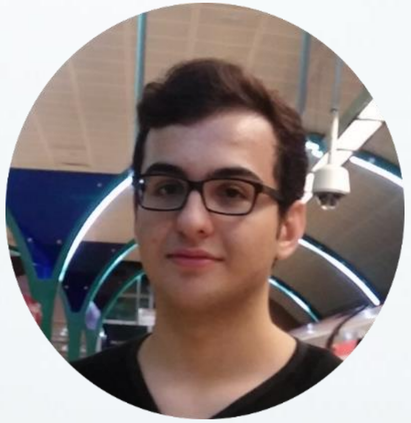
V-INTELLIGENCE

VESTEL



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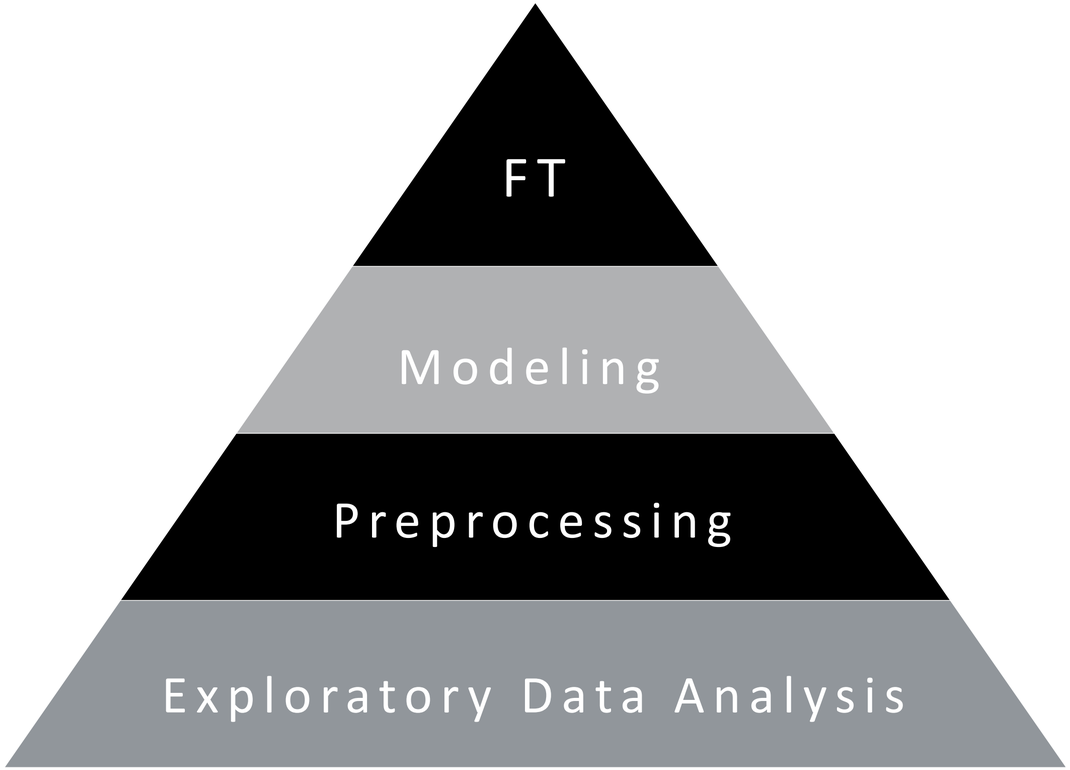
3.Sınıf

Procedure



Exploratory Data Analysis

Imbalanced Dataset

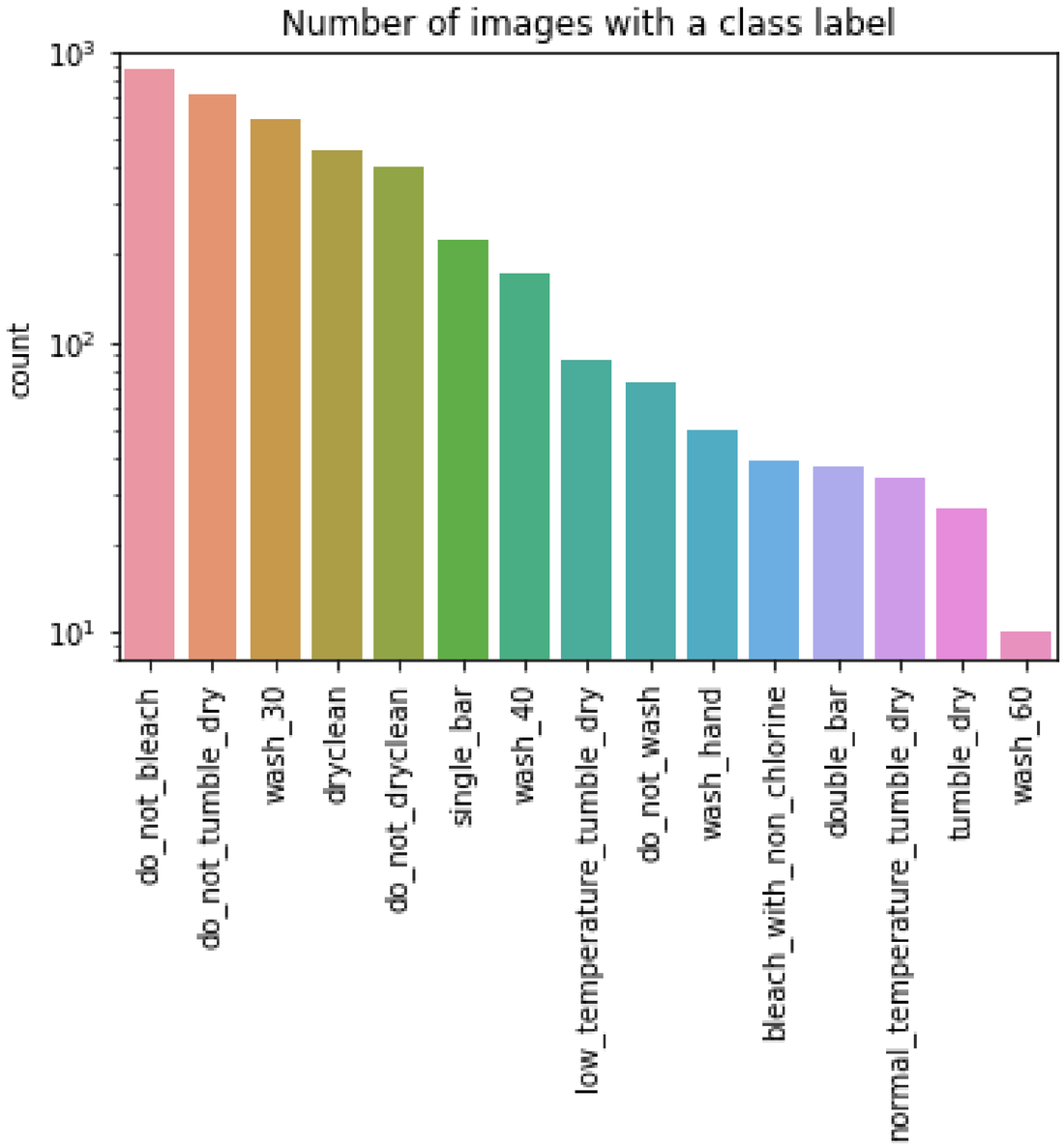
Classes are not represented equally

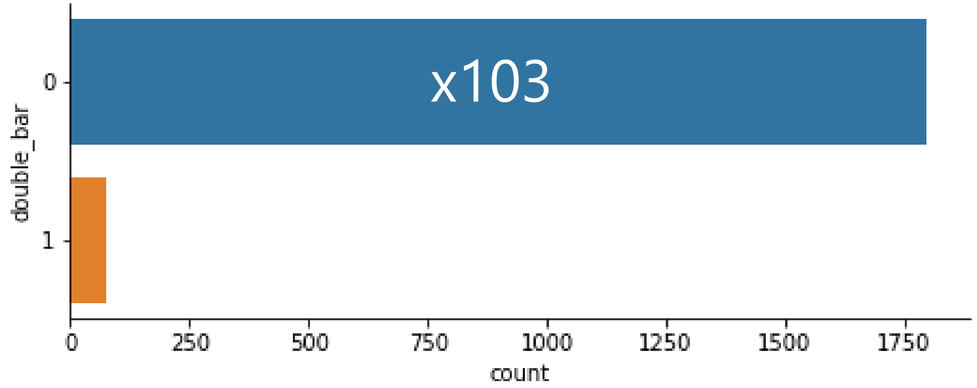
Irrelevant Objects

International symbols, characters & background.

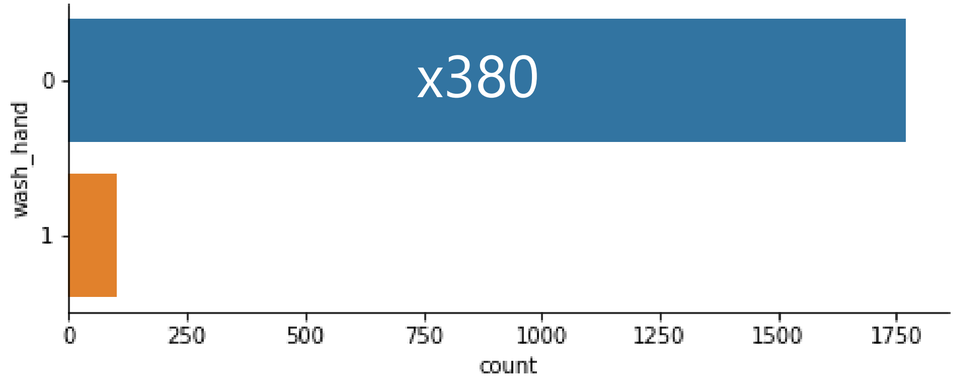
Poorly taken Images

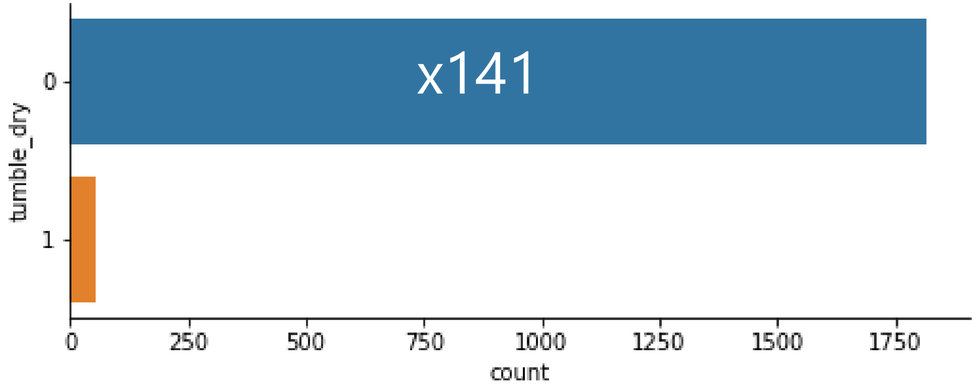
Blurry & carelessly taken images with different conditions.


Number of images with a class label
count
10^3
10^2
10^1
do_not_bleach
do_not_tumble_dry
wash_30
dryclean
do_not_dryclean
single_bar
wash_40
low_temperature_tumble_dry
do_not_wash
wash_hand
bleach_with_non_chlorine
double_bar
normal_temperature_tumble_dry
tumble_dry
wash_60


x103
double_bar
0
1
0
250
500
750
1000
1250
1500
1750
count


60°


x380
wash_hand
0
1
0
250
500
750
1000
1250
1500
1750
count


x141
tumble_dry
0
1
0
250
500
750
1000
1250
1500
1750
count

Preprocessing

Tag Recognition vs. Bounding Box

Custom YOLO model was trained for creating bounding boxes around care symbol tags. Square cropping was made w.r.t higher height or width of boxes.

Contrast Limited Adaptive Histogram Equalization

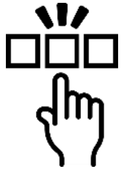
Used for improving the local contrast and enhancing the definitions of edges in each region of an image.

Gamma Correction & Brightness Enhancement

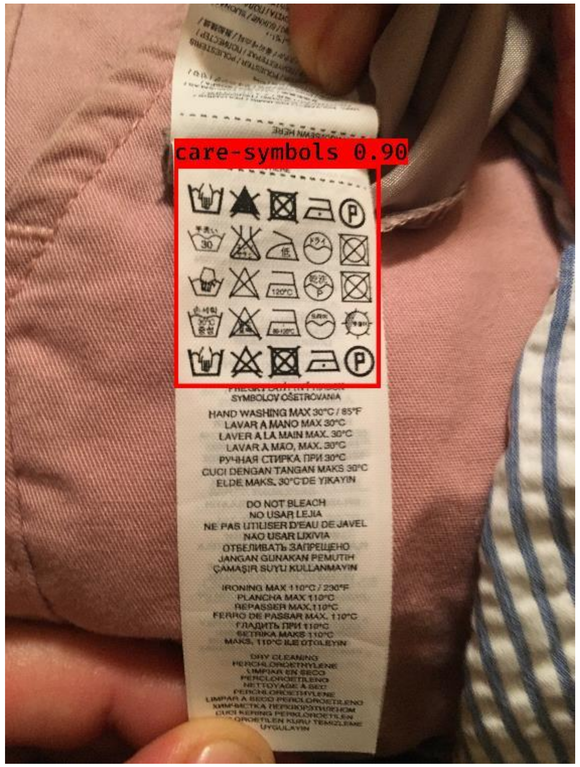
Clearer images were created.

Data Augmentation

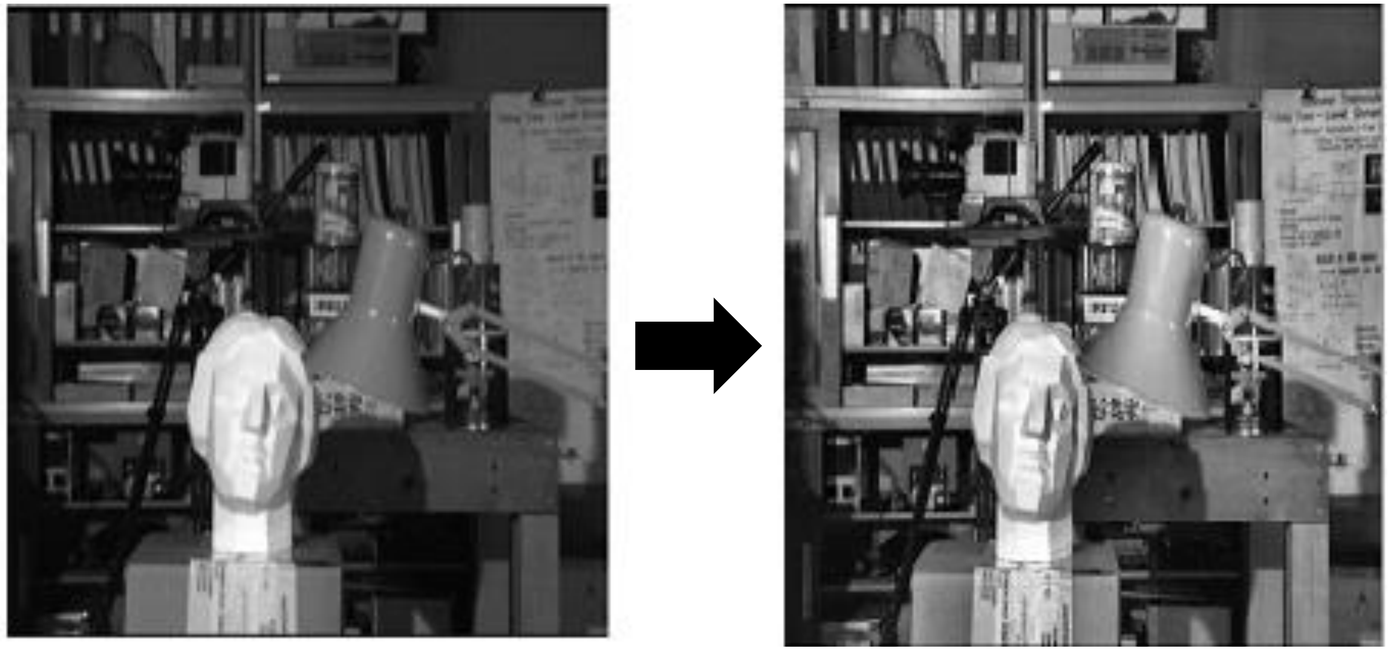
On batch augmented image production with Keras ImageDataGenerator.



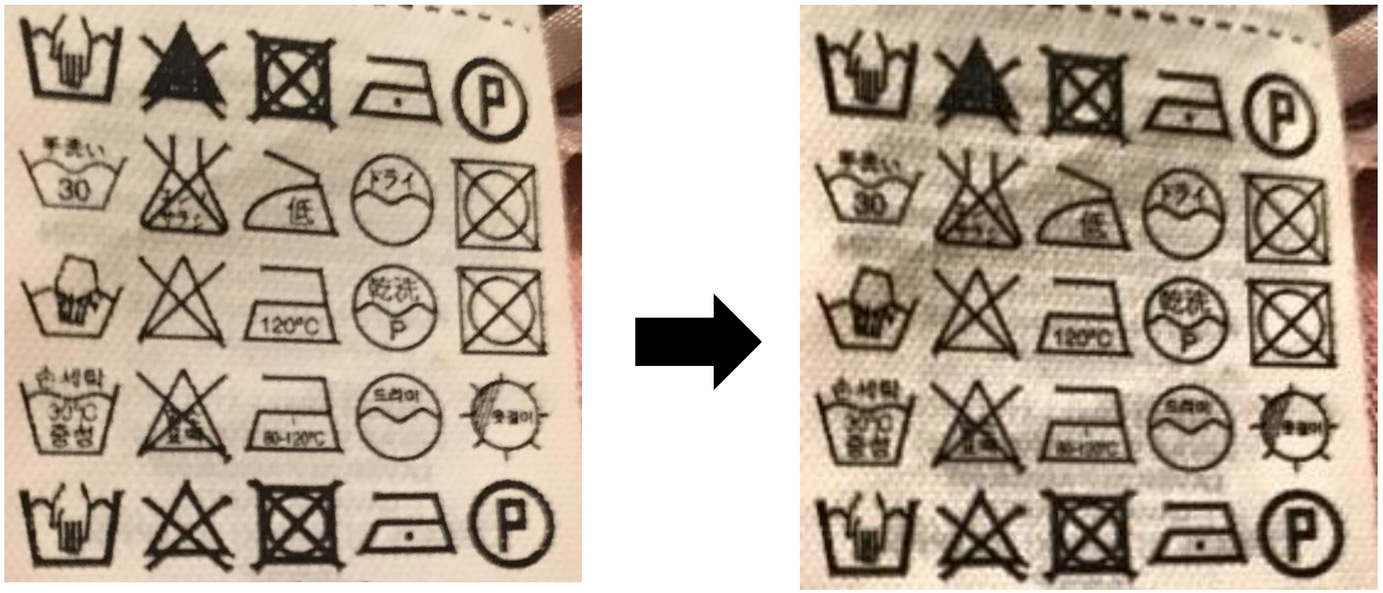
Bounding Box



CLAHE



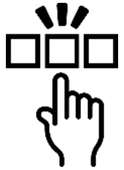
CLAHE



Gamma Correction & Brightness Enhancement

Data Augmentation

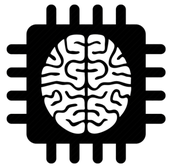
```
aug = ImageDataGenerator(rotation_range = 40,
                         width_shift_range = 0.15,
                         height_shift_range = 0.15,
                         shear_range = 0.15,
                         zoom_range = 0.2,
                         horizontal_flip = True,
                         vertical_flip = False,
                         fill_mode ='nearest')
```



Data Augmentation

Models

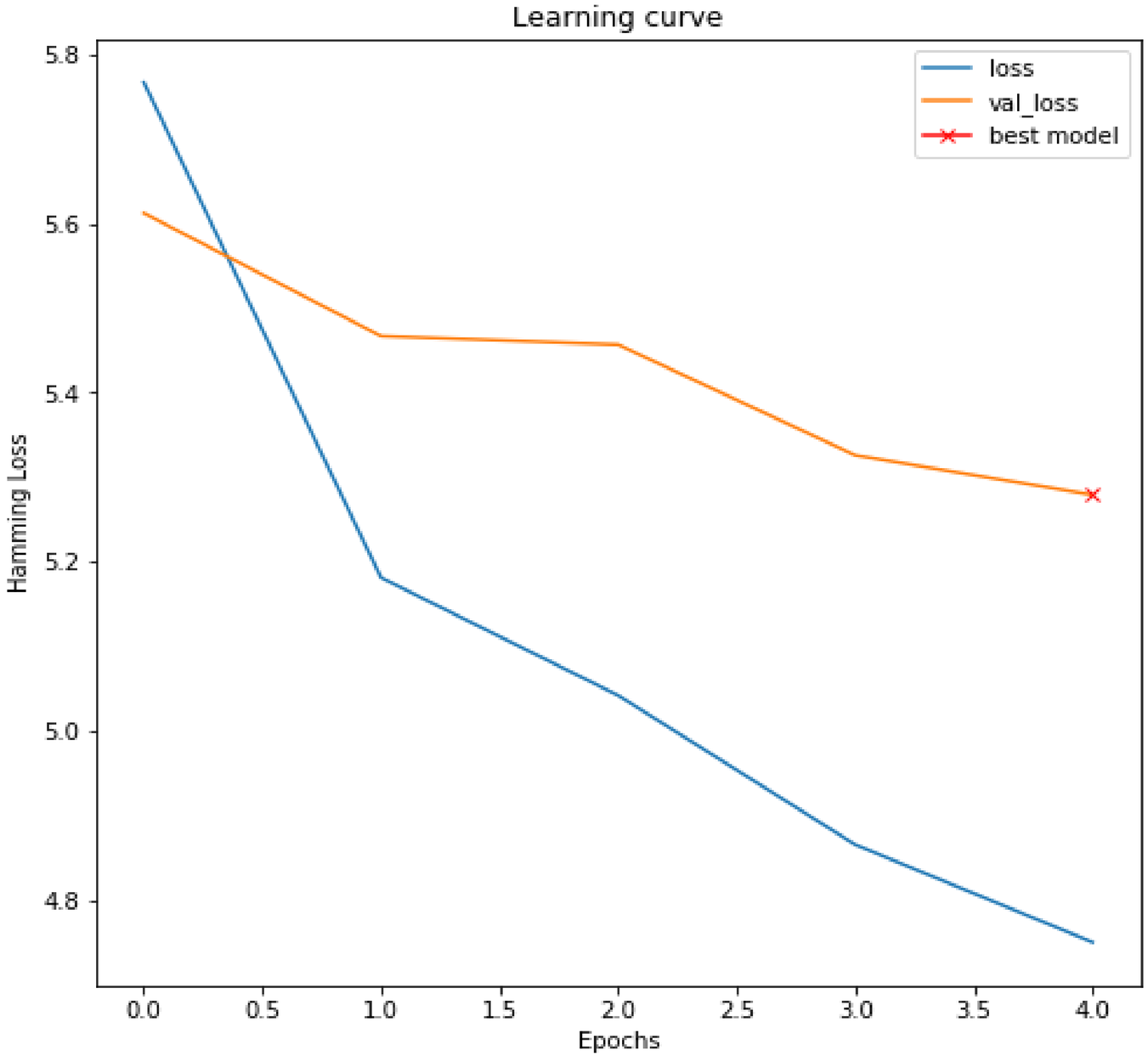
- DenseNet169
- **Best Model : DenseNet121 + ImageNet**
- NASNet
- ResNet

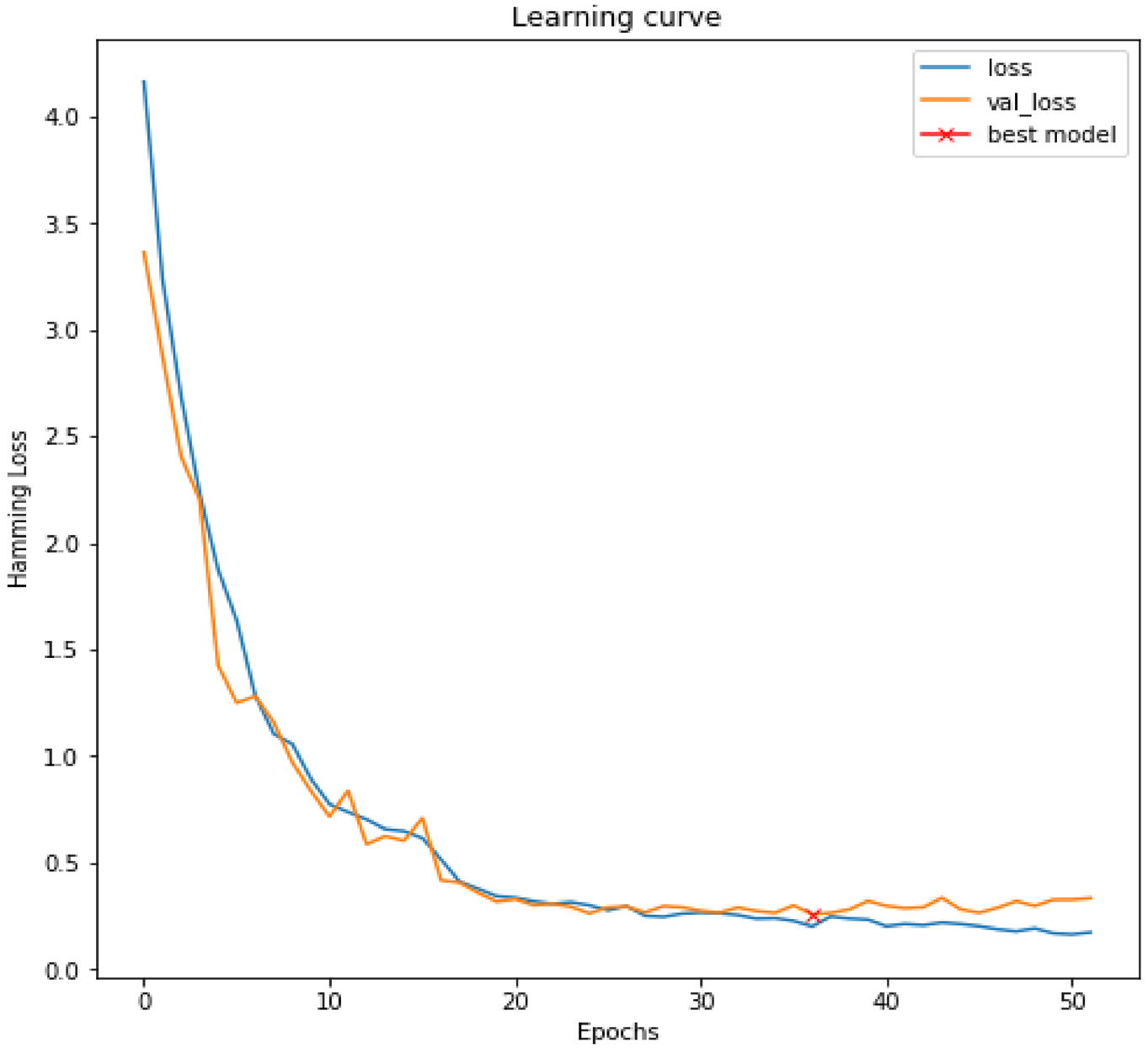


DenseNet121 + ImageNet

```
base_model = DenseNet121(include_top=False, weights='imagenet',
                         input_shape=(SIZE, SIZE, 3), classes=15)
x = base_model.output
x = GlobalAveragePooling2D()(x)
x = Dense(1024, activation='relu')(x)
x = Dropout(.2)(x)

predictions = Dense(15, activation='sigmoid')(x)
model = Model(inputs=base_model.input, outputs=predictions)

## Multiple GPU

from keras.utils import multi_gpu_model
model = multi_gpu_model(model, gpus=2)

## Freeze network except last three layers:

for layer in model.layers:
    layer.trainable = False

for i in range(-3,0):
    model.layers[i].trainable = True

model.compile(optimizer=Adam(lr=1e-4, decay=1e-9), loss=hn_multilabel_loss, metrics=['binary_crossentropy',
              categorical_crossentropy, categorical_accuracy, top_3_accuracy])
```

```
BS = 16
SIZE = 390
TEST_SIZE = 0.1
```


Learning curve
loss
val_loss
best model
Hamming Loss
5.8
5.6
5.4
5.2
5.0
4.8
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Epochs


Learning curve
loss
val_loss
best model
Hamming Loss
Epochs
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
0
10
20
30
40
50

Future Improvements

Bounding Box

Custom detection model is not accurate enough to produce precise croppings, better model is needed.

Multiple Model Fine-Tuning

Due to computation limitations, I only focused on improving DenseNet121 architecture.

Balanced Train-Test Split & Merge

İmbalanced splits & not merging train-test sets on best model while predicting validation set can lower the performance

Model Optimizer

Only adaptive moment estimation was tested.

Teşekkürler

Melik Burak Bozbey