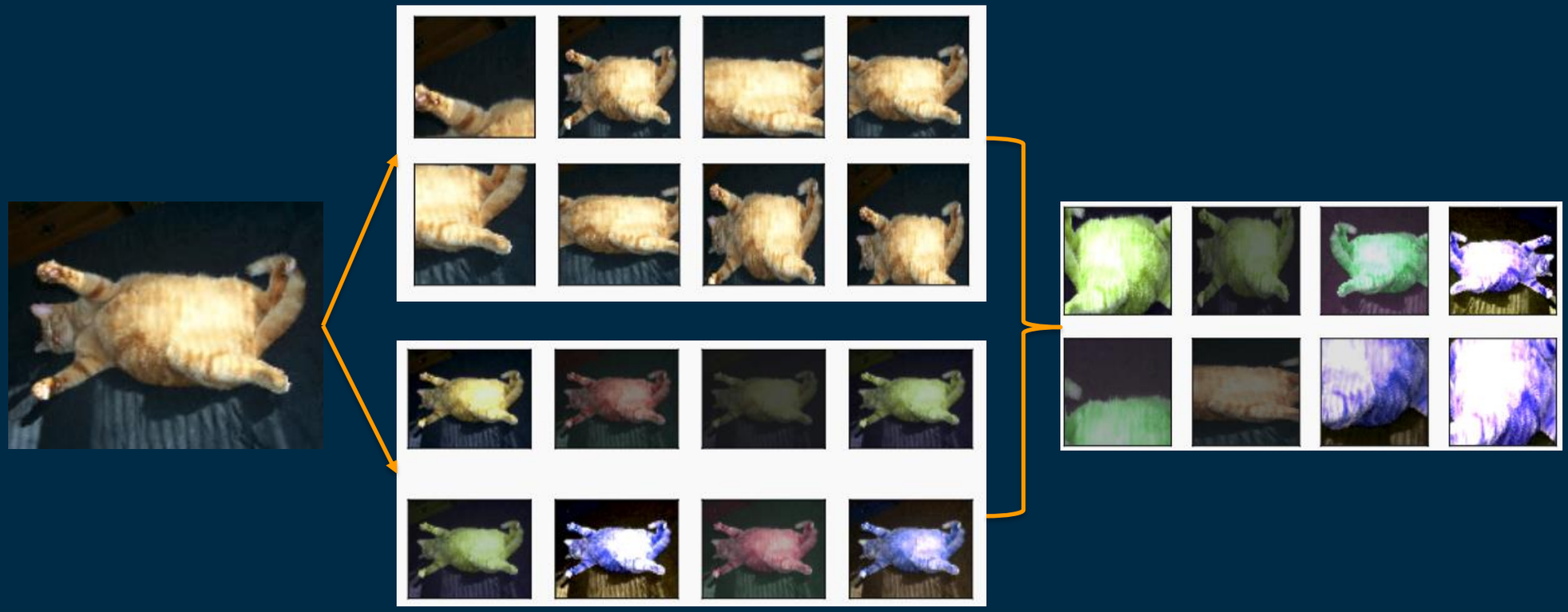
Classification with GluonCV

Training Essentials

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

Classification with GluonCV

Data Preprocessing



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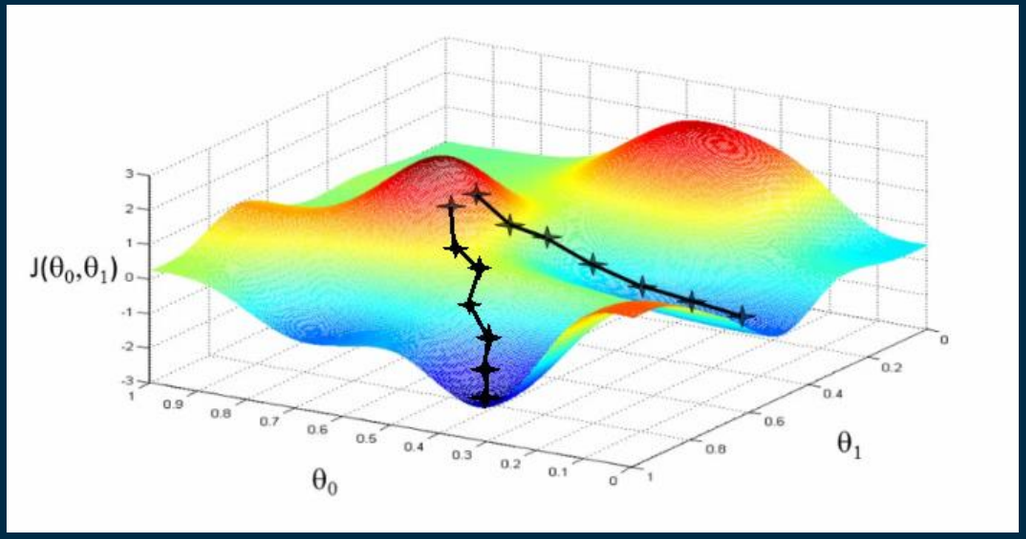
Classification with GluonCV

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!

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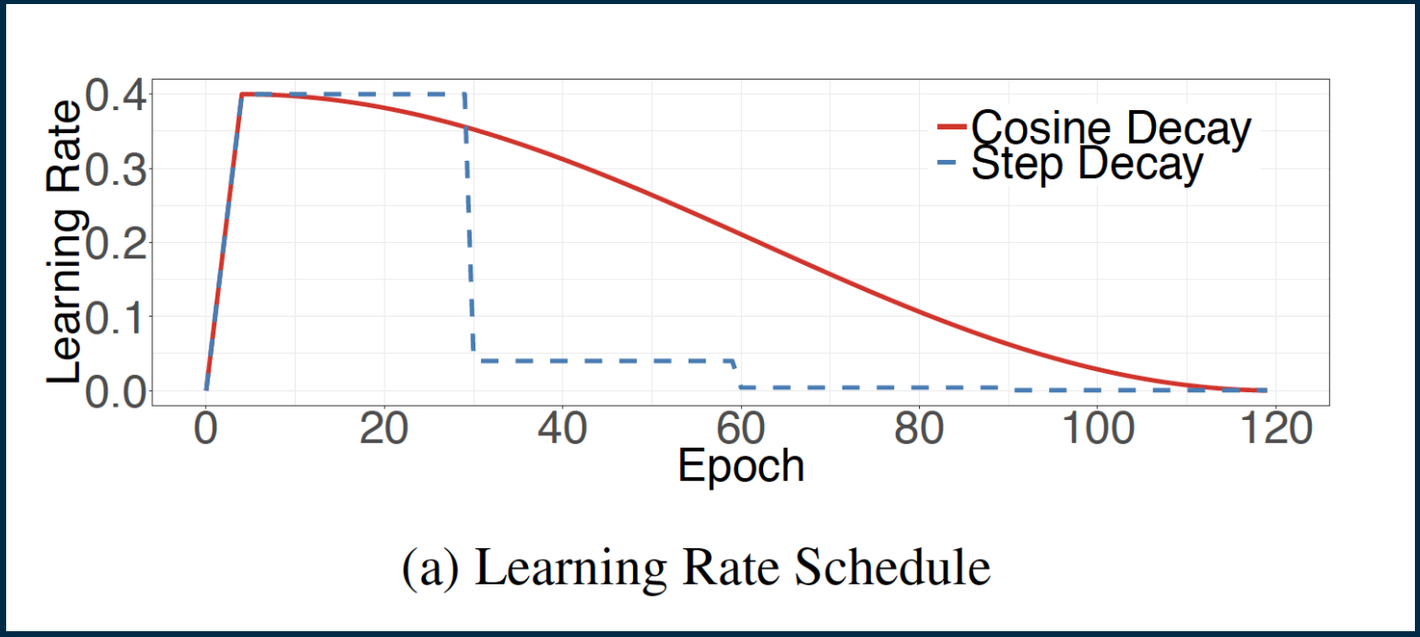
Classification with GluonCV

Learning Rate Schedule

- Step
- Cosine
- Poly



(a) Learning Rate Schedule

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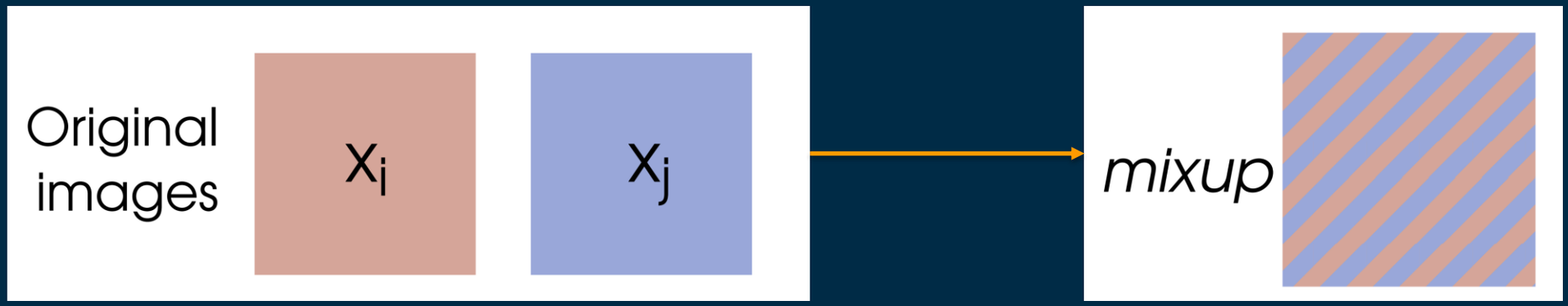
Classification with GluonCV

Mix-Up

- Linear mapping
- $f(ax\_i+bx\_j)=af(x\_i)+bf(x\_j)$



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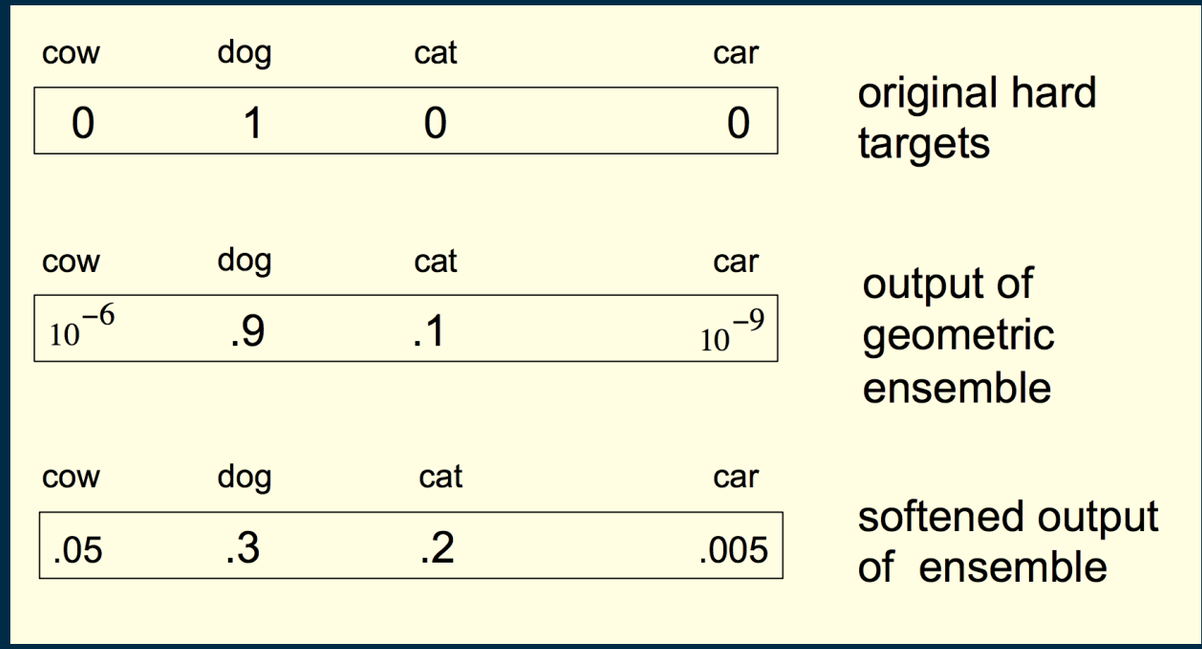
Classification with GluonCV

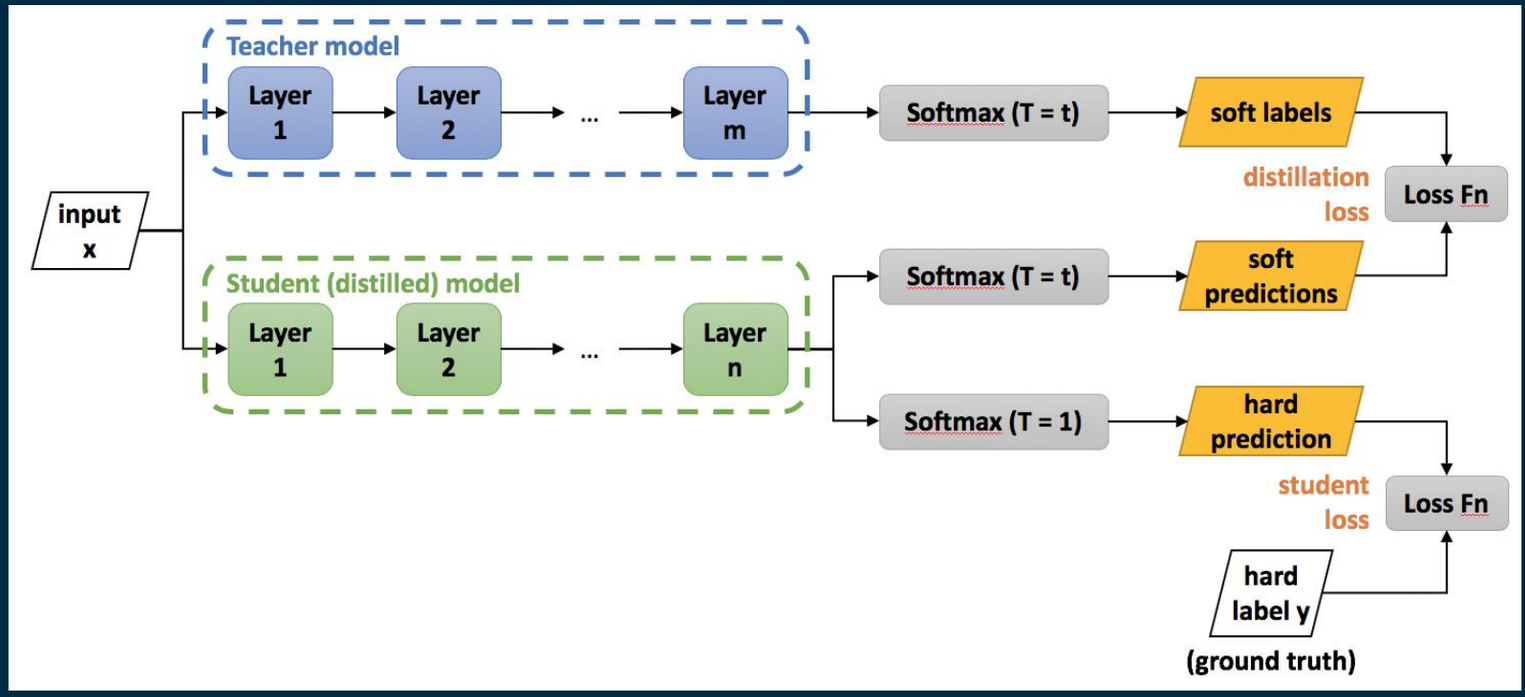
Knowledge Distillation

- Dark Knowledge
  - Dog vs Cat
  - Dog vs Car



Classification with GluonCV

Knowledge Distillation



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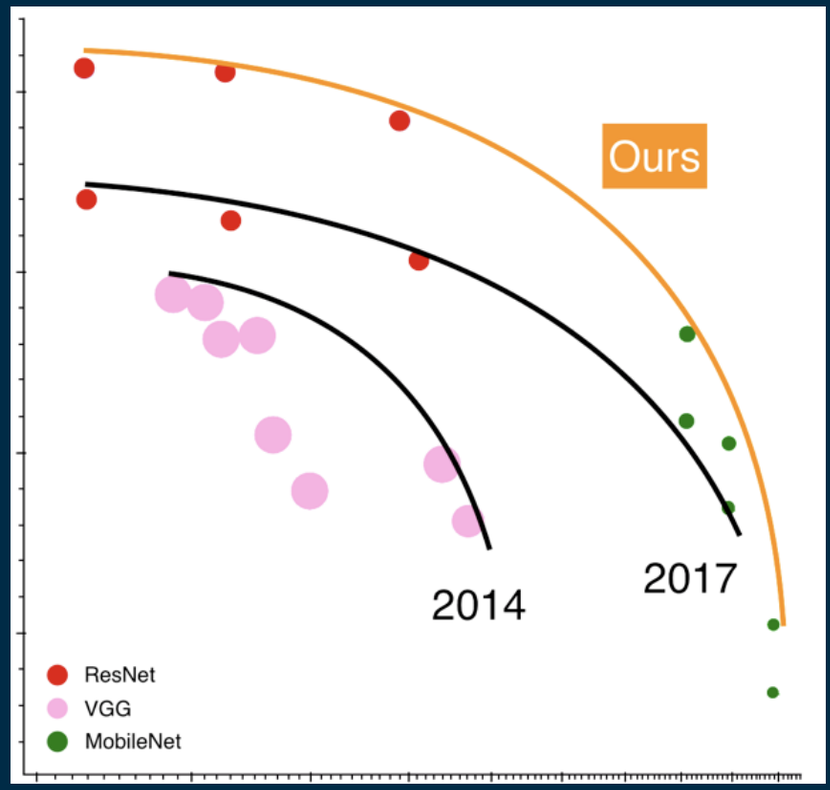
Classification with GluonCV

GluonCV Model Zoo

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



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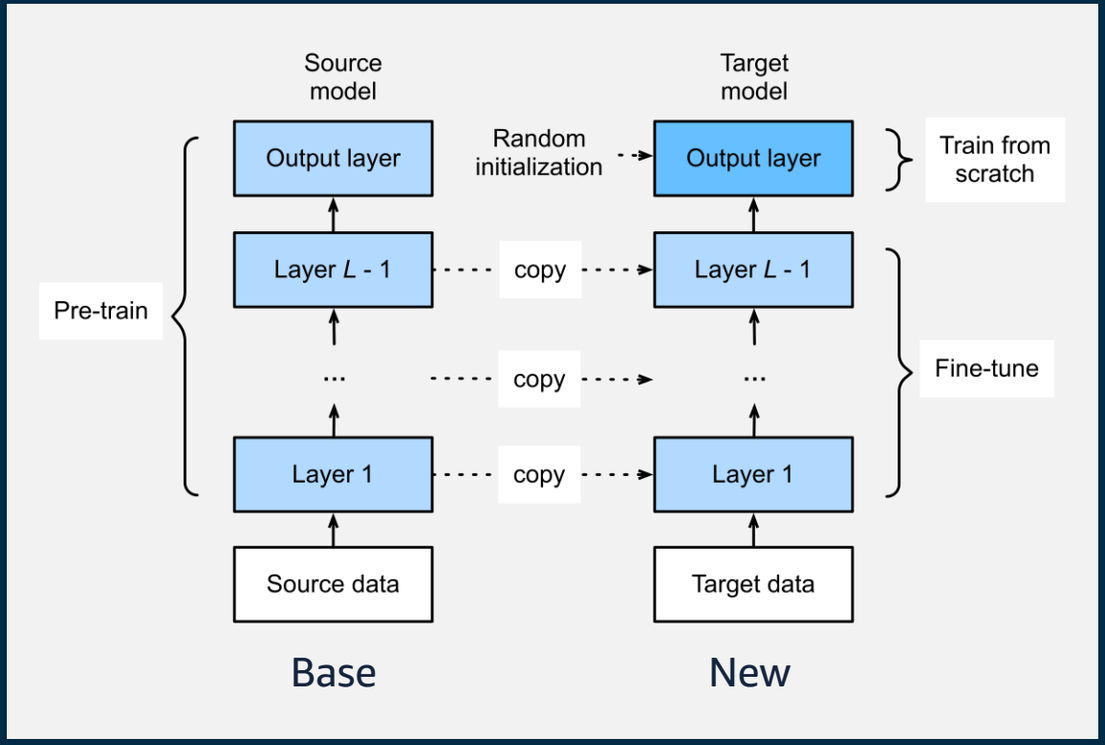
Classification with GluonCV

Transfer learning

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



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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/

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Object Detection with GluonCV

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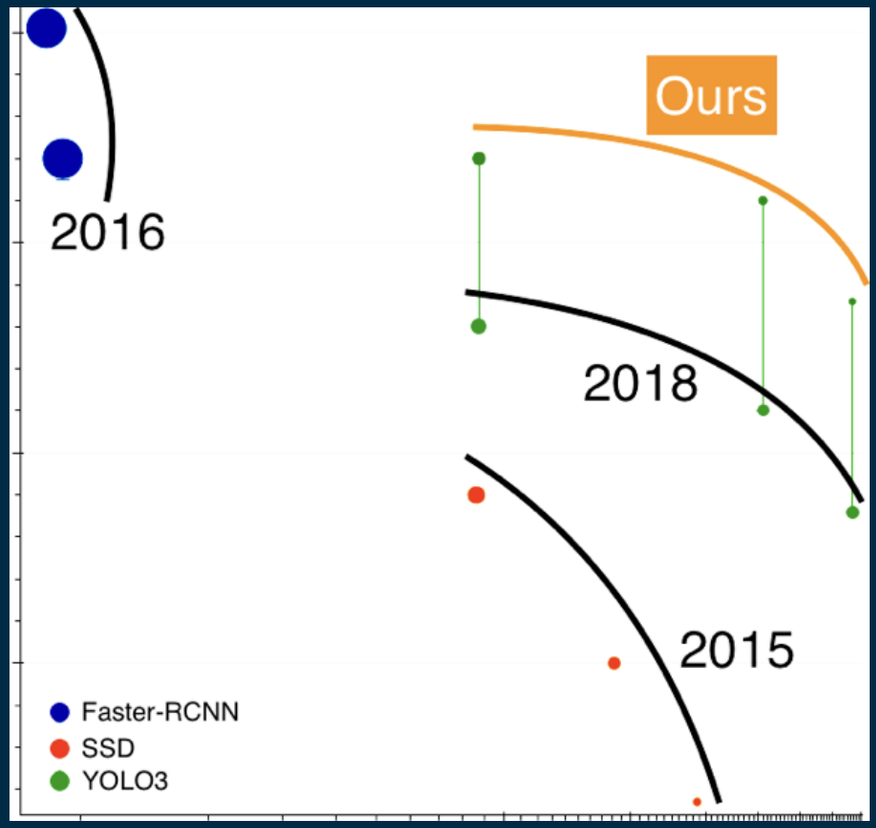
Object Detection with GluonCV

Model Zoo

Paper under review, to be released soon



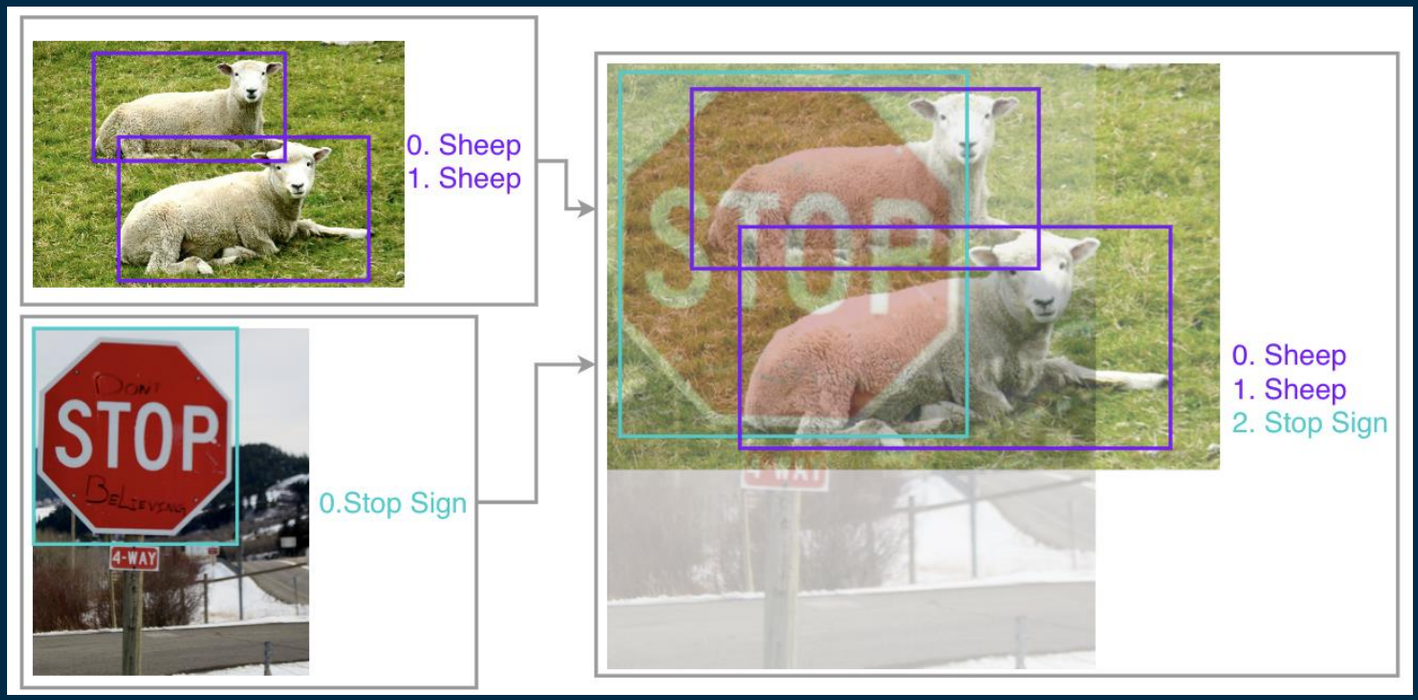
Object Detection with GluonCV

Advanced Training

- Learning rate schedule
- Mix-up
- Label smoothing

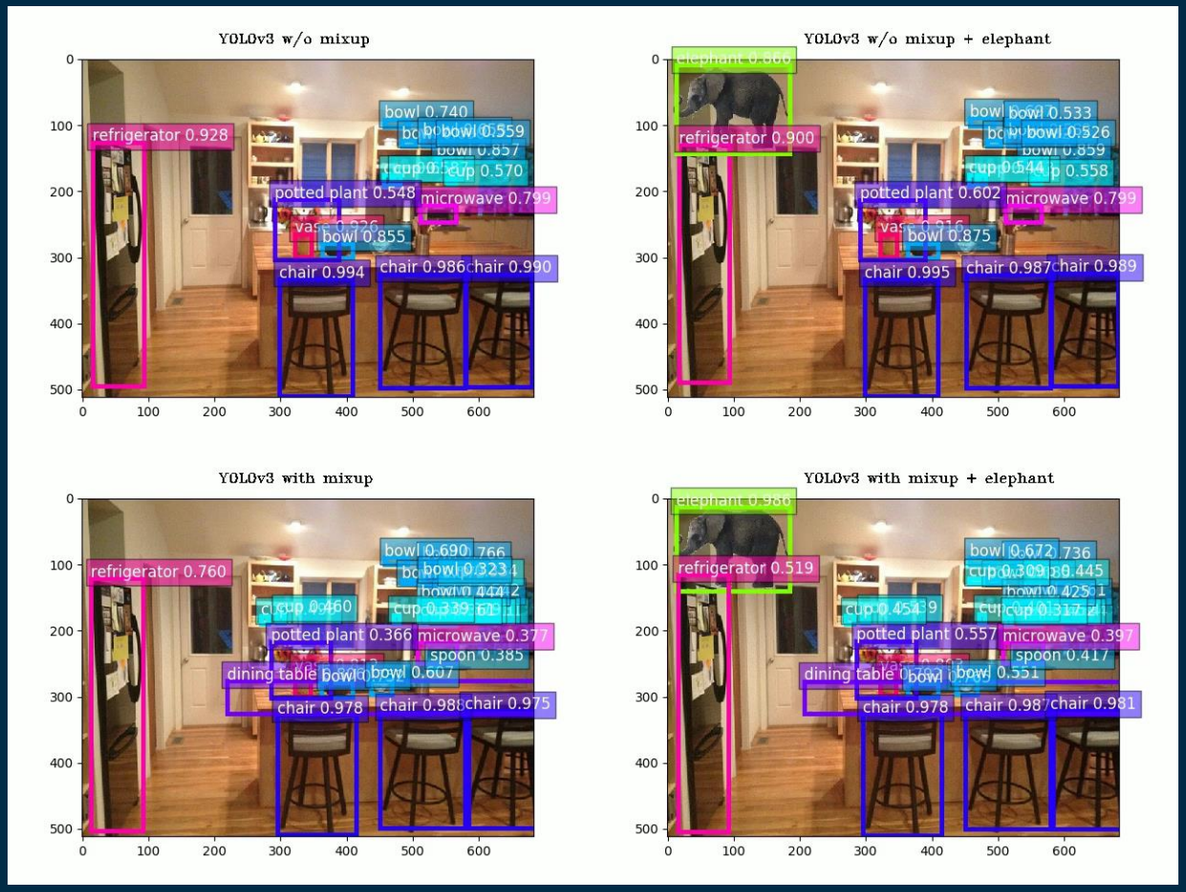
Object Detection with GluonCV

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!

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Segmentation with GluonCV

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Segmentation with GluonCV

Our Office in E Palo Alto, California

Segmentation with GluonCV

Model Zoo

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

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!

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Data Collection

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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

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Data Loading with GluonCV

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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(lighting_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

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Data Transformation with GluonCV

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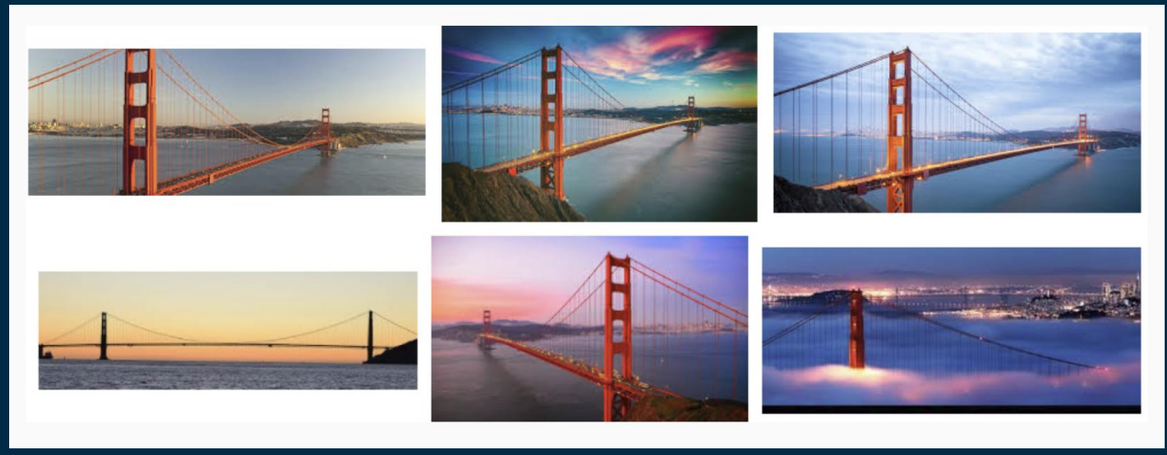
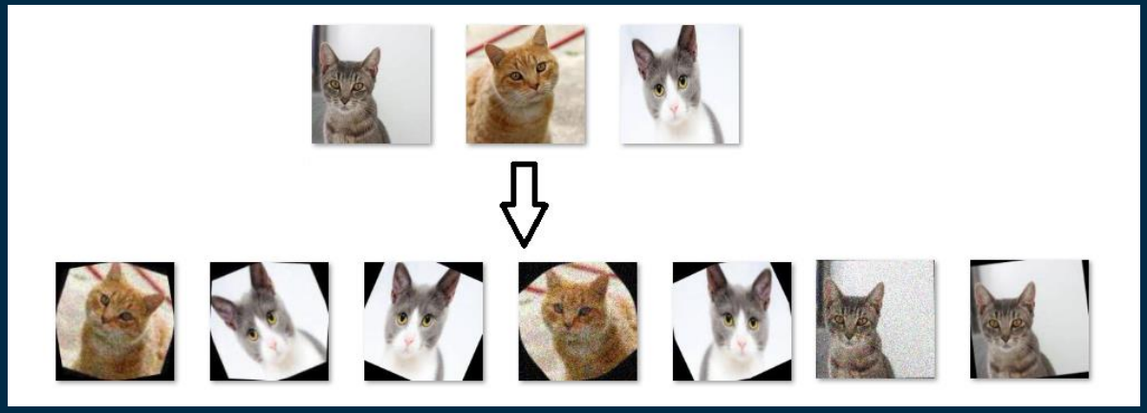
Data Transformation with GluonCV

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



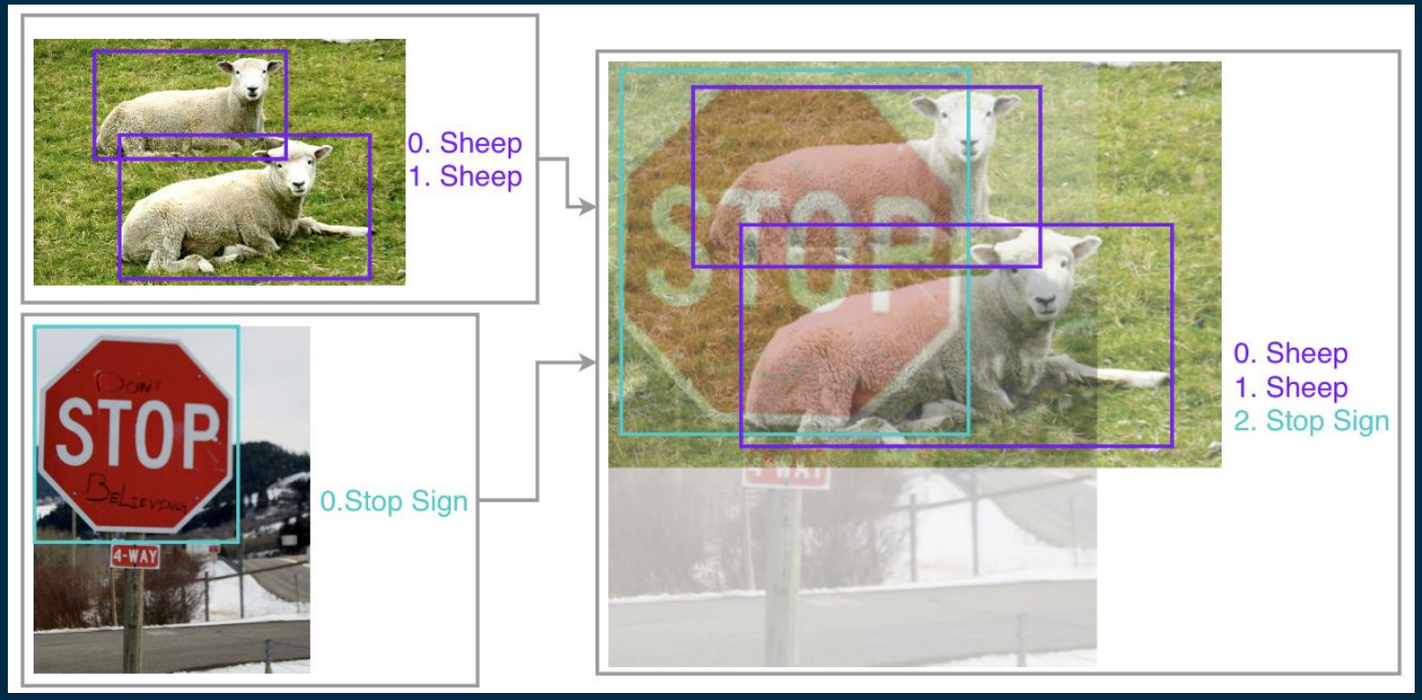
Data Transformation with GluonCV

- 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

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Fast IO in GluonCV

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Fast IO in GluonCV

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

Fast IO in GluonCV

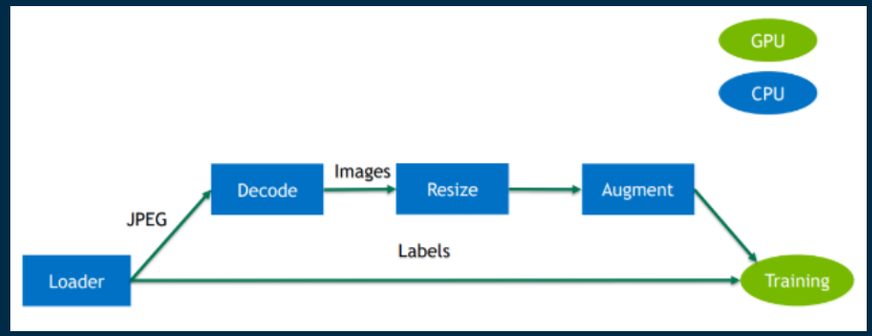
- Image Format: Raw Image
    - Support any kind of tasks
    - Read through DataLoader
    - Slow
    - Need to unzip on each new machine

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



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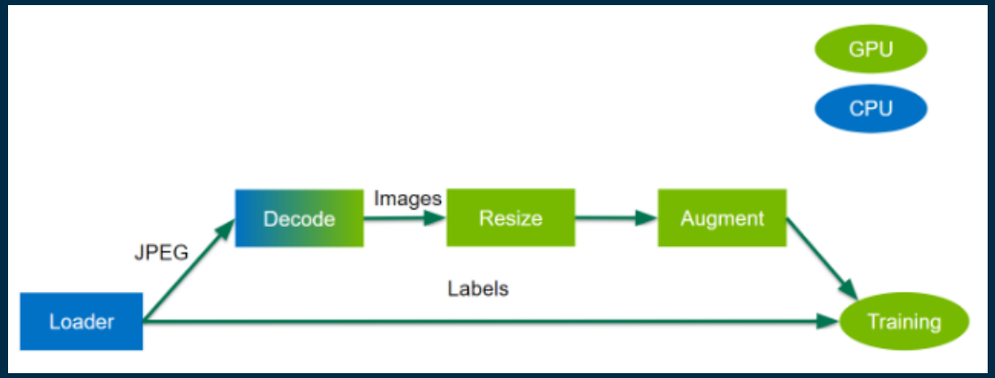
Fast IO in GluonCV

- Interface: Nvidia DALI (with nvJPEG)
  - Combination of
    - DataSet
    - Transform
    - DataLoader
  - Flexible
  - Extremely Fast
  - In-Development



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Thank you!

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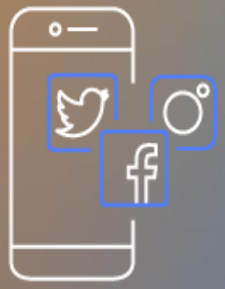
여러분의 피드백을 기다립니다!

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!

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