Wire Detection in Electronic Devices With DCNN

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REF: UPWORK
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TechRefs:

- Tensorflow
- Keras
- TPU
- GCS

Models

EfficientNetB7

Based on:

EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks

Mingxing Tan, Quoc V. Le

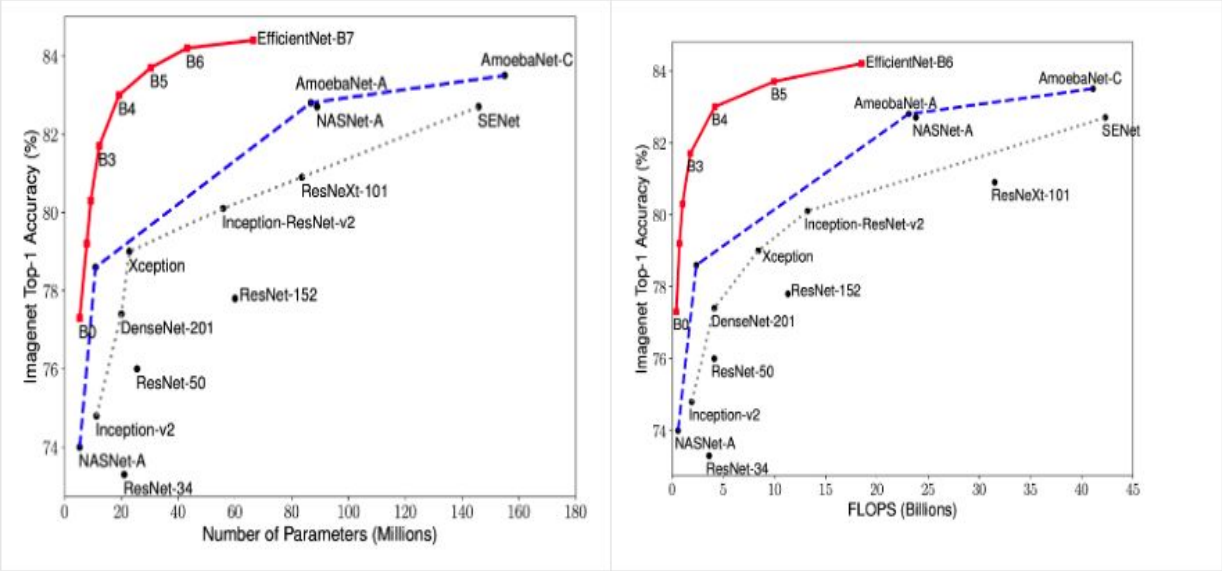
Source-code: https://github.com/qubvel/efficientnet

BibTeX:

```
@misc{tan2019efficientnet,
    title={EfficientNet: Rethinking Model Scaling for Convolutional Neural Networks},
    author={Mingxing Tan and Quoc V. Le},
    year={2019},
    eprint={1905.11946},
    archivePrefix={arXiv},
    primaryClass={cs.LG}
}
```

About EfficientNet Models

EfficientNets rely on AutoML and compound scaling to achieve superior performance without compromising resource efficiency. The AutoML Mobile framework has helped develop a mobile-size baseline network, **EfficientNet-B0**, which is then improved by the compound scaling method to obtain EfficientNet-B1 to B7.



EfficientNets achieve state-of-the-art accuracy on ImageNet with an order of magnitude better efficiency:

Img-source: https://github.com/qubvel/efficientnet

InceptionV3

Based on:

Rethinking the Inception Architecture for Computer Vision

Christian Szegedy, Vincent Vanhoucke, Sergey Ioffe, Jonathon Shlens, Zbigniew Wojna

Source-code:

https://github.com/tensorflow/models/blob/master/research/slim/nets/inception_v3.py

BibTeX:

```
@misc{szegedy2015rethinking,
   title={Rethinking the Inception Architecture for Computer Vision},
   author={Christian Szegedy and Vincent Vanhoucke and Sergey Ioffe and Jonathon Shlens and Zbigniew
Wojna},
   year={2015},
   eprint={1512.00567},
   archivePrefix={arXiv},
   primaryClass={cs.CV}
}
```

InceptionresnetV2

Based on:

Inception-v4, Inception-ResNet and the Impact of Residual Connections on Learning

Christian Szegedy, Sergey Ioffe, Vincent Vanhoucke, Alex Alemi

Source-code:

https://github.com/tensorflow/models/blob/master/research/slim/nets/inception_resnet_v2.py

BibTeX:

```
@misc{szegedy2016inceptionv4,
   title={Inception-v4, Inception-ResNet and the Impact of Residual Connections on Learning},
   author={Christian Szegedy and Sergey Ioffe and Vincent Vanhoucke and Alex Alemi},
   year={2016},
   eprint={1602.07261},
   archivePrefix={arXiv},
   primaryClass={cs.CV}
}
```

DenseNet201

Based on:
Densely Connected Convolutional Networks
Gao Huang, Zhuang Liu, Laurens van der Maaten, Kilian Q. Weinberger

Source-code:
https://github.com/tensorflow/examples/tree/master/tensorflow_examples/models/densenet

BibTeX:
```
@misc{huang2016densely,
   title={Densely Connected Convolutional Networks},
   author={Gao Huang and Zhuang Liu and Laurens van der Maaten and Kilian Q. Weinberger},
   year={2016},
   eprint={1608.06993},
   archivePrefix={arXiv},
   primaryClass={cs.CV}
}
```

Architecture

Based on:
U-Net: Convolutional Networks for Biomedical Image Segmentation
Olaf Ronneberger, Philipp Fischer, Thomas Brox
BibTeX:
```
@misc{ronneberger2015unet,
   title={U-Net: Convolutional Networks for Biomedical Image Segmentation},
   author={Olaf Ronneberger and Philipp Fischer and Thomas Brox},
   year={2015},
   eprint={1505.04597},
   archivePrefix={arXiv},
   primaryClass={cs.CV}
}
```

Module

Source-code: https://github.com/qubvel/segmentation_models
BibTeX:
```
@misc{Yakubovskiy:2019,
  Author = {Pavel Yakubovskiy},
  Title = {Segmentation Models},
  Year = {2019},
  Publisher = {GitHub},
  Journal = {GitHub repository},
  Howpublished = {\url{https://github.com/qubvel/segmentation_models}}
}
```

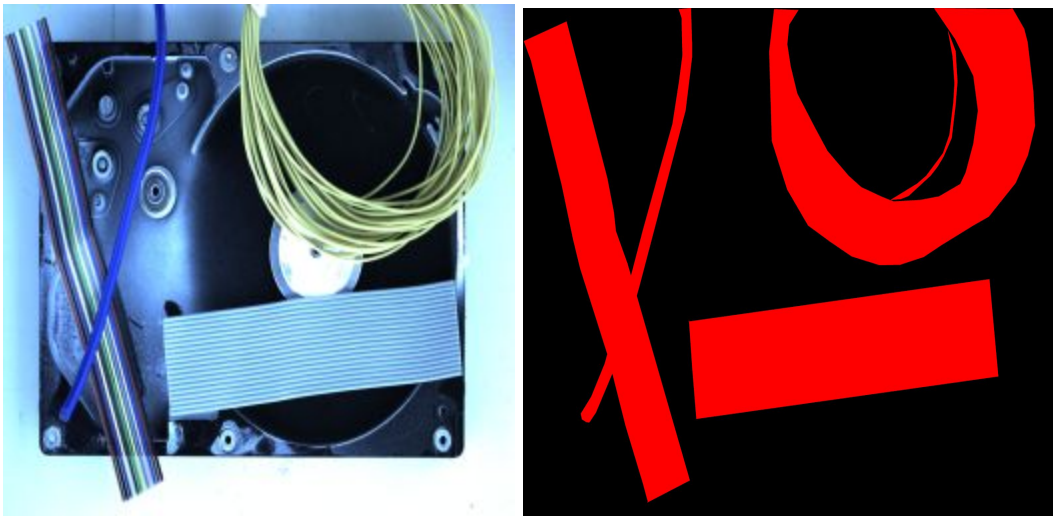
Data Synthesis

1)AugMix:

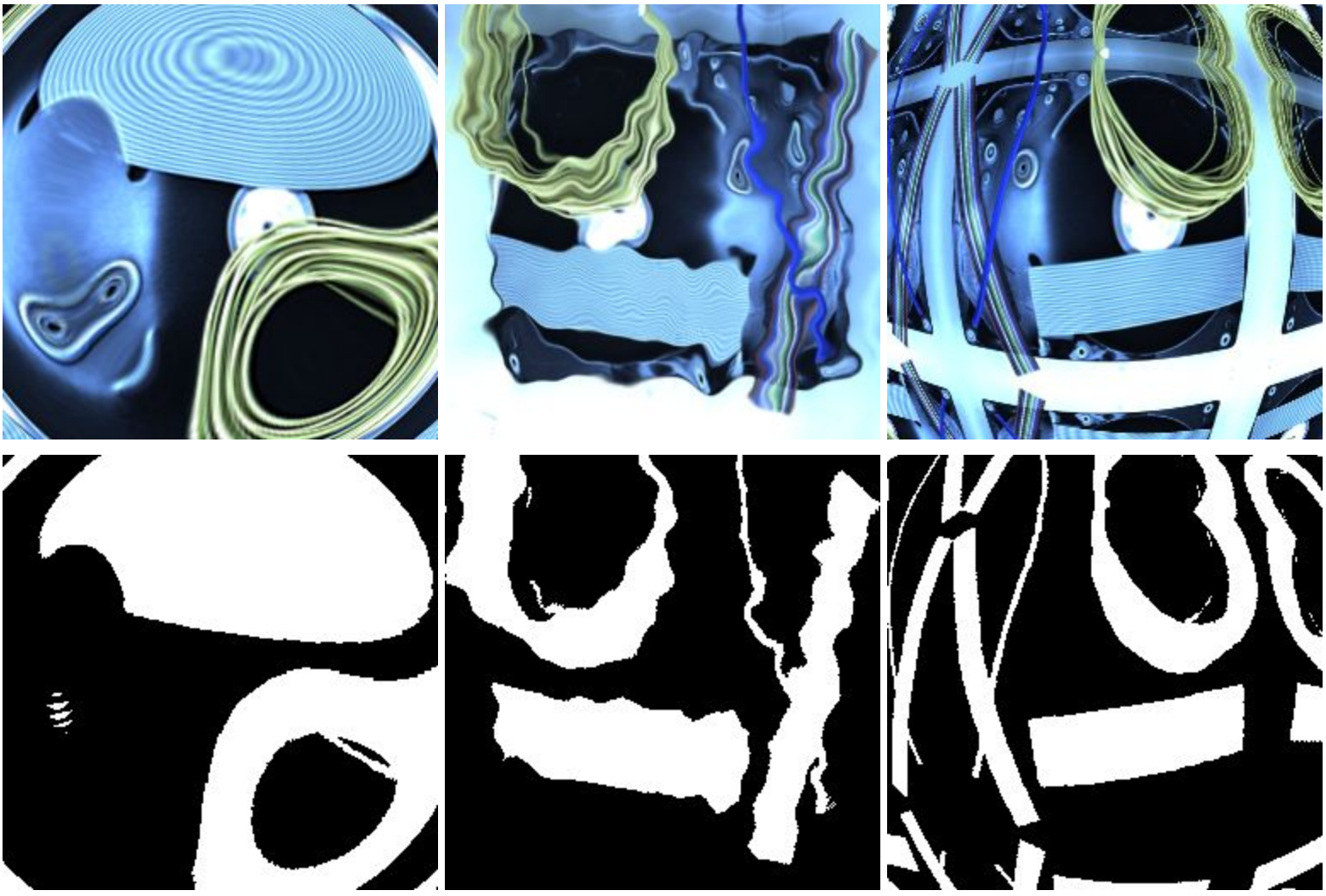
Operation	Spec	Probability
Vertical Flip	N/A	0.5
HorizontalFlip	N/A	0.5
RandomRotate 90	N/A	0.5
Transpose	N/A	0.5
Shift Scale Rotate	shift_limit=0.01, scale_limit=0.04, rotate_limit=0	0.25
Random Brightness Contrast	N/A	0.5
Random Gamma	N/A	0.5
IAA Emboss	N/A	0.25
Blur	blur_limit = 3	0.01
Elastic Transform	alpha=120, sigma=120 * 0.05, alpha_affine=120 * 0.03	0.8*0.33*0.5
GridDistortion	N/A	0.5*0.8*0.33
OpticalDistortion	distort_limit=2, shift_limit=0.5	0.5*0.8

- Source to Generation Ratio = 1/20=0.05
- DataSet Occupancy Ratio (Train) = 20*100/20840=0.096
- Clustering = None (Optimized)

DATASAMPLE

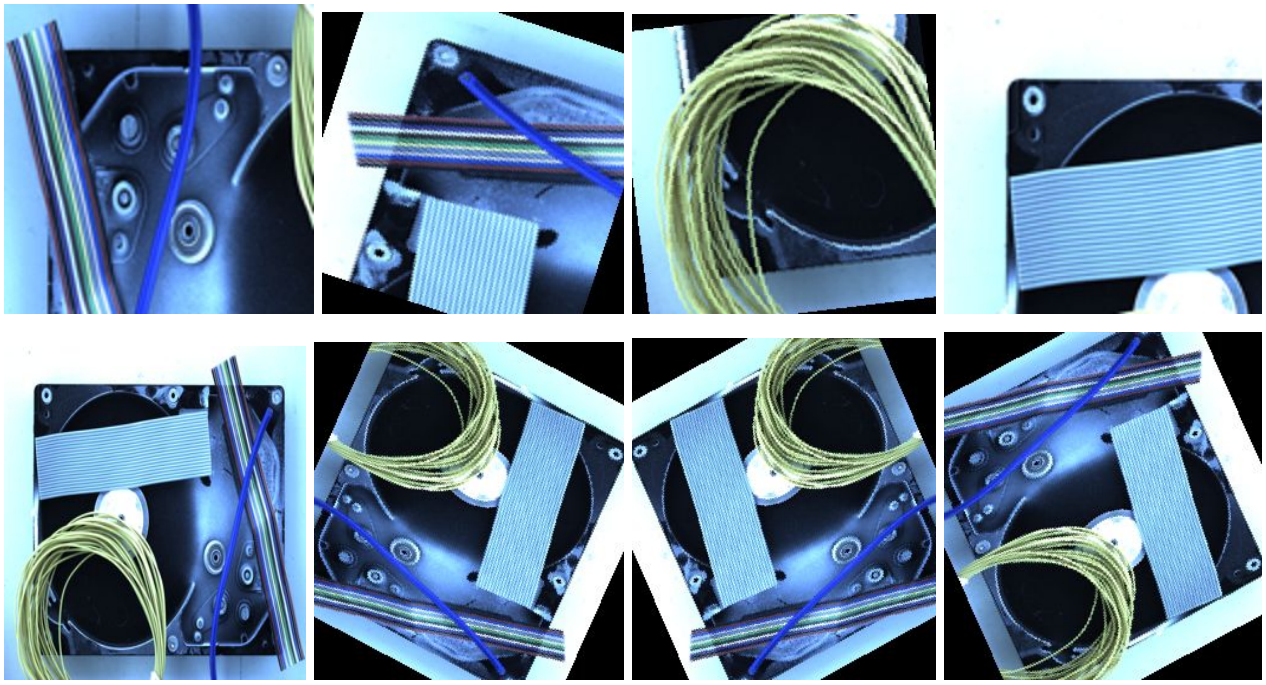


AugMix(K-GEN Sampled)



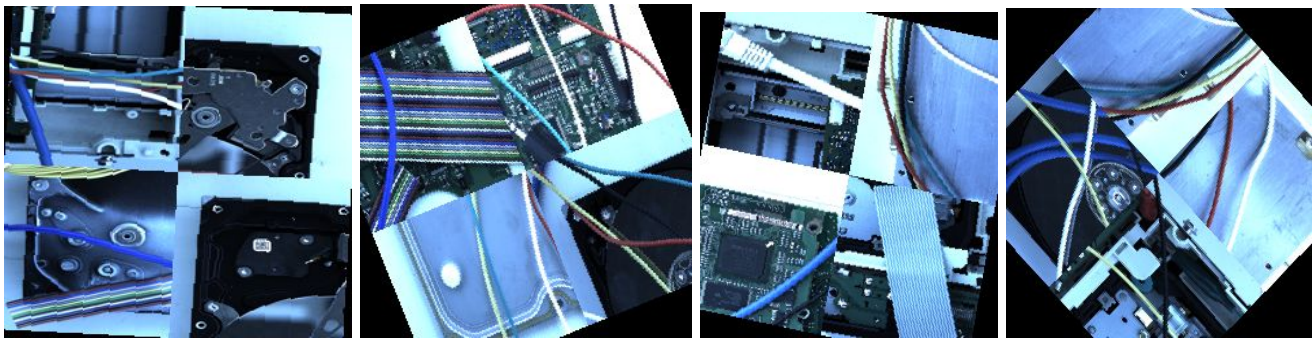
2)CropMix:

- Num of Crop Segment Per image: 4
- Rotation : (0 , 25) → 5 degree increase
- Flip : None, LeftRight,UpDown,Mirror
- Source to Generation Ratio : 1/100=0.001
- DataSet Occupancy Ratio (Train) = 100*100/20840=0.488
- Clustering = None (Optimized)



3)CombMix:

- Rotation : (0 ,90) random
- Flip : None, LeftRight,UpDown,Mirror
- Source to Generation Ratio : N/A
- DataSet Occupancy Ratio (Train) = 0.416
- Clustering = Sample Based



Scores

SSIM

MODEL NAME	MAX	MEAN	MIN
efficientnetb7	0.956	0.877	0.761
inceptionv3	0.944	0.863	0.758
inceptionresnetv2	0.941	0.859	0.743
densenet201	0.940	0.862	0.747

IoU/F1

MODEL NAME	MAX	MEAN	MIN
efficientnetb7	0.988	0.952	0.897
inceptionv3	0.977	0.947	0.894
inceptionresnetv2	0.983	0.943	0.886
densenet201	0.978	0.945	0.891

Efficient Net B7

K-Gen Variance (Approximated)

Metric	MAX	MEAN	MIN
SSIM	0.97 ± 0.02	0.88 ± 0.02	0.78 ± 0.02
IoU	0.97 ± 0.01	0.95 ± 0.02	0.88 ± 0.02