SIMPLE PRESENTATION FOR COMPETITION HUBMAP + HPA

SEGMENT MULTI-ORGAN FUNCTIONAL TISSUE UNITS

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ACCURACY IMPROVE STRATEGY

- Augmentation Strategy
  - Kidney 1st
  - Kidney 3rd
- Dataset Image Size
  - 256 * 256
  - 512 *512
- Number of Epoch
  - 16
  - 25
- Different Model
  - Efficient Net

AUGMENTATION STRATEGY

First trial

```
HorizontalFlip(),
VerticalFlip(),
RandomRotate90(),
  Transpose(),
ShiftScaleRotate(shift_l
                 border_
OneOf([
    OpticalDistortion(p=0.3),
    GridDistortion(p=.1),
    IAAPiecewiseAffine(p=0.3),
], p=0.3),
OneOf([
    HueSaturationValue(10,15,10),
    CLAHE(clip_limit=2),
    RandomBrightnessContrast(),
], p=0.3),
```

[Inference] - FastAI Baseline
original (version 4/9)
3 days ago by KaggleJbt

Notebook [Inference] - FastAI Baseline | original

Succeeded 0.57

AUGMENTATION STRATEGY

- 1st Augmentation strategy

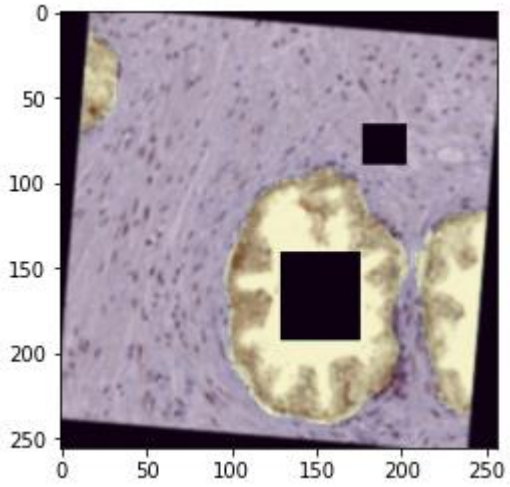
```
input_resolution = (256, 256)

Ost = Compose([
    #Basic
    RandomRotate90(p=1),
    HorizontalFlip(p=0.5),

    #Morphology
    ShiftScaleRotate(shift_limit=0, scale_limit=(-0.2,0.2), rotate_limit=(-30,30),
                     interpolation=1, border_mode=0, value=(0,0,0), p=0.5),
    GaussNoise(var_limit=(0,50.0), mean=0, p=0.5),
    GaussianBlur(blur_limit=(3,7), p=0.5),

    #Color
    RandomBrightnessContrast(brightness_limit=0.35, contrast_limit=0.5,
                             brightness_by_max=True,p=0.5),
    HueSaturationValue(hue_shift_limit=30, sat_shift_limit=30,
                       val_shift_limit=0, p=0.5),

    CoarseDropout(max_holes=2,
                  max_height=input_resolution[0]//4, max_width=input_resolution[1]//4,
                  min_holes=1,
                  min_height=input_resolution[0]//16, min_width=input_resolution[1]//16,
                  fill_value=0, mask_fill_value=0, p=0.5),
], p=1)

augmentedOne = Ost(image=image, mask=mask)
```

- 3rd Augmentation strategy

```
Trd  = Compose([
    HorizontalFlip(),
    VerticalFlip(),
    RandomRotate90(),
    Transpose(),
    ShiftScaleRotate(shift_limit=0.0625, scale_limit=0.2, rotate_limit=15, p=0.9,
                     border_mode=cv2.BORDER_REFLECT),
    OneOf([
        ElasticTransform(p=0.3),
        GaussianBlur(p=0.3),
        GaussNoise(p=0.3),
        OpticalDistortion(p=0.3),
        GridDistortion(p=0.1),
        PiecewiseAffine(p=0.3),
    ], p=0.3),
    OneOf([
        HueSaturationValue(15,25,0),
        CLAHE(clip_limit=2),
        RandomBrightnessContrast(brightness_limit=0.3, contrast_limit=0.3),
    ], p=0.3),
], p=1)
```

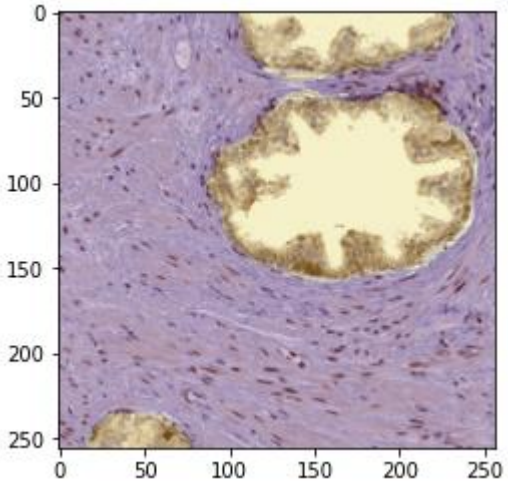
AUGMENTATION STRATEGY

1st Augmentation

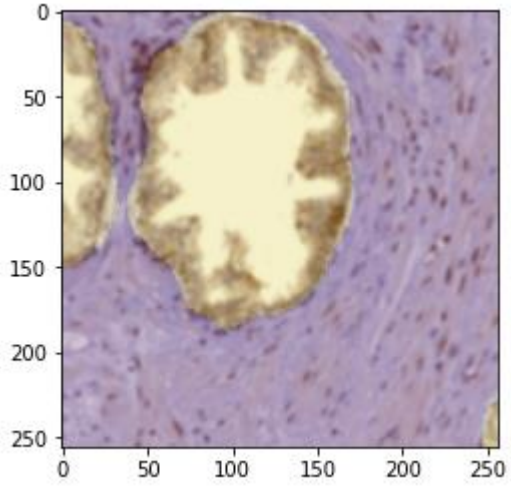


- The Random Coarse Dropout May Lose Important Feature…

Original Image



3rd Augmentation



AUGMENTATION STRATEGY

- Result Compare

[Inference] - FastAI Baseline — Succeeded — 0.56
change_aug (version 2/9)
2 days ago by cenxun
Notebook [Inference] - FastAI Baseline | change_aug

[Inference] - FastAI Baseline — Succeeded — 0.64
3rd_place_aug (version 6/9)
2 days ago by KaggleJbt
Notebook [Inference] - FastAI Baseline | 3rd_place_aug

```
    OneOf([
        HueSaturationValue(15,25,0),
        CLAHE(clip_limit=2),
        RandomBrightnessContrast(brightness_limit=0.3, contrast_limit=
    ], p=0.3),
], p=1)
```

- Unexpected Error Due to Small Parameter Changed…
  - With combined with Pre-trained model

[Inference] - FastAI Baseline — Succeeded — 0.56
256*256+pretrain+3rdaug+epoch=25 (version 9/9)
an hour ago by cenxun
Notebook [Inference] - FastAI Baseline |
256*256+pretrain+3rdaug+epoch=25

```
    OneOf([
        HueSaturationValue(10,15,10),
        CLAHE(clip_limit=2),
        RandomBrightnessContrast(),
    ], p=0.3),
], p=p)
```

DATASET IMAGE SIZE

- The training process has reached the highest score.

```
6519.9s    10    Better model found at epoch 11 with dice_th value: 0.8454148769378662.
8405.7s    11    Better model found at epoch 16 with dice_th value: 0.8500909209251404.
8755.1s    12    Better model found at epoch 17 with dice_th value: 0.8517698049545288.
9120.2s    13    Better model found at epoch 18 with dice_th value: 0.8626195788383484.
11438.6s   14    Using cache found in /root/.cache/torch/hub/facebookresearch_semi-super
13290.9s   15    Better model found at epoch 0 with dice_th value: 0.7271682620048523.
13731.7s   16    Better model found at epoch 1 with dice_th value: 0.7609712481498718.
14171.5s   17    Better model found at epoch 2 with dice_th value: 0.7656829953193665.
14612.7s   18    Better model found at epoch 3 with dice_th value: 0.8053669929504395.
16315.7s   19    Better model found at epoch 7 with dice_th value: 0.8299878239631653.
18729.0s   20    Better model found at epoch 13 with dice_th value: 0.8487520217895508.
19863.4s   21    Better model found at epoch 16 with dice_th value: 0.8583133816719055.
20955.7s   22    Better model found at epoch 19 with dice_th value: 0.8616945743560791.
```

DATASET IMAGE SIZE

- The inference code need to debug to performance the best of 512x512 model.

[Inference] - FastAI Baseline 3rd+stdmean+512*512 (version 7/9) 18 hours ago by cenxun Notebook [Inference] - FastAI Baseline | 3rd+stdmean+512*512	Succeeded	0.28	☐
[Inference] - FastAI Baseline 512*512_3rd_aug (version 9/9) 19 hours ago by KaggleJbt Notebook [Inference] - FastAI Baseline | 512*512_3rd_aug	Succeeded	0.37	☐

NEW MODEL

Change the encoder backbone from ResNet50 to Efficientnet-b5

```python
class UneXt50(nn.Module):
    def __init__(self, stride=1, **kwargs):
        super().__init__()
        #encoder
        m = ResNet(Bottleneck, [3, 4, 6, 3], groups=32, width_per_group=4)
        #m = torch.hub.load('facebookresearch/semi-supervised-ImageNet1K-models',
        #                   'resnext50_32x4d_ssl')
        self.enc0 = nn.Sequential(m.conv1, m.bn1, nn.ReLU(inplace=True))
        self.enc1 = nn.Sequential(nn.MaxPool2d(kernel_size=3, stride=2, padding=1, dilation=1),
                                  m.layer1) #256
        self.enc2 = m.layer2 #512
        self.enc3 = m.layer3 #1024
        self.enc4 = m.layer4 #2048
        #aspp with customized dilatations
        self.aspp = ASPP(2048,256,out_c=512,dilations=[stride*1,stride*2,stride*3,stride*4])
```

```python
class EfficientNetEncoder(EfficientNet):
    def __init__(self, stage_idxs, out_channels, model_name, depth=5):

        blocks_args, global_params = get_model_params(model_name, override_params=None)
        super().__init__(blocks_args, global_params)

        cfg = efficient_net_encoders[model_name]

        self._stage_idxs = stage_idxs
        self._out_channels = out_channels
        self._depth = depth
        self._in_channels = 3

        del self._fc
        self.load_state_dict(torch.load(cfg['weight_path']))

    def get_stages(self):
        return [
            nn.Identity(),
            nn.Sequential(self._conv_stem, self._bn0, self._swish),
            self._blocks[:self._stage_idxs[0]],
            self._blocks[self._stage_idxs[0]:self._stage_idxs[1]],
            self._blocks[self._stage_idxs[1]:self._stage_idxs[2]],
            self._blocks[self._stage_idxs[2]:],
        ]
```

NEW MODEL

```
HorizontalFlip(p=0.5),
VerticalFlip(),
RandomRotate90(p=1),
#Morphology
ShiftScaleRotate(shift_limit=0,
                 interpolation=
GaussNoise(var_limit=(0,50.0),
GaussianBlur(blur_limit=(3,7), p=0.5),
#Color
RandomBrightnessContrast(brightness_limit=0.35, contrast_limit=0.5,
                         brightness_by_max=True,p=0.5),
HueSaturationValue(hue_shift_limit=30, sat_shift_limit=30,
                   val_shift_limit=0, p=0.5),
OneOf([
    OpticalDistortion(p=0.3),
    GridDistortion(p=.1),
    IAAPiecewiseAffine(p=0.3),
], p=0.3),
```

[Inference]-HuBMAP fast.ai starter (EfficientNet) Succeeded 0.66
original_efficientnet_b5 (version 1/1)
3 hours ago by KaggleJbt

Notebook [Inference]-HuBMAP fast.ai starter (EfficientNet) | original_efficientnet_b5

FUTURE PLAN

- Optimize 512x512 inference code.
- Combine best performance augmentation with efficient net.

Thank you!