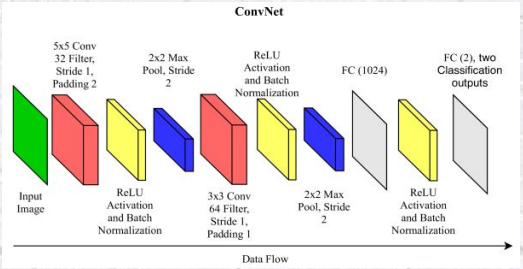
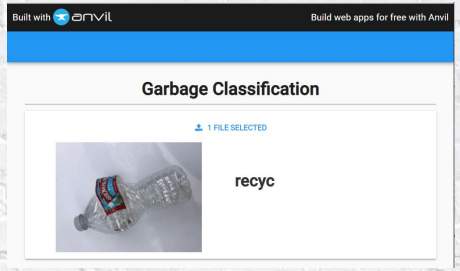
Garbage Classification

Yanchi Fang, Jintao Xu, Hongliang Wang & Peiyi Yu





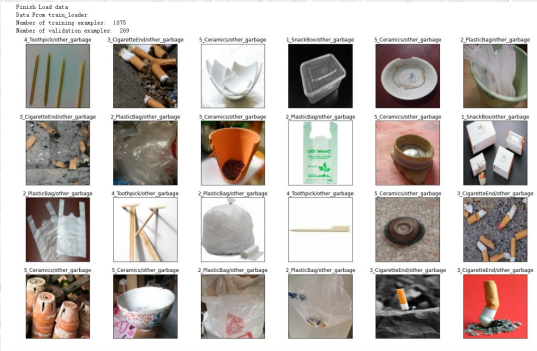
BACKGROUND

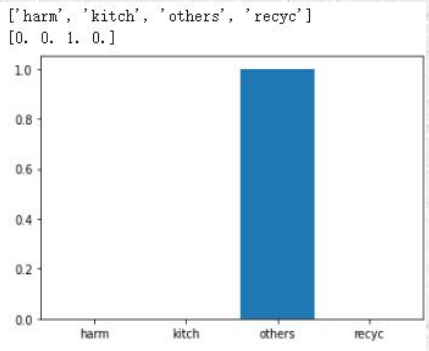
DATA

MODEL

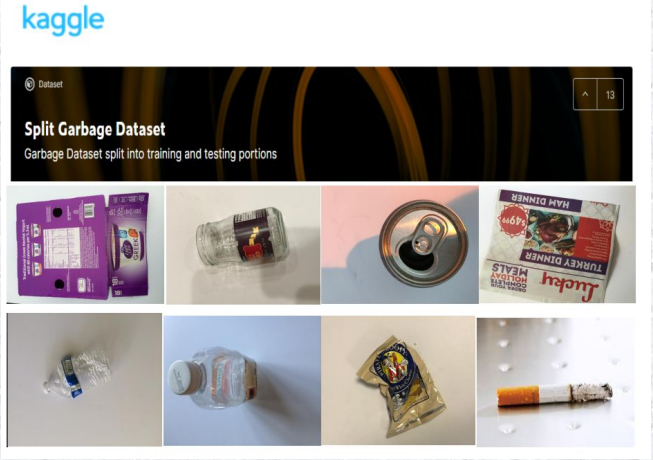
DEMO

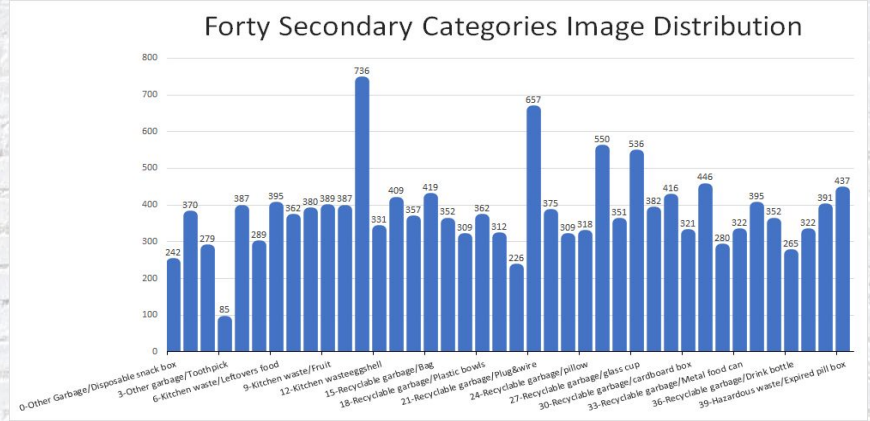
RESULT



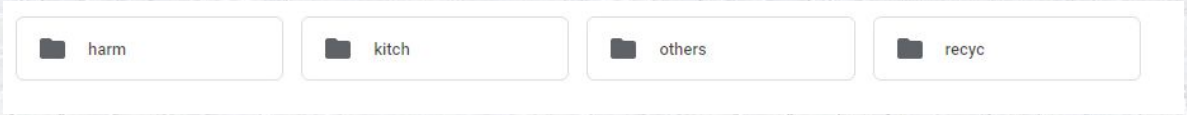


Data



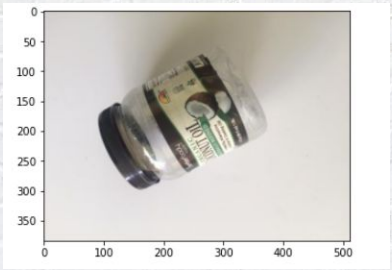


Manually

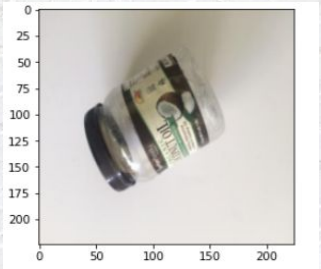


Data Processing

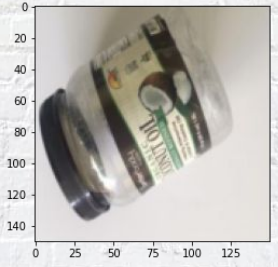
1. resize
2. center crop
3. random rotation
4. color change
5. normalize



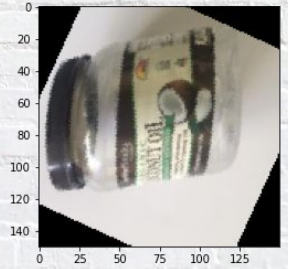
original



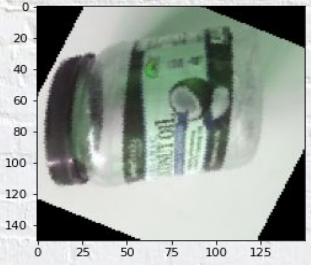
resize



crop



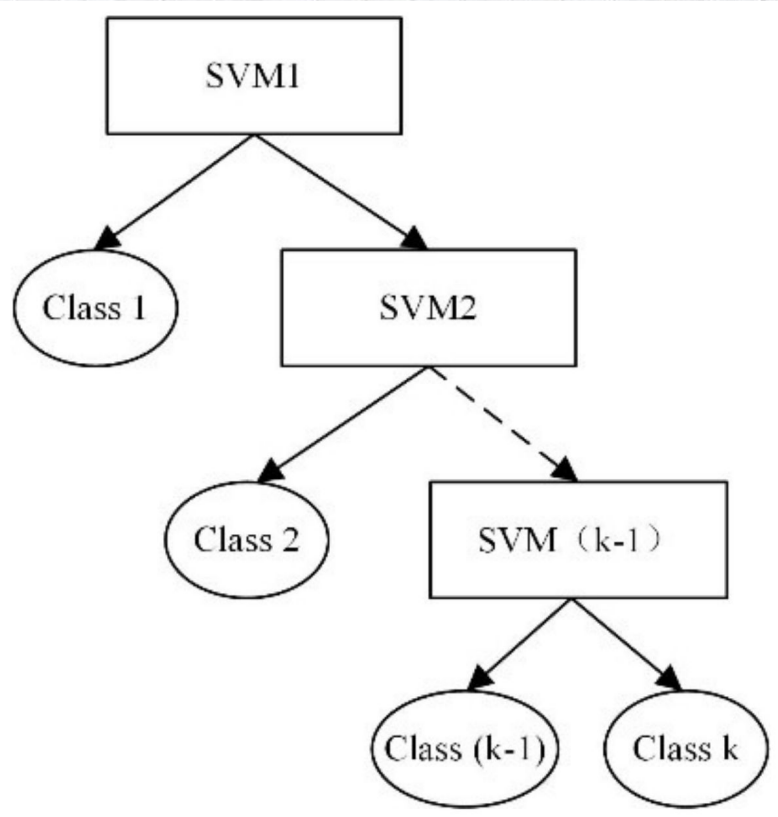
rotate



color change

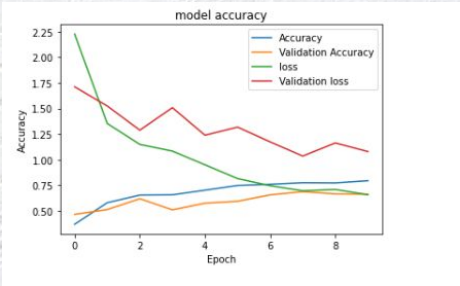
Baseline Model

(k-1) SVM



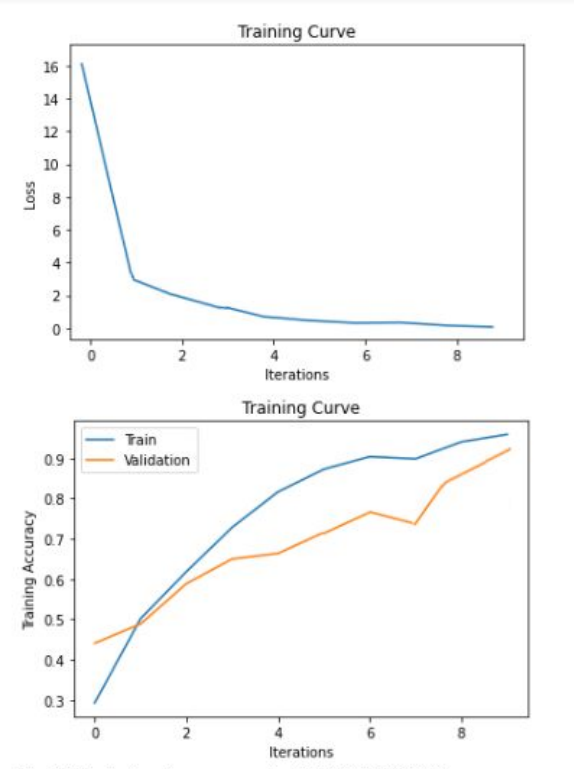
Primary Model

VGG16



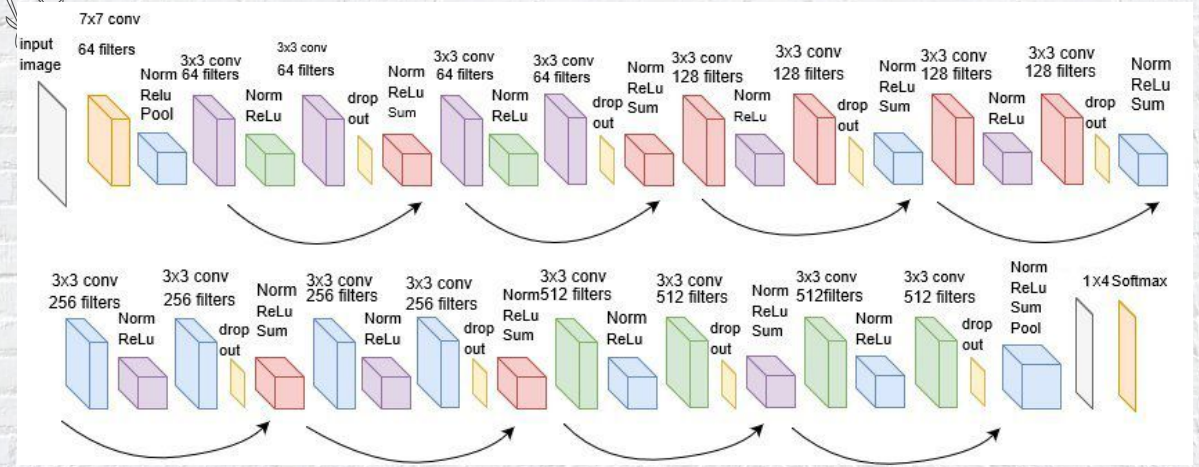
Training Accuracy: 0.7961
Validation Accuracy: 0.6625

Resnet18



Training Accuracy: 0.9791
Validation Accuracy: 0.9224

Resnet 18 Features



Total 22 layer

- 13 Convolutional layer
- 5 pooling layer
- 4 fully connected layer

```
AdaptiveAvgPool2d-67                [-1, 512, 1, 1]               0
Linear-68                           [-1, 4]                   2,052
================================================================
Total params: 11,172,356
Trainable params: 11,172,356
Non-trainable params: 0
----------------------------------------------------------------
Input size (MB): 0.00
Forward/backward pass size (MB): 3.75
Params size (MB): 42.62
Estimated Total Size (MB): 46.37
----------------------------------------------------------------
```


```
AdaptiveAvgPool2d-67                [-1, 512, 1, 1]               0
Linear-68                           [-1, 4]                   2,052
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----------------------------------------------------------------
```


Layer (type)	Output Shape	Param #
Conv2d-1	[-1, 64, 26, 26]	3,200
BatchNorm2d-2	[-1, 64, 26, 26]	128
ReLU-3	[-1, 64, 26, 26]	0
MaxPool2d-4	[-1, 64, 13, 13]	0
Conv2d-5	[-1, 64, 13, 13]	36,864
BatchNorm2d-6	[-1, 64, 13, 13]	128
ReLU-7	[-1, 64, 13, 13]	0
Conv2d-8	[-1, 64, 13, 13]	36,864
BatchNorm2d-9	[-1, 64, 13, 13]	128
ReLU-10	[-1, 64, 13, 13]	0
BasicBlock-11	[-1, 64, 13, 13]	0
Conv2d-12	[-1, 64, 13, 13]	36,864
BatchNorm2d-13	[-1, 64, 13, 13]	128
ReLU-14	[-1, 64, 13, 13]	0
Conv2d-15	[-1, 64, 13, 13]	36,864
BatchNorm2d-16	[-1, 64, 13, 13]	128
ReLU-17	[-1, 64, 13, 13]	0
BasicBlock-18	[-1, 64, 13, 13]	0
Conv2d-19	[-1, 128, 7, 7]	73,728
BatchNorm2d-20	[-1, 128, 7, 7]	256
ReLU-21	[-1, 128, 7, 7]	0
Conv2d-22	[-1, 128, 7, 7]	147,456
BatchNorm2d-23	[-1, 128, 7, 7]	256
Conv2d-24	[-1, 128, 7, 7]	8,192
BatchNorm2d-25	[-1, 128, 7, 7]	256
ReLU-26	[-1, 128, 7, 7]	0
BasicBlock-27	[-1, 128, 7, 7]	0
Conv2d-28	[-1, 128, 7, 7]	147,456
BatchNorm2d-29	[-1, 128, 7, 7]	256
ReLU-30	[-1, 128, 7, 7]	0
Conv2d-31	[-1, 128, 7, 7]	147,456
BatchNorm2d-32	[-1, 128, 7, 7]	256
ReLU-33	[-1, 128, 7, 7]	0
BasicBlock-34	[-1, 128, 7, 7]	0
Conv2d-35	[-1, 256, 4, 4]	294,912
BatchNorm2d-36	[-1, 256, 4, 4]	512
ReLU-37	[-1, 256, 4, 4]	0
Conv2d-38	[-1, 256, 4, 4]	589,824
BatchNorm2d-39	[-1, 256, 4, 4]	512
Conv2d-40	[-1, 256, 4, 4]	32,768
BatchNorm2d-41	[-1, 256, 4, 4]	512
ReLU-42	[-1, 256, 4, 4]	0
BasicBlock-43	[-1, 256, 4, 4]	0
Conv2d-44	[-1, 256, 4, 4]	589,824
BatchNorm2d-45	[-1, 256, 4, 4]	512
ReLU-46	[-1, 256, 4, 4]	0
Conv2d-47	[-1, 256, 4, 4]	589,824
BatchNorm2d-48	[-1, 256, 4, 4]	512
ReLU-49	[-1, 256, 4, 4]	0
BasicBlock-50	[-1, 256, 4, 4]	0
Conv2d-51	[-1, 512, 2, 2]	1,179,648
BatchNorm2d-52	[-1, 512, 2, 2]	1,024
ReLU-53	[-1, 512, 2, 2]	0
Conv2d-54	[-1, 512, 2, 2]	2,359,296
BatchNorm2d-55	[-1, 512, 2, 2]	1,024
Conv2d-56	[-1, 512, 2, 2]	131,072
BatchNorm2d-57	[-1, 512, 2, 2]	1,024
ReLU-58	[-1, 512, 2, 2]	0
BasicBlock-59	[-1, 512, 2, 2]	0
Conv2d-60	[-1, 512, 2, 2]	2,359,296
BatchNorm2d-61	[-1, 512, 2, 2]	1,024
ReLU-62	[-1, 512, 2, 2]	0
Conv2d-63	[-1, 512, 2, 2]	2,359,296
BatchNorm2d-64	[-1, 512, 2, 2]	1,024
ReLU-65	[-1, 512, 2, 2]	0
BasicBlock-66	[-1, 512, 2, 2]	0
AdaptiveAvgPool2d-67	[-1, 512, 1, 1]	0
Linear-68	[-1, 4]	2,052


```
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Trainable params: 11,172,356
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----------------------------------------------------------------
Input size (MB): 0.00
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----------------------------------------------------------------
```

Training our model

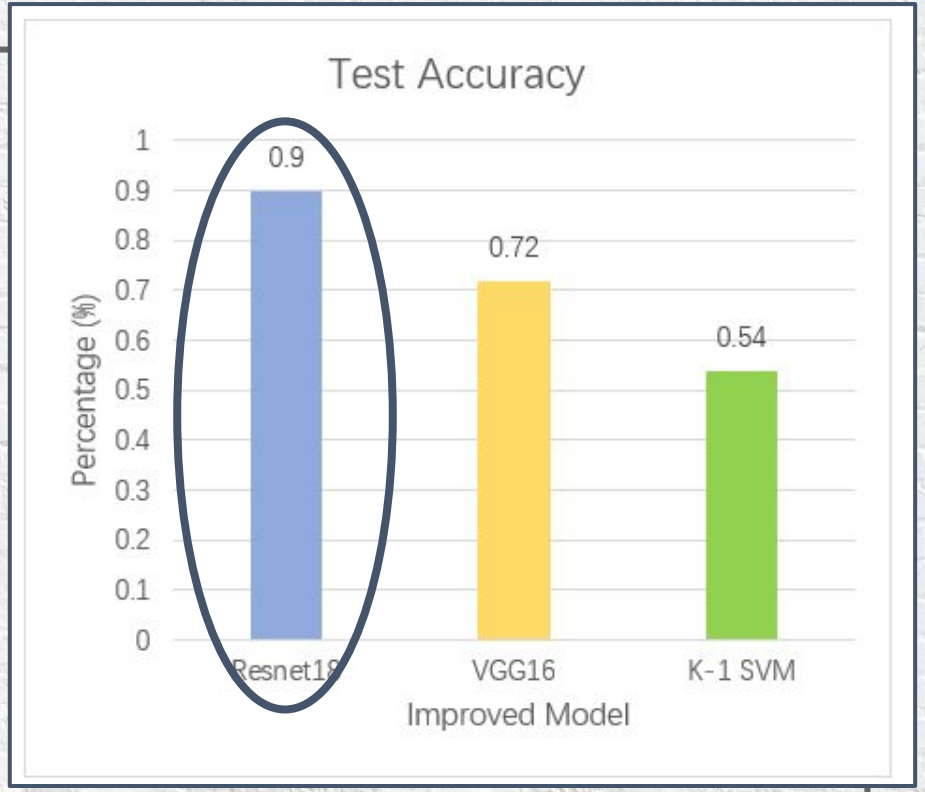
1. Transfer Learning
2. Fine-tuning
3. Dropout
4. Cross Entropy Loss
5. Adam

Hyperparameter:

batch_size = 32
learning_rate = 1e-4
epochs = 10

Performance

Partial Test Dataset



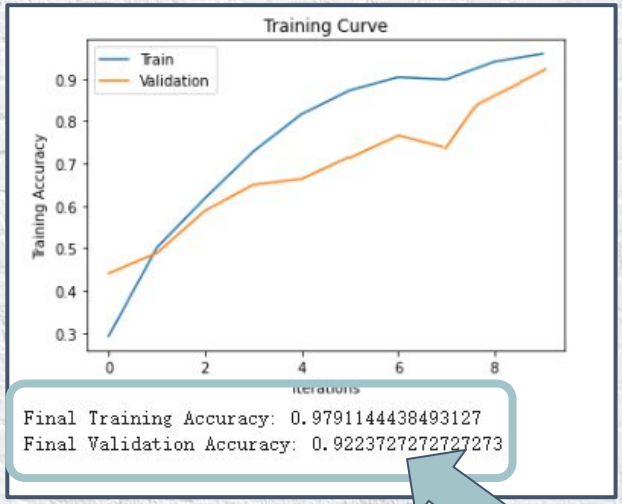
Quantitative Results

Test Result

```
There are 300 Test images

Test accuracy is:  0.9011764705882353
```

≈ 90%



Qualitative Results

/content/gdrive/
harmful

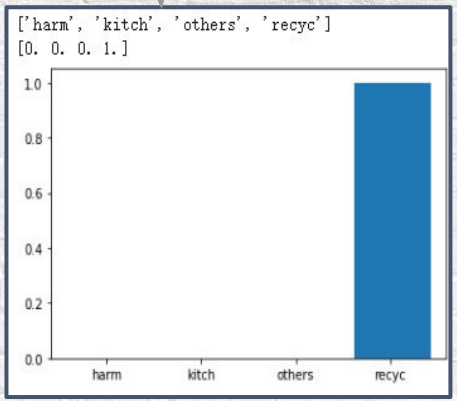
Method to show the result

Word

Bar Chart

Took By Ourselves

['harm', 'kitch', 'others', 'recyc']
[0. 0. 0. 1.]



Thank you for watching!