

Dataset information

```
In [ ]: import os

dataset_path = "./TXL_PBC"
splits = ["train", "val", "test"]

# Print the number of dataset
for split in splits:
    print(split)
    image_dir = os.path.join(dataset_path, "images", split)
    label_dir = os.path.join(dataset_path, "labels", split)
    print(f"{split} - img: {len(os.listdir(image_dir))}, label: {len(os.listdir(label_dir))}\n")
```

```
# Classes information
classes_file_path = "./TXL_PBC/labels/classes.txt"
```

```
with open(classes_file_path, "r") as f:
    classes = [line.strip() for line in f.readlines()]

print("Classes of the dataset:")
for i, class_name in enumerate(classes):
    print(f"{i}: {class_name}")
```

```
train
train - img: 1008, label: 1008
```

```
val
val - img: 288, label: 288
```

```
test
test - img: 144, label: 144
```

```
Classes of the dataset:
```

```
0: WBC
1: RBC
2: Platelet
```

Training and Validation

```
In [ ]: from ultralytics import YOLO

model = YOLO("yolov8n.pt")
```

```
model.train(  
    data="/Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/data.yaml", # local dataset configuration file  
    epochs=50,  
    batch=16,  
    imgsz=640,  
    workers=4,  
    device="cpu"  
)  
  
print("Training is complete!")
```

Downloading https://github.com/ultralytics/assets/releases/download/v8.3.0/yolov8n.pt to 'yolov8n.pt'...

100%|██████████| 6.25M/6.25M [00:01<00:00, 3.37MB/s]

Ultralytics 8.3.90 🚀 Python-3.10.13 torch-2.6.0 CPU (Apple M2)
engine/trainer: task=detect, mode=train, model=yolov8n.pt, data=/Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/data.yaml, epochs=50, time=None, patience=100, batch=16, imgsz=640, save=True, save_period=-1, cache=False, device=cpu, workers=4, project=None, name=train, exist_ok=False, pretrained=True, optimizer=auto, verbose=True, seed=0, deterministic=True, single_cls=False, rect=False, cos_lr=False, close_mosaic=10, resume=False, amp=True, fraction=1.0, profile=False, freeze=None, multi_scale=False, overlap_mask=True, mask_ratio=4, dropout=0.0, val=True, split=val, save_json=False, save_hybrid=False, conf=None, iou=0.7, max_det=300, half=False, dnn=False, plots=True, source=None, vid_stride=1, stream_buffer=False, visualize=False, augment=False, agnostic_nms=False, classes=None, retina_masks=False, embed=None, show=False, save_frames=False, save_txt=False, save_conf=False, save_crop=False, show_labels=True, show_conf=True, show_boxes=True, line_width=None, format=torchscript, keras=False, optimize=False, int8=False, dynamic=False, simplify=True, opset=None, workspace=None, nms=False, lr0=0.01, lrf=0.01, momentum=0.937, weight_decay=0.0005, warmup_epochs=3.0, warmup_momentum=0.8, warmup_bias_lr=0.1, box=7.5, cls=0.5, dfl=1.5, pose=12.0, kobj=1.0, nbs=64, hsv_h=0.015, hsv_s=0.7, hsv_v=0.4, degrees=0.0, translate=0.1, scale=0.5, shear=0.0, perspective=0.0, flipud=0.0, fliplr=0.5, bgr=0.0, mosaic=1.0, mixup=0.0, copy_paste=0.0, copy_paste_mode=flip, auto_augment=randaugment, erasing=0.4, crop_fraction=1.0, cfg=None, tracker=botsort.yaml, save_dir=runs/detect/train
Overriding model.yaml nc=80 with nc=3

| | from | n | params | module | arguments |
|----|------|--------------|--------|---|----------------------|
| 0 | | -1 | 1 | 464 ultralytics.nn.modules.conv.Conv | [3, 16, 3, 2] |
| 1 | | -1 | 1 | 4672 ultralytics.nn.modules.conv.Conv | [16, 32, 3, 2] |
| 2 | | -1 | 1 | 7360 ultralytics.nn.modules.block.C2f | [32, 32, 1, True] |
| 3 | | -1 | 1 | 18560 ultralytics.nn.modules.conv.Conv | [32, 64, 3, 2] |
| 4 | | -1 | 2 | 49664 ultralytics.nn.modules.block.C2f | [64, 64, 2, True] |
| 5 | | -1 | 1 | 73984 ultralytics.nn.modules.conv.Conv | [64, 128, 3, 2] |
| 6 | | -1 | 2 | 197632 ultralytics.nn.modules.block.C2f | [128, 128, 2, True] |
| 7 | | -1 | 1 | 295424 ultralytics.nn.modules.conv.Conv | [128, 256, 3, 2] |
| 8 | | -1 | 1 | 460288 ultralytics.nn.modules.block.C2f | [256, 256, 1, True] |
| 9 | | -1 | 1 | 164608 ultralytics.nn.modules.block.SPPF | [256, 256, 5] |
| 10 | | -1 | 1 | 0 torch.nn.modules.upsampling.Upsample | [None, 2, 'nearest'] |
| 11 | | [-1, 6] | 1 | 0 ultralytics.nn.modules.conv.Concat | [1] |
| 12 | | -1 | 1 | 148224 ultralytics.nn.modules.block.C2f | [384, 128, 1] |
| 13 | | -1 | 1 | 0 torch.nn.modules.upsampling.Upsample | [None, 2, 'nearest'] |
| 14 | | [-1, 4] | 1 | 0 ultralytics.nn.modules.conv.Concat | [1] |
| 15 | | -1 | 1 | 37248 ultralytics.nn.modules.block.C2f | [192, 64, 1] |
| 16 | | -1 | 1 | 36992 ultralytics.nn.modules.conv.Conv | [64, 64, 3, 2] |
| 17 | | [-1, 12] | 1 | 0 ultralytics.nn.modules.conv.Concat | [1] |
| 18 | | -1 | 1 | 123648 ultralytics.nn.modules.block.C2f | [192, 128, 1] |
| 19 | | -1 | 1 | 147712 ultralytics.nn.modules.conv.Conv | [128, 128, 3, 2] |
| 20 | | [-1, 9] | 1 | 0 ultralytics.nn.modules.conv.Concat | [1] |
| 21 | | -1 | 1 | 493056 ultralytics.nn.modules.block.C2f | [384, 256, 1] |
| 22 | | [15, 18, 21] | 1 | 751897 ultralytics.nn.modules.head.Detect | [3, [64, 128, 256]] |

Model summary: 129 layers, 3,011,433 parameters, 3,011,417 gradients

Transferred 319/355 items from pretrained weights

Freezing layer 'model.22.dfl.conv.weight'

train: Scanning /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/labels/train... 1008 images, 0 backgrounds, 0 corrupt: 100%|██████████| 1008/1008 [00:00<00:00, 3766.36it/s]

train: WARNING ! /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/train/img143.jpg: 1 duplicate labels removed
train: WARNING ! /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/train/img81.jpg: 1 duplicate labels removed
train: New cache created: /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/labels/train.cache
val: Scanning /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/labels/val... 288 images, 0 backgrounds, 0 corrupt: 100%|██████████| 288/288 [00:00<00:00, 4133.54it/s]
val: New cache created: /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/labels/val.cache
 Plotting labels to runs/detect/train/labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937' and determining best 'optimizer', 'lr0' and 'momentum' automatically...
optimizer: AdamW(lr=0.001429, momentum=0.9) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 bias(decay=0.0)
 Image sizes 640 train, 640 val
 Using 0 dataloader workers
 Logging results to **runs/detect/train**
 Starting training for 50 epochs...

| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |
|-------|-------------|------------------|---------------------|-----------------|-----------|---|--|
| 1/50 | 0G Class | 0.9837 Images | 1.766 Instances | 1.229 Box(P) | 558 R | 640: 100% ██████████ 63/63 [05:11<00:00, 4.95s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:38<00:00, 4. |
| | | all | 288 | 5334 | 0.962 | 0.596 | 0.644 0.505 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |
| 2/50 | 0G Class | 0.7912 Images | 0.7752 Instances | 1.132 Box(P) | 352 R | 640: 100% ██████████ 63/63 [05:15<00:00, 5.00s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. |
| | | all | 288 | 5334 | 0.888 | 0.835 | 0.921 0.702 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |
| 3/50 | 0G Class | 0.7588 Images | 0.6745 Instances | 1.094 Box(P) | 451 R | 640: 100% ██████████ 63/63 [05:16<00:00, 5.03s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:36<00:00, 4. |
| | | all | 288 | 5334 | 0.913 | 0.865 | 0.937 0.66 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |
| 4/50 | 0G Class | 0.7502 Images | 0.6292 Instances | 1.075 Box(P) | 485 R | 640: 100% ██████████ 63/63 [05:11<00:00, 4.94s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. |
| | | all | 288 | 5334 | 0.888 | 0.89 | 0.95 0.741 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |

| | | | | | | | | |
|---------|----------|---------------|------------------|------------------|--------------|--|---|---|
| | 5/50 | 0G Class | 0.7083 Images | 0.5749 Instances | 1.053 Box(P) | 485 R | 640: 100% ██████████ 63/63 [05:17<00:00, 5.05s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. |
| 15s/it] | | all | 288 | 5334 | 0.943 | 0.921 | 0.96 | 0.741 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 6/50 | 0G Class | 0.6949 Images | 0.5522 Instances | 1.038 Box(P) | 555 R | 640: 100% ██████████ 63/63 [05:25<00:00, 5.17s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. | |
| 18s/it] | | all | 288 | 5334 | 0.944 | 0.917 | 0.955 | 0.754 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 7/50 | 0G Class | 0.6824 Images | 0.5269 Instances | 1.032 Box(P) | 563 R | 640: 100% ██████████ 63/63 [05:13<00:00, 4.98s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. | |
| 12s/it] | | all | 288 | 5334 | 0.92 | 0.919 | 0.963 | 0.766 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 8/50 | 0G Class | 0.6643 Images | 0.5012 Instances | 1.026 Box(P) | 437 R | 640: 100% ██████████ 63/63 [05:02<00:00, 4.80s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. | |
| 15s/it] | | all | 288 | 5334 | 0.943 | 0.935 | 0.968 | 0.792 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 9/50 | 0G Class | 0.6503 Images | 0.4817 Instances | 1.015 Box(P) | 456 R | 640: 100% ██████████ 63/63 [05:14<00:00, 4.99s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. | |
| 15s/it] | | all | 288 | 5334 | 0.94 | 0.925 | 0.968 | 0.796 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 10/50 | 0G Class | 0.6432 Images | 0.469 Instances | 1.008 Box(P) | 576 R | 640: 100% ██████████ 63/63 [05:12<00:00, 4.95s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. | |
| 19s/it] | | all | 288 | 5334 | 0.949 | 0.922 | 0.961 | 0.76 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 11/50 | 0G Class | 0.6408 Images | 0.464 Instances | 1.009 Box(P) | 517 R | 640: 100% ██████████ 63/63 [05:33<00:00, 5.30s/it] | mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. | |
| 17s/it] | | all | 288 | 5334 | 0.944 | 0.933 | 0.97 | 0.801 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |

| | | | | | | | |
|-------|----------|---------------|------------------|------------------|--------------|--|--|
| | 12/50 | 0G Class | 0.6371 Images | 0.4549 Instances | 1.007 Box(P) | 379 R | 640: 100% ██████████ 63/63 [05:13<00:00, 4.98s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:39<00:00, 4.39s/it] |
| | | all | 288 | 5334 | 0.963 | 0.934 | 0.974 0.801 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |
| 13/50 | 0G Class | 0.6357 Images | 0.4453 Instances | 1.003 Box(P) | 370 R | 640: 100% ██████████ 63/63 [05:20<00:00, 5.08s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4.12s/it] | |
| | | all | 288 | 5334 | 0.945 | 0.936 | 0.97 0.8 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |
| 14/50 | 0G Class | 0.6279 Images | 0.4385 Instances | 1 Box(P) | 425 R | 640: 100% ██████████ 63/63 [05:05<00:00, 4.85s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4.13s/it] | |
| | | all | 288 | 5334 | 0.926 | 0.947 | 0.97 0.801 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |
| 15/50 | 0G Class | 0.6165 Images | 0.4292 Instances | 0.9982 Box(P) | 461 R | 640: 100% ██████████ 63/63 [05:05<00:00, 4.85s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4.11s/it] | |
| | | all | 288 | 5334 | 0.94 | 0.926 | 0.967 0.796 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |
| 16/50 | 0G Class | 0.6153 Images | 0.4252 Instances | 0.9986 Box(P) | 498 R | 640: 100% ██████████ 63/63 [05:03<00:00, 4.82s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:36<00:00, 4.07s/it] | |
| | | all | 288 | 5334 | 0.956 | 0.944 | 0.972 0.811 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |
| 17/50 | 0G Class | 0.6072 Images | 0.4189 Instances | 0.9909 Box(P) | 570 R | 640: 100% ██████████ 63/63 [05:00<00:00, 4.77s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:36<00:00, 4.11s/it] | |
| | | all | 288 | 5334 | 0.942 | 0.945 | 0.972 0.809 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |
| 18/50 | 0G Class | 0.6073 Images | 0.4136 Instances | 0.9951 Box(P) | 473 R | 640: 100% ██████████ 63/63 [05:00<00:00, 4.77s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:36<00:00, 4.07s/it] | |
| | | all | 288 | 5334 | 0.943 | 0.941 | 0.971 0.811 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | |

| | | | | | | |
|-------|-------------|------------------|---------------------|------------------|-----------|--|
| 19/50 | 0G Class | 0.6093 Images | 0.4101 Instances | 0.9916 Box(P) | 490 R | 640: 100% ██████████ 63/63 [05:02<00:00, 4.80s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:36<00:00, 4. 10s/it] |
| | all | 288 | 5334 | 0.957 | 0.94 | 0.974 0.815 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size |
| 20/50 | 0G Class | 0.6051 Images | 0.4055 Instances | 0.9889 Box(P) | 423 R | 640: 100% ██████████ 63/63 [20:49<00:00, 19.83s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:36<00:00, 4. 10s/it] |
| | all | 288 | 5334 | 0.931 | 0.944 | 0.969 0.805 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size |
| 21/50 | 0G Class | 0.6113 Images | 0.4028 Instances | 0.9901 Box(P) | 417 R | 640: 100% ██████████ 63/63 [05:06<00:00, 4.86s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 14s/it] |
| | all | 288 | 5334 | 0.966 | 0.927 | 0.972 0.814 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size |
| 22/50 | 0G Class | 0.5871 Images | 0.3931 Instances | 0.9799 Box(P) | 409 R | 640: 100% ██████████ 63/63 [21:00<00:00, 20.01s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [17:13<00:00, 11. 4.81s/it] |
| | all | 288 | 5334 | 0.947 | 0.938 | 0.975 0.816 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size |
| 23/50 | 0G Class | 0.5955 Images | 0.3913 Instances | 0.9868 Box(P) | 513 R | 640: 100% ██████████ 63/63 [24:57<00:00, 23.77s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:38<00:00, 4. 23s/it] |
| | all | 288 | 5334 | 0.957 | 0.938 | 0.97 0.803 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size |
| 24/50 | 0G Class | 0.588 Images | 0.3856 Instances | 0.9826 Box(P) | 415 R | 640: 100% ██████████ 63/63 [05:06<00:00, 4.86s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 15s/it] |
| | all | 288 | 5334 | 0.955 | 0.944 | 0.975 0.816 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size |
| 25/50 | 0G Class | 0.5904 Images | 0.3816 Instances | 0.982 Box(P) | 450 R | 640: 100% ██████████ 63/63 [14:19<00:00, 13.65s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:38<00:00, 4. 29s/it] |
| | all | 288 | 5334 | 0.962 | 0.943 | 0.974 0.813 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size |
| 26/50 | 0G Class | 0.5902 Images | 0.3775 Instances | 0.9795 Box(P) | 413 R | 640: 100% ██████████ 63/63 [05:24<00:00, 5.15s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:36<00:00, 4. 10s/it] |

| | | | | | | | | |
|-------|-------------|------------------|---------------------|------------------|-----------|--|-------|-------|
| | | all | 288 | 5334 | 0.953 | 0.946 | 0.974 | 0.822 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 27/50 | 0G Class | 0.5784 Images | 0.3664 Instances | 0.9755 Box(P) | 605 R | 640: 100% ██████████ 63/63 [05:08<00:00, 4.89s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 13s/it] | | |
| | | all | 288 | 5334 | 0.946 | 0.956 | 0.976 | 0.83 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 28/50 | 0G Class | 0.5793 Images | 0.369 Instances | 0.974 Box(P) | 508 R | 640: 100% ██████████ 63/63 [05:11<00:00, 4.94s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:36<00:00, 4. 09s/it] | | |
| | | all | 288 | 5334 | 0.954 | 0.952 | 0.976 | 0.832 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 29/50 | 0G Class | 0.5688 Images | 0.3652 Instances | 0.969 Box(P) | 452 R | 640: 100% ██████████ 63/63 [05:03<00:00, 4.82s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 14s/it] | | |
| | | all | 288 | 5334 | 0.958 | 0.947 | 0.976 | 0.825 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 30/50 | 0G Class | 0.5732 Images | 0.3629 Instances | 0.97 Box(P) | 512 R | 640: 100% ██████████ 63/63 [05:04<00:00, 4.84s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 13s/it] | | |
| | | all | 288 | 5334 | 0.954 | 0.949 | 0.975 | 0.827 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 31/50 | 0G Class | 0.5714 Images | 0.3611 Instances | 0.9725 Box(P) | 352 R | 640: 100% ██████████ 63/63 [05:04<00:00, 4.84s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 13s/it] | | |
| | | all | 288 | 5334 | 0.946 | 0.955 | 0.976 | 0.833 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 32/50 | 0G Class | 0.5719 Images | 0.3584 Instances | 0.9718 Box(P) | 469 R | 640: 100% ██████████ 63/63 [05:06<00:00, 4.87s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:36<00:00, 4. 11s/it] | | |
| | | all | 288 | 5334 | 0.949 | 0.949 | 0.976 | 0.825 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 33/50 | 0G Class | 0.5642 Images | 0.3521 Instances | 0.9727 Box(P) | 463 R | 640: 100% ██████████ 63/63 [05:06<00:00, 4.87s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:36<00:00, 4. 09s/it] | | |

| | | | | | | | | |
|-------|-------------|------------------|---------------------|------------------|-----------|--|-------|-------|
| | | all | 288 | 5334 | 0.96 | 0.951 | 0.978 | 0.836 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 34/50 | 0G Class | 0.5628 Images | 0.3508 Instances | 0.9651 Box(P) | 434 R | 640: 100% ██████████ 63/63 [05:07<00:00, 4.89s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 13s/it] | | |
| | | all | 288 | 5334 | 0.959 | 0.944 | 0.976 | 0.833 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 35/50 | 0G Class | 0.5664 Images | 0.3496 Instances | 0.9688 Box(P) | 488 R | 640: 100% ██████████ 63/63 [05:07<00:00, 4.88s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 14s/it] | | |
| | | all | 288 | 5334 | 0.949 | 0.949 | 0.977 | 0.839 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 36/50 | 0G Class | 0.5565 Images | 0.3433 Instances | 0.9655 Box(P) | 334 R | 640: 100% ██████████ 63/63 [05:07<00:00, 4.88s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 15s/it] | | |
| | | all | 288 | 5334 | 0.958 | 0.95 | 0.979 | 0.838 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 37/50 | 0G Class | 0.5526 Images | 0.3423 Instances | 0.965 Box(P) | 378 R | 640: 100% ██████████ 63/63 [05:07<00:00, 4.89s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 13s/it] | | |
| | | all | 288 | 5334 | 0.965 | 0.934 | 0.977 | 0.839 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 38/50 | 0G Class | 0.5538 Images | 0.3411 Instances | 0.9607 Box(P) | 545 R | 640: 100% ██████████ 63/63 [05:10<00:00, 4.92s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 16s/it] | | |
| | | all | 288 | 5334 | 0.95 | 0.969 | 0.982 | 0.844 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 39/50 | 0G Class | 0.5495 Images | 0.3359 Instances | 0.9606 Box(P) | 458 R | 640: 100% ██████████ 63/63 [05:07<00:00, 4.88s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 14s/it] | | |
| | | all | 288 | 5334 | 0.961 | 0.95 | 0.98 | 0.845 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 40/50 | 0G Class | 0.5438 Images | 0.3324 Instances | 0.9601 Box(P) | 511 R | 640: 100% ██████████ 63/63 [05:08<00:00, 4.89s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 15s/it] | | |

| | | | | | | | | |
|---------------------------|-------------|------------------|---------------------|------------------|-----------|--|-------|-------|
| | | all | 288 | 5334 | 0.954 | 0.957 | 0.978 | 0.841 |
| Closing dataloader mosaic | | | | | | | | |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 41/50 | 0G Class | 0.5213 Images | 0.3191 Instances | 0.9586 Box(P) | 268 R | 640: 100% ██████████ 63/63 [05:00<00:00, 4.77s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 14s/it] | | |
| | all | 288 | 5334 | 0.947 | 0.959 | 0.978 | 0.835 | |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 42/50 | 0G Class | 0.5205 Images | 0.3112 Instances | 0.954 Box(P) | 249 R | 640: 100% ██████████ 63/63 [05:01<00:00, 4.79s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 13s/it] | | |
| | all | 288 | 5334 | 0.955 | 0.95 | 0.979 | 0.842 | |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 43/50 | 0G Class | 0.5051 Images | 0.3028 Instances | 0.9435 Box(P) | 274 R | 640: 100% ██████████ 63/63 [04:59<00:00, 4.76s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 12s/it] | | |
| | all | 288 | 5334 | 0.954 | 0.952 | 0.978 | 0.84 | |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 44/50 | 0G Class | 0.5027 Images | 0.2968 Instances | 0.9448 Box(P) | 287 R | 640: 100% ██████████ 63/63 [05:00<00:00, 4.78s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 12s/it] | | |
| | all | 288 | 5334 | 0.954 | 0.957 | 0.978 | 0.845 | |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 45/50 | 0G Class | 0.5025 Images | 0.2983 Instances | 0.9447 Box(P) | 235 R | 640: 100% ██████████ 63/63 [05:02<00:00, 4.80s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 12s/it] | | |
| | all | 288 | 5334 | 0.951 | 0.96 | 0.979 | 0.847 | |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 46/50 | 0G Class | 0.4969 Images | 0.29 Instances | 0.9428 Box(P) | 276 R | 640: 100% ██████████ 63/63 [05:01<00:00, 4.78s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 12s/it] | | |
| | all | 288 | 5334 | 0.955 | 0.956 | 0.979 | 0.85 | |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | Size | | |
| 47/50 | 0G Class | 0.4968 Images | 0.2918 Instances | 0.9466 Box(P) | 277 R | 640: 100% ██████████ 63/63 [05:01<00:00, 4.79s/it] mAP50 mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. 12s/it] | | |

| | | | | | | | | |
|---------|---------|----------|----------|-----------|-----------|---|-------|--|
| | | all | 288 | 5334 | 0.955 | 0.952 | 0.977 | 0.848 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | | Size | |
| 48/50 | 0G | 0.4912 | 0.2875 | 0.9401 | 265 | 640: 100% ██████████ 63/63 [05:00<00:00, 4.77s/it] | mAP50 | mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. |
| 13s/it] | | Class | Images | Instances | Box(P) | R | | |
| | | all | 288 | 5334 | 0.949 | 0.964 | 0.98 | 0.851 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | | Size | |
| 49/50 | 0G | 0.4881 | 0.2858 | 0.9352 | 231 | 640: 100% ██████████ 63/63 [05:04<00:00, 4.84s/it] | mAP50 | mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. |
| 13s/it] | | Class | Images | Instances | Box(P) | R | | |
| | | all | 288 | 5334 | 0.949 | 0.96 | 0.98 | 0.851 |
| Epoch | GPU_mem | box_loss | cls_loss | dfl_loss | Instances | | Size | |
| 50/50 | 0G | 0.4829 | 0.2817 | 0.9354 | 248 | 640: 100% ██████████ 63/63 [04:59<00:00, 4.76s/it] | mAP50 | mAP50-95): 100% ██████████ 9/9 [00:37<00:00, 4. |
| 14s/it] | | Class | Images | Instances | Box(P) | R | | |
| | | all | 288 | 5334 | 0.95 | 0.96 | 0.98 | 0.853 |

50 epochs completed in 6.087 hours.

Optimizer stripped from runs/detect/train/weights/last.pt, 6.2MB

Optimizer stripped from runs/detect/train/weights/best.pt, 6.2MB

Validating runs/detect/train/weights/best.pt...

Ultralytics 8.3.90 🚀 Python-3.10.13 torch-2.6.0 CPU (Apple M2)

Model summary (fused): 72 layers, 3,006,233 parameters, 0 gradients

| | | | | | | | | |
|---------|----------|--------|-----------|--------|-------|-------|--|-------|
| | Class | Images | Instances | Box(P) | R | mAP50 | mAP50-95): 100% ██████████ 9/9 [00:33<00:00, 3. | |
| 77s/it] | | all | 288 | 5334 | 0.95 | 0.959 | 0.98 | 0.853 |
| | WBC | 287 | 305 | 0.991 | 0.974 | 0.985 | 0.87 | |
| | RBC | 288 | 4850 | 0.933 | 0.976 | 0.989 | 0.904 | |
| | Platelet | 108 | 179 | 0.927 | 0.928 | 0.966 | 0.785 | |

Speed: 1.0ms preprocess, 113.7ms inference, 0.0ms loss, 0.2ms postprocess per image

Results saved to **runs/detect/train**

Training is complete!

Set a seed so that the result of evaluation and testing will remain same.

```
In [ ]: # Set fixed seed so that the result of prediction remains same.
import torch
import random
import numpy as np
```

```
# Set global random seeds
def set_seed(seed=42):
    random.seed(seed)
    np.random.seed(seed)
    torch.manual_seed(seed)

set_seed(42)
```

Validation evaluation

```
In [ ]: from ultralytics import YOLO

# Load the trained YOLOv8 model
model = YOLO("runs/detect/train/weights/best.pt") # Selecting the best model

metrics_val = model.val(save_json=True, project="runs/detect", name="val")

print("Validation evaluation completed, results saved in runs/detect/val/")

print(metrics_val)
```

Ultralytics 8.3.90 🚀 Python-3.10.13 torch-2.6.0 CPU (Apple M2)
Model summary (fused): 72 layers, 3,006,233 parameters, 0 gradients

val: Scanning /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/labels/val.cache... 288 images, 0 backgrounds, 0 corrupt: 100%|██████████| 288/288 [00:00<?, ?it/s]
Class Images Instances Box(P) R mAP50 mAP50-95): 100%|██████████| 18/18 [00:38<00:00, 2.11s/it]

| | | | | | | |
|----------|-----|------|-------|-------|-------|-------|
| all | 288 | 5334 | 0.95 | 0.959 | 0.98 | 0.853 |
| WBC | 287 | 305 | 0.991 | 0.974 | 0.985 | 0.87 |
| RBC | 288 | 4850 | 0.933 | 0.976 | 0.989 | 0.904 |
| Platelet | 108 | 179 | 0.927 | 0.928 | 0.966 | 0.785 |

Speed: 0.6ms preprocess, 128.4ms inference, 0.0ms loss, 0.3ms postprocess per image

Saving runs/detect/val/predictions.json...

Results saved to **runs/detect/val**

Validation evaluation completed, results saved in runs/detect/val/
ultralytics.utils.metrics.DetMetrics object with attributes:

```

ap_class_index: array([0, 1, 2])
box: ultralytics.utils.metrics.Metric object
confusion_matrix: <ultralytics.utils.metrics.ConfusionMatrix object at 0x14c34c880>
curves: ['Precision-Recall(B)', 'F1-Confidence(B)', 'Precision-Confidence(B)', 'Recall-Confidence(B)']
curves_results: [[array([
    0, 0.001001, 0.002002, 0.003003, 0.004004, 0.005005, 0.006006, 0.007007,
0.008008, 0.009009, 0.01001, 0.011011, 0.012012, 0.013013, 0.014014, 0.015015, 0.016016, 0.017017,
0.018018, 0.019019, 0.02002, 0.021021, 0.022022, 0.023023,
    0.024024, 0.025025, 0.026026, 0.027027, 0.028028, 0.029029, 0.03003, 0.031031, 0.032032,
0.033033, 0.034034, 0.035035, 0.036036, 0.037037, 0.038038, 0.039039, 0.04004, 0.041041, 0.042042,
0.043043, 0.044044, 0.045045, 0.046046, 0.047047,
    0.048048, 0.049049, 0.05005, 0.051051, 0.052052, 0.053053, 0.054054, 0.055055, 0.056056,
0.057057, 0.058058, 0.059059, 0.06006, 0.061061, 0.062062, 0.063063, 0.064064, 0.065065, 0.066066,
0.067067, 0.068068, 0.069069, 0.07007, 0.071071,
    0.072072, 0.073073, 0.074074, 0.075075, 0.076076, 0.077077, 0.078078, 0.079079, 0.08008,
0.081081, 0.082082, 0.083083, 0.084084, 0.085085, 0.086086, 0.087087, 0.088088, 0.089089, 0.09009,
0.091091, 0.092092, 0.093093, 0.094094, 0.095095,
    0.096096, 0.097097, 0.098098, 0.099099, 0.1001, 0.1011, 0.1021, 0.1031, 0.1041,
0.10511, 0.10611, 0.10711, 0.10811, 0.10911, 0.11011, 0.11111, 0.11211, 0.11311, 0.11411,
0.11512, 0.11612, 0.11712, 0.11812, 0.11912,
    0.12012, 0.12112, 0.12212, 0.12312, 0.12412, 0.12513, 0.12613, 0.12713, 0.12813,
0.12913, 0.13013, 0.13113, 0.13213, 0.13313, 0.13413, 0.13514, 0.13614, 0.13714, 0.13814,
0.13914, 0.14014, 0.14114, 0.14214, 0.14314,
    0.14414, 0.14515, 0.14615, 0.14715, 0.14815, 0.14915, 0.15015, 0.15115, 0.15215,
0.15315, 0.15415, 0.15516, 0.15616, 0.15716, 0.15816, 0.15916, 0.16016, 0.16116, 0.16216,
0.16316, 0.16416, 0.16517, 0.16617, 0.16717,
    0.16817, 0.16917, 0.17017, 0.17117, 0.17217, 0.17317, 0.17417, 0.17518, 0.17618,
0.17718, 0.17818, 0.17918, 0.18018, 0.18118, 0.18218, 0.18318, 0.18418, 0.18519, 0.18619,
0.18719, 0.18819, 0.18919, 0.19019, 0.19119,
    0.19219, 0.19319, 0.19419, 0.1952, 0.1962, 0.1972, 0.1982, 0.1992, 0.2002,
0.2012, 0.2022, 0.2032, 0.2042, 0.20521, 0.20621, 0.20721, 0.20821, 0.20921, 0.21021,
0.21121, 0.21221, 0.21321, 0.21421, 0.21522,
    0.21622, 0.21722, 0.21822, 0.21922, 0.22022, 0.22122, 0.22222, 0.22322, 0.22422,
0.22523, 0.22623, 0.22723, 0.22823, 0.22923, 0.23023, 0.23123, 0.23223, 0.23323, 0.23423,
0.23524, 0.23624, 0.23724, 0.23824, 0.23924,
    0.24024, 0.24124, 0.24224, 0.24324, 0.24424, 0.24525, 0.24625, 0.24725, 0.24825,
0.24925, 0.25025, 0.25125, 0.25225, 0.25325, 0.25425, 0.25526, 0.25626, 0.25726, 0.25826,
])]]]

```

| | | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--|
| 0.25926, | 0.26026, | 0.26126, | 0.26226, | 0.26326, | | | | | | |
| | 0.26426, | 0.26527, | 0.26627, | 0.26727, | 0.26827, | 0.26927, | 0.27027, | 0.27127, | 0.27227, | |
| 0.27327, | 0.27427, | 0.27528, | 0.27628, | 0.27728, | 0.27828, | 0.27928, | 0.28028, | 0.28128, | 0.28228, | |
| 0.28328, | 0.28428, | 0.28529, | 0.28629, | 0.28729, | | | | | | |
| | 0.28829, | 0.28929, | 0.29029, | 0.29129, | 0.29229, | 0.29329, | 0.29429, | 0.2953, | 0.2963, | |
| 0.2973, | 0.2983, | 0.2993, | 0.3003, | 0.3013, | 0.3023, | 0.3033, | 0.3043, | 0.30531, | 0.30631, | |
| 0.30731, | 0.30831, | 0.30931, | 0.31031, | 0.31131, | | | | | | |
| | 0.31231, | 0.31331, | 0.31431, | 0.31532, | 0.31632, | 0.31732, | 0.31832, | 0.31932, | 0.32032, | |
| 0.32132, | 0.32232, | 0.32332, | 0.32432, | 0.32533, | 0.32633, | 0.32733, | 0.32833, | 0.32933, | 0.33033, | |
| 0.33133, | 0.33233, | 0.33333, | 0.33433, | 0.33534, | | | | | | |
| | 0.33634, | 0.33734, | 0.33834, | 0.33934, | 0.34034, | 0.34134, | 0.34234, | 0.34334, | 0.34434, | |
| 0.34535, | 0.34635, | 0.34735, | 0.34835, | 0.34935, | 0.35035, | 0.35135, | 0.35235, | 0.35335, | 0.35435, | |
| 0.35536, | 0.35636, | 0.35736, | 0.35836, | 0.35936, | | | | | | |
| | 0.36036, | 0.36136, | 0.36236, | 0.36336, | 0.36436, | 0.36537, | 0.36637, | 0.36737, | 0.36837, | |
| 0.36937, | 0.37037, | 0.37137, | 0.37237, | 0.37337, | 0.37437, | 0.37538, | 0.37638, | 0.37738, | 0.37838, | |
| 0.37938, | 0.38038, | 0.38138, | 0.38238, | 0.38338, | | | | | | |
| | 0.38438, | 0.38539, | 0.38639, | 0.38739, | 0.38839, | 0.38939, | 0.39039, | 0.39139, | 0.39239, | |
| 0.39339, | 0.39439, | 0.39539, | 0.39639, | 0.39739, | 0.39839, | 0.39939, | 0.40039, | 0.40139, | 0.40239, | |
| 0.4034, | 0.4044, | 0.40541, | 0.40641, | 0.40741, | | | | | | |
| | 0.40841, | 0.40941, | 0.41041, | 0.41141, | 0.41241, | 0.41341, | 0.41441, | 0.41542, | 0.41642, | |
| 0.41742, | 0.41842, | 0.41942, | 0.42042, | 0.42142, | 0.42242, | 0.42342, | 0.42442, | 0.42543, | 0.42643, | |
| 0.42743, | 0.42843, | 0.42943, | 0.43043, | 0.43143, | | | | | | |
| | 0.43243, | 0.43343, | 0.43443, | 0.43544, | 0.43644, | 0.43744, | 0.43844, | 0.43944, | 0.44044, | |
| 0.44144, | 0.44244, | 0.44344, | 0.44444, | 0.44545, | 0.44645, | 0.44745, | 0.44845, | 0.44945, | 0.45045, | |
| 0.45145, | 0.45245, | 0.45345, | 0.45445, | 0.45546, | | | | | | |
| | 0.45646, | 0.45746, | 0.45846, | 0.45946, | 0.46046, | 0.46146, | 0.46246, | 0.46346, | 0.46446, | |
| 0.46547, | 0.46647, | 0.46747, | 0.46847, | 0.46947, | 0.47047, | 0.47147, | 0.47247, | 0.47347, | 0.47447, | |
| 0.47548, | 0.47648, | 0.47748, | 0.47848, | 0.47948, | | | | | | |
| | 0.48048, | 0.48148, | 0.48248, | 0.48348, | 0.48448, | 0.48549, | 0.48649, | 0.48749, | 0.48849, | |
| 0.48949, | 0.49049, | 0.49149, | 0.49249, | 0.49349, | 0.49449, | 0.4955, | 0.4965, | 0.4975, | 0.4985, | |
| 0.4995, | 0.5005, | 0.5015, | 0.5025, | 0.5035, | | | | | | |
| | 0.5045, | 0.50551, | 0.50651, | 0.50751, | 0.50851, | 0.50951, | 0.51051, | 0.51151, | 0.51251, | |
| 0.51351, | 0.51451, | 0.51552, | 0.51652, | 0.51752, | 0.51852, | 0.51952, | 0.52052, | 0.52152, | 0.52252, | |
| 0.52352, | 0.52452, | 0.52553, | 0.52653, | 0.52753, | | | | | | |
| | 0.52853, | 0.52953, | 0.53053, | 0.53153, | 0.53253, | 0.53353, | 0.53453, | 0.53554, | 0.53654, | |
| 0.53754, | 0.53854, | 0.53954, | 0.54054, | 0.54154, | 0.54254, | 0.54354, | 0.54454, | 0.54555, | 0.54655, | |
| 0.54755, | 0.54855, | 0.54955, | 0.55055, | 0.55155, | | | | | | |
| | 0.55255, | 0.55355, | 0.55455, | 0.55556, | 0.55656, | 0.55756, | 0.55856, | 0.55956, | 0.56056, | |
| 0.56156, | 0.56256, | 0.56356, | 0.56456, | 0.56557, | 0.56657, | 0.56757, | 0.56857, | 0.56957, | 0.57057, | |
| 0.57157, | 0.57257, | 0.57357, | 0.57457, | 0.57558, | | | | | | |
| | 0.57658, | 0.57758, | 0.57858, | 0.57958, | 0.58058, | 0.58158, | 0.58258, | 0.58358, | 0.58458, | |
| 0.58559, | 0.58659, | 0.58759, | 0.58859, | 0.58959, | 0.59059, | 0.59159, | 0.59259, | 0.59359, | 0.59459, | |
| 0.5956, | 0.5966, | 0.5976, | 0.5986, | 0.5996, | | | | | | |
| | 0.6006, | 0.6016, | 0.6026, | 0.6036, | 0.6046, | 0.60561, | 0.60661, | 0.60761, | 0.60861, | |
| 0.60961, | 0.61061, | 0.61161, | 0.61261, | 0.61361, | 0.61461, | 0.61562, | 0.61662, | 0.61762, | 0.61862, | |
| 0.61962, | 0.62062, | 0.62162, | 0.62262, | 0.62362, | | | | | | |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 0.62462, | 0.62563, | 0.62663, | 0.62763, | 0.62863, | 0.62963, | 0.63063, | 0.63163, | 0.63263, |
| 0.63363, | 0.63463, | 0.63564, | 0.63664, | 0.63764, | 0.63864, | 0.63964, | 0.64064, | 0.64164, | 0.64264, |
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| | 0.64865, | 0.64965, | 0.65065, | 0.65165, | 0.65265, | 0.65365, | 0.65465, | 0.65566, | 0.65666, |
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| | 0.67267, | 0.67367, | 0.67467, | 0.67568, | 0.67668, | 0.67768, | 0.67868, | 0.67968, | 0.68068, |
| 0.68168, | 0.68268, | 0.68368, | 0.68468, | 0.68569, | 0.68669, | 0.68769, | 0.68869, | 0.68969, | 0.69069, |
| 0.69169, | 0.69269, | 0.69369, | 0.69469, | 0.6957, | | | | | |
| | 0.6967, | 0.6977, | 0.6987, | 0.6997, | 0.7007, | 0.7017, | 0.7027, | 0.7037, | 0.7047, |
| 0.70571, | 0.70671, | 0.70771, | 0.70871, | 0.70971, | 0.71071, | 0.71171, | 0.71271, | 0.71371, | 0.71471, |
| 0.71572, | 0.71672, | 0.71772, | 0.71872, | 0.71972, | | | | | |
| | 0.72072, | 0.72172, | 0.72272, | 0.72372, | 0.72472, | 0.72573, | 0.72673, | 0.72773, | 0.72873, |
| 0.72973, | 0.73073, | 0.73173, | 0.73273, | 0.73373, | 0.73473, | 0.73574, | 0.73674, | 0.73774, | 0.73874, |
| 0.73974, | 0.74074, | 0.74174, | 0.74274, | 0.74374, | | | | | |
| | 0.74474, | 0.74575, | 0.74675, | 0.74775, | 0.74875, | 0.74975, | 0.75075, | 0.75175, | 0.75275, |
| 0.75375, | 0.75475, | 0.75576, | 0.75676, | 0.75776, | 0.75876, | 0.75976, | 0.76076, | 0.76176, | 0.76276, |
| 0.76376, | 0.76476, | 0.76577, | 0.76677, | 0.76777, | | | | | |
| | 0.76877, | 0.76977, | 0.77077, | 0.77177, | 0.77277, | 0.77377, | 0.77477, | 0.77578, | 0.77678, |
| 0.77778, | 0.77878, | 0.77978, | 0.78078, | 0.78178, | 0.78278, | 0.78378, | 0.78478, | 0.78579, | 0.78679, |
| 0.78779, | 0.78879, | 0.78979, | 0.79079, | 0.79179, | | | | | |
| | 0.79279, | 0.79379, | 0.79479, | 0.7958, | 0.7968, | 0.7978, | 0.7988, | 0.7998, | 0.8008, |
| 0.8018, | 0.8028, | 0.8038, | 0.8048, | 0.80581, | 0.80681, | 0.80781, | 0.80881, | 0.80981, | 0.81081, |
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| | 0.81682, | 0.81782, | 0.81882, | 0.81982, | 0.82082, | 0.82182, | 0.82282, | 0.82382, | 0.82482, |
| 0.82583, | 0.82683, | 0.82783, | 0.82883, | 0.82983, | 0.83083, | 0.83183, | 0.83283, | 0.83383, | 0.83483, |
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| | 0.84084, | 0.84184, | 0.84284, | 0.84384, | 0.84484, | 0.84585, | 0.84685, | 0.84785, | 0.84885, |
| 0.84985, | 0.85085, | 0.85185, | 0.85285, | 0.85385, | 0.85485, | 0.85586, | 0.85686, | 0.85786, | 0.85886, |
| 0.85986, | 0.86086, | 0.86186, | 0.86286, | 0.86386, | | | | | |
| | 0.86486, | 0.86587, | 0.86687, | 0.86787, | 0.86887, | 0.86987, | 0.87087, | 0.87187, | 0.87287, |
| 0.87387, | 0.87487, | 0.87588, | 0.87688, | 0.87788, | 0.87888, | 0.87988, | 0.88088, | 0.88188, | 0.88288, |
| 0.88388, | 0.88488, | 0.88589, | 0.88689, | 0.88789, | | | | | |
| | 0.88889, | 0.88989, | 0.89089, | 0.89189, | 0.89289, | 0.89389, | 0.89489, | 0.8959, | 0.8969, |
| 0.8979, | 0.8989, | 0.8999, | 0.9009, | 0.9019, | 0.9029, | 0.9039, | 0.9049, | 0.90591, | 0.90691, |
| 0.90791, | 0.90891, | 0.90991, | 0.91091, | 0.91191, | | | | | |
| | 0.91291, | 0.91391, | 0.91491, | 0.91592, | 0.91692, | 0.91792, | 0.91892, | 0.91992, | 0.92092, |
| 0.92192, | 0.92292, | 0.92392, | 0.92492, | 0.92593, | 0.92693, | 0.92793, | 0.92893, | 0.92993, | 0.93093, |
| 0.93193, | 0.93293, | 0.93393, | 0.93493, | 0.93594, | | | | | |
| | 0.93694, | 0.93794, | 0.93894, | 0.93994, | 0.94094, | 0.94194, | 0.94294, | 0.94394, | 0.94494, |
| 0.94595, | 0.94695, | 0.94795, | 0.94895, | 0.94995, | 0.95095, | 0.95195, | 0.95295, | 0.95395, | 0.95495, |
| 0.95596, | 0.95696, | 0.95796, | 0.95896, | 0.95996, | | | | | |
| | 0.96096, | 0.96196, | 0.96296, | 0.96396, | 0.96496, | 0.96597, | 0.96697, | 0.96797, | 0.96897, |
| 0.96997, | 0.97097, | 0.97197, | 0.97297, | 0.97397, | 0.97497, | 0.97598, | 0.97698, | 0.97798, | 0.97898, |
| 0.97998, | 0.98098, | 0.98198, | 0.98298, | 0.98398, | | | | | |
| | 0.98498, | 0.98599, | 0.98699, | 0.98799, | 0.98899, | 0.98999, | 0.99099, | 0.99199, | 0.99299, |

| | | | | | | | | |
|--------------|-----------|-----------|-----------|-----------|-----------|---------------------------------------|-----------|-----------|
| 0.99399, | 0.99499, | 0.996, | 0.997, | 0.998, | 0.999, | 1]), array([[| 1, | 1, |
| 1, ... , | 0.027755, | 0.013878, | 0], | | | | | |
| [| 1, | 1, | 1, ... , | 0.46986, | 0.22451, | 0], | | |
| [| 1, | 1, | 1, ... , | 0.099981, | 0.04999, | 0]], 'Recall', 'Precision'], [array([| | |
| 0, 0.001001, | 0.002002, | 0.003003, | 0.004004, | 0.005005, | 0.006006, | 0.007007, | 0.008008, | 0.009009, |
| 0.01001, | 0.011011, | 0.012012, | 0.013013, | 0.014014, | 0.015015, | 0.016016, | 0.017017, | 0.018018, |
| 0.02002, | 0.021021, | 0.022022, | 0.023023, | | | | | 0.019019, |
| | 0.024024, | 0.025025, | 0.026026, | 0.027027, | 0.028028, | 0.029029, | 0.03003, | 0.031031, |
| 0.033033, | 0.034034, | 0.035035, | 0.036036, | 0.037037, | 0.038038, | 0.039039, | 0.04004, | 0.041041, |
| 0.043043, | 0.044044, | 0.045045, | 0.046046, | 0.047047, | | | | 0.042042, |
| | 0.048048, | 0.049049, | 0.05005, | 0.051051, | 0.052052, | 0.053053, | 0.054054, | 0.055055, |
| 0.057057, | 0.058058, | 0.059059, | 0.06006, | 0.061061, | 0.062062, | 0.063063, | 0.064064, | 0.065065, |
| 0.067067, | 0.068068, | 0.069069, | 0.07007, | 0.071071, | | | | 0.066066, |
| | 0.072072, | 0.073073, | 0.074074, | 0.075075, | 0.076076, | 0.077077, | 0.078078, | 0.079079, |
| 0.081081, | 0.082082, | 0.083083, | 0.084084, | 0.085085, | 0.086086, | 0.087087, | 0.088088, | 0.089089, |
| 0.091091, | 0.092092, | 0.093093, | 0.094094, | 0.095095, | | | | 0.09009, |
| | 0.096096, | 0.097097, | 0.098098, | 0.099099, | 0.1001, | 0.1011, | 0.1021, | 0.1031, |
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| 0.11512, | 0.11612, | 0.11712, | 0.11812, | 0.11912, | | | | 0.11411, |
| | 0.12012, | 0.12112, | 0.12212, | 0.12312, | 0.12412, | 0.12513, | 0.12613, | 0.12713, |
| 0.12913, | 0.13013, | 0.13113, | 0.13213, | 0.13313, | 0.13413, | 0.13514, | 0.13614, | 0.13714, |
| 0.13914, | 0.14014, | 0.14114, | 0.14214, | 0.14314, | | | | 0.13814, |
| | 0.14414, | 0.14515, | 0.14615, | 0.14715, | 0.14815, | 0.14915, | 0.15015, | 0.15115, |
| 0.15315, | 0.15415, | 0.15516, | 0.15616, | 0.15716, | 0.15816, | 0.15916, | 0.16016, | 0.16116, |
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| | 0.16817, | 0.16917, | 0.17017, | 0.17117, | 0.17217, | 0.17317, | 0.17417, | 0.17518, |
| 0.17718, | 0.17818, | 0.17918, | 0.18018, | 0.18118, | 0.18218, | 0.18318, | 0.18418, | 0.18519, |
| 0.18719, | 0.18819, | 0.18919, | 0.19019, | 0.19119, | | | | 0.18619, |
| | 0.19219, | 0.19319, | 0.19419, | 0.1952, | 0.1962, | 0.1972, | 0.1982, | 0.1992, |
| 0.2012, | 0.2022, | 0.2032, | 0.2042, | 0.20521, | 0.20621, | 0.20721, | 0.20821, | 0.20921, |
| 0.21121, | 0.21221, | 0.21321, | 0.21421, | 0.21522, | | | | 0.21021, |
| | 0.21622, | 0.21722, | 0.21822, | 0.21922, | 0.22022, | 0.22122, | 0.22222, | 0.22322, |
| 0.22523, | 0.22623, | 0.22723, | 0.22823, | 0.22923, | 0.23023, | 0.23123, | 0.23223, | 0.23323, |
| 0.23524, | 0.23624, | 0.23724, | 0.23824, | 0.23924, | | | | 0.23423, |
| | 0.24024, | 0.24124, | 0.24224, | 0.24324, | 0.24424, | 0.24525, | 0.24625, | 0.24725, |
| 0.24925, | 0.25025, | 0.25125, | 0.25225, | 0.25325, | 0.25425, | 0.25526, | 0.25626, | 0.25726, |
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| | 0.26426, | 0.26527, | 0.26627, | 0.26727, | 0.26827, | 0.26927, | 0.27027, | 0.27127, |
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| | 0.28829, | 0.28929, | 0.29029, | 0.29129, | 0.29229, | 0.29329, | 0.29429, | 0.2953, |
| 0.2973, | 0.2983, | 0.2993, | 0.3003, | 0.3013, | 0.3023, | 0.3033, | 0.3043, | 0.30531, |
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| | 0.31231, | 0.31331, | 0.31431, | 0.31532, | 0.31632, | 0.31732, | 0.31832, | 0.31932, |
| 0.32132, | 0.32232, | 0.32332, | 0.32432, | 0.32533, | 0.32633, | 0.32733, | 0.32833, | 0.32933, |
| 0.33133, | 0.33233, | 0.33333, | 0.33433, | 0.33534, | | | | 0.33033, |

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| | 0.33634, | 0.33734, | 0.33834, | 0.33934, | 0.34034, | 0.34134, | 0.34234, | 0.34334, | 0.34434, |
| 0.34535, | 0.34635, | 0.34735, | 0.34835, | 0.34935, | 0.35035, | 0.35135, | 0.35235, | 0.35335, | 0.35435, |
| 0.35536, | 0.35636, | 0.35736, | 0.35836, | 0.35936, | | | | | |
| | 0.36036, | 0.36136, | 0.36236, | 0.36336, | 0.36436, | 0.36537, | 0.36637, | 0.36737, | 0.36837, |
| 0.36937, | 0.37037, | 0.37137, | 0.37237, | 0.37337, | 0.37437, | 0.37538, | 0.37638, | 0.37738, | 0.37838, |
| 0.37938, | 0.38038, | 0.38138, | 0.38238, | 0.38338, | | | | | |
| | 0.38438, | 0.38539, | 0.38639, | 0.38739, | 0.38839, | 0.38939, | 0.39039, | 0.39139, | 0.39239, |
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| 0.4034, | 0.4044, | 0.40541, | 0.40641, | 0.40741, | | | | | |
| | 0.40841, | 0.40941, | 0.41041, | 0.41141, | 0.41241, | 0.41341, | 0.41441, | 0.41542, | 0.41642, |
| 0.41742, | 0.41842, | 0.41942, | 0.42042, | 0.42142, | 0.42242, | 0.42342, | 0.42442, | 0.42543, | 0.42643, |
| 0.42743, | 0.42843, | 0.42943, | 0.43043, | 0.43143, | | | | | |
| | 0.43243, | 0.43343, | 0.43443, | 0.43544, | 0.43644, | 0.43744, | 0.43844, | 0.43944, | 0.44044, |
| 0.44144, | 0.44244, | 0.44344, | 0.44444, | 0.44545, | 0.44645, | 0.44745, | 0.44845, | 0.44945, | 0.45045, |
| 0.45145, | 0.45245, | 0.45345, | 0.45445, | 0.45546, | | | | | |
| | 0.45646, | 0.45746, | 0.45846, | 0.45946, | 0.46046, | 0.46146, | 0.46246, | 0.46346, | 0.46446, |
| 0.46547, | 0.46647, | 0.46747, | 0.46847, | 0.46947, | 0.47047, | 0.47147, | 0.47247, | 0.47347, | 0.47447, |
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| | 0.48048, | 0.48148, | 0.48248, | 0.48348, | 0.48448, | 0.48549, | 0.48649, | 0.48749, | 0.48849, |
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| | 0.5045, | 0.50551, | 0.50651, | 0.50751, | 0.50851, | 0.50951, | 0.51051, | 0.51151, | 0.51251, |
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| | 0.52853, | 0.52953, | 0.53053, | 0.53153, | 0.53253, | 0.53353, | 0.53453, | 0.53554, | 0.53654, |
| 0.53754, | 0.53854, | 0.53954, | 0.54054, | 0.54154, | 0.54254, | 0.54354, | 0.54454, | 0.54555, | 0.54655, |
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| | 0.55255, | 0.55355, | 0.55455, | 0.55556, | 0.55656, | 0.55756, | 0.55856, | 0.55956, | 0.56056, |
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| | 0.57658, | 0.57758, | 0.57858, | 0.57958, | 0.58058, | 0.58158, | 0.58258, | 0.58358, | 0.58458, |
| 0.58559, | 0.58659, | 0.58759, | 0.58859, | 0.58959, | 0.59059, | 0.59159, | 0.59259, | 0.59359, | 0.59459, |
| 0.5956, | 0.5966, | 0.5976, | 0.5986, | 0.5996, | | | | | |
| | 0.6006, | 0.6016, | 0.6026, | 0.6036, | 0.6046, | 0.60561, | 0.60661, | 0.60761, | 0.60861, |
| 0.60961, | 0.61061, | 0.61161, | 0.61261, | 0.61361, | 0.61461, | 0.61562, | 0.61662, | 0.61762, | 0.61862, |
| 0.61962, | 0.62062, | 0.62162, | 0.62262, | 0.62362, | | | | | |
| | 0.62462, | 0.62563, | 0.62663, | 0.62763, | 0.62863, | 0.62963, | 0.63063, | 0.63163, | 0.63263, |
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| 0.64364, | 0.64464, | 0.64565, | 0.64665, | 0.64765, | | | | | |
| | 0.64865, | 0.64965, | 0.65065, | 0.65165, | 0.65265, | 0.65365, | 0.65465, | 0.65566, | 0.65666, |
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| 0.66767, | 0.66867, | 0.66967, | 0.67067, | 0.67167, | | | | | |
| | 0.67267, | 0.67367, | 0.67467, | 0.67568, | 0.67668, | 0.67768, | 0.67868, | 0.67968, | 0.68068, |
| 0.68168, | 0.68268, | 0.68368, | 0.68468, | 0.68569, | 0.68669, | 0.68769, | 0.68869, | 0.68969, | 0.69069, |
| 0.69169, | 0.69269, | 0.69369, | 0.69469, | 0.6957, | | | | | |
| | 0.6967, | 0.6977, | 0.6987, | 0.6997, | 0.7007, | 0.7017, | 0.7027, | 0.7037, | 0.7047, |

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|-----------|------------|-----------|-----------|-----------|-----------|-----------|---------------|---------------|-----------------|------|
| 0.70571, | 0.70671, | 0.70771, | 0.70871, | 0.70971, | 0.71071, | 0.71171, | 0.71271, | 0.71371, | 0.71471, | |
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| | 0.72072, | 0.72172, | 0.72272, | 0.72372, | 0.72472, | 0.72573, | 0.72673, | 0.72773, | 0.72873, | |
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| 0.73974, | 0.74074, | 0.74174, | 0.74274, | 0.74374, | | | | | | |
| | 0.74474, | 0.74575, | 0.74675, | 0.74775, | 0.74875, | 0.74975, | 0.75075, | 0.75175, | 0.75275, | |
| 0.75375, | 0.75475, | 0.75576, | 0.75676, | 0.75776, | 0.75876, | 0.75976, | 0.76076, | 0.76176, | 0.76276, | |
| 0.76376, | 0.76476, | 0.76577, | 0.76677, | 0.76777, | | | | | | |
| | 0.76877, | 0.76977, | 0.77077, | 0.77177, | 0.77277, | 0.77377, | 0.77477, | 0.77578, | 0.77678, | |
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| 0.78779, | 0.78879, | 0.78979, | 0.79079, | 0.79179, | | | | | | |
| | 0.79279, | 0.79379, | 0.79479, | 0.7958, | 0.7968, | 0.7978, | 0.7988, | 0.7998, | 0.8008, | |
| 0.8018, | 0.8028, | 0.8038, | 0.8048, | 0.80581, | 0.80681, | 0.80781, | 0.80881, | 0.80981, | 0.81081, | |
| 0.81181, | 0.81281, | 0.81381, | 0.81481, | 0.81582, | | | | | | |
| | 0.81682, | 0.81782, | 0.81882, | 0.81982, | 0.82082, | 0.82182, | 0.82282, | 0.82382, | 0.82482, | |
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| | 0.84084, | 0.84184, | 0.84284, | 0.84384, | 0.84484, | 0.84585, | 0.84685, | 0.84785, | 0.84885, | |
| 0.84985, | 0.85085, | 0.85185, | 0.85285, | 0.85385, | 0.85485, | 0.85586, | 0.85686, | 0.85786, | 0.85886, | |
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| | 0.86486, | 0.86587, | 0.86687, | 0.86787, | 0.86887, | 0.86987, | 0.87087, | 0.87187, | 0.87287, | |
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| | 0.88889, | 0.88989, | 0.89089, | 0.89189, | 0.89289, | 0.89389, | 0.89489, | 0.8959, | 0.8969, | |
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| 0.90791, | 0.90891, | 0.90991, | 0.91091, | 0.91191, | | | | | | |
| | 0.91291, | 0.91391, | 0.91491, | 0.91592, | 0.91692, | 0.91792, | 0.91892, | 0.91992, | 0.92092, | |
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| | 0.93694, | 0.93794, | 0.93894, | 0.93994, | 0.94094, | 0.94194, | 0.94294, | 0.94394, | 0.94494, | |
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| | 0.96096, | 0.96196, | 0.96296, | 0.96396, | 0.96496, | 0.96597, | 0.96697, | 0.96797, | 0.96897, | |
| 0.96997, | 0.97097, | 0.97197, | 0.97297, | 0.97397, | 0.97497, | 0.97598, | 0.97698, | 0.97798, | 0.97898, | |
| 0.97998, | 0.98098, | 0.98198, | 0.98298, | 0.98398, | | | | | | |
| | 0.98498, | 0.98599, | 0.98699, | 0.98799, | 0.98899, | 0.98999, | 0.99099, | 0.99199, | 0.99299, | |
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| 001, | 0.011011, | 0.012012, | 0.013013, | 0.014014, | 0.015015, | 0.016016, | 0.017017, | 0.018018, | 0.019019, | 0. |
| 02002, | 0.021021, | 0.022022, | 0.023023, | | | | | | | |
| | 0.024024, | 0.025025, | 0.026026, | 0.027027, | 0.028028, | 0.029029, | 0.03003, | 0.031031, | 0.032032, | |
| 0.033033, | 0.034034, | 0.035035, | 0.036036, | 0.037037, | 0.038038, | 0.039039, | 0.04004, | 0.041041, | 0.042042, | |
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| | | | | | | | | | |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | 0.048048, | 0.049049, | 0.05005, | 0.051051, | 0.052052, | 0.053053, | 0.054054, | 0.055055, | 0.056056, |
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| 0.15315, | 0.15415, | 0.15516, | 0.15616, | 0.15716, | 0.15816, | 0.15916, | 0.16016, | 0.16116, | 0.16216, |
| 0.16316, | 0.16416, | 0.16517, | 0.16617, | 0.16717, | | | | | |
| | 0.16817, | 0.16917, | 0.17017, | 0.17117, | 0.17217, | 0.17317, | 0.17417, | 0.17518, | 0.17618, |
| 0.17718, | 0.17818, | 0.17918, | 0.18018, | 0.18118, | 0.18218, | 0.18318, | 0.18418, | 0.18519, | 0.18619, |
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| | 0.40841, | 0.40941, | 0.41041, | 0.41141, | 0.41241, | 0.41341, | 0.41441, | 0.41542, | 0.41642, |

| | | | | | | | | | |
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| | 0.5045, | 0.50551, | 0.50651, | 0.50751, | 0.50851, | 0.50951, | 0.51051, | 0.51151, | 0.51251, |
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| 0.73974, | 0.74074, | 0.74174, | 0.74274, | 0.74374, | | | | | |
| | 0.74474, | 0.74575, | 0.74675, | 0.74775, | 0.74875, | 0.74975, | 0.75075, | 0.75175, | 0.75275, |
| 0.75375, | 0.75475, | 0.75576, | 0.75676, | 0.75776, | 0.75876, | 0.75976, | 0.76076, | 0.76176, | 0.76276, |
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| | 0.76877, | 0.76977, | 0.77077, | 0.77177, | 0.77277, | 0.77377, | 0.77477, | 0.77578, | 0.77678, |
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| | 0.81682, | 0.81782, | 0.81882, | 0.81982, | 0.82082, | 0.82182, | 0.82282, | 0.82382, | 0.82482, | |
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| | 0.88889, | 0.88989, | 0.89089, | 0.89189, | 0.89289, | 0.89389, | 0.89489, | 0.8959, | 0.8969, | |
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| 0.94595, | 0.94695, | 0.94795, | 0.94895, | 0.94995, | 0.95095, | 0.95195, | 0.95295, | 0.95395, | 0.95495, | |
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| | 0.96096, | 0.96196, | 0.96296, | 0.96396, | 0.96496, | 0.96597, | 0.96697, | 0.96797, | 0.96897, | |
| 0.96997, | 0.97097, | 0.97197, | 0.97297, | 0.97397, | 0.97497, | 0.97598, | 0.97698, | 0.97798, | 0.97898, | |
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| | 0.98498, | 0.98599, | 0.98699, | 0.98799, | 0.98899, | 0.98999, | 0.99099, | 0.99199, | 0.99299, | |
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| | [0.279, | 0.279, | 0.38309, | ..., | 1, | 1, | 1]], | 'Confidence', | 'Precision'], | |
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| 9019, | 0.02002, | 0.021021, | 0.022022, | 0.023023, | | | | | | |
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| | 0.048048, | 0.049049, | 0.05005, | 0.051051, | 0.052052, | 0.053053, | 0.054054, | 0.055055, | 0.056056, | |
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| 0.067067, | 0.068068, | 0.069069, | 0.07007, | 0.071071, | | | | | | |
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| | 0.096096, | 0.097097, | 0.098098, | 0.099099, | 0.1001, | 0.1011, | 0.1021, | 0.1031, | 0.1041, | |
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| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
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| 0.2012, | 0.2022, | 0.2032, | 0.2042, | 0.20521, | 0.20621, | 0.20721, | 0.20821, | 0.20921, | 0.21021, |
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| | 0.21622, | 0.21722, | 0.21822, | 0.21922, | 0.22022, | 0.22122, | 0.22222, | 0.22322, | 0.22422, |
| 0.22523, | 0.22623, | 0.22723, | 0.22823, | 0.22923, | 0.23023, | 0.23123, | 0.23223, | 0.23323, | 0.23423, |
| 0.23524, | 0.23624, | 0.23724, | 0.23824, | 0.23924, | | | | | |
| | 0.24024, | 0.24124, | 0.24224, | 0.24324, | 0.24424, | 0.24525, | 0.24625, | 0.24725, | 0.24825, |
| 0.24925, | 0.25025, | 0.25125, | 0.25225, | 0.25325, | 0.25425, | 0.25526, | 0.25626, | 0.25726, | 0.25826, |
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| | 0.36036, | 0.36136, | 0.36236, | 0.36336, | 0.36436, | 0.36537, | 0.36637, | 0.36737, | 0.36837, |
| 0.36937, | 0.37037, | 0.37137, | 0.37237, | 0.37337, | 0.37437, | 0.37538, | 0.37638, | 0.37738, | 0.37838, |
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| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
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0.98361, ..., 0,          0,          0], [
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fitness: 0.8659527937527103
keys: ['metrics/precision(B)', 'metrics/recall(B)', 'metrics/mAP50(B)', 'metrics/mAP50-95(B)']
maps: array([ 0.87005, 0.9043, 0.78548])
names: {0: 'WBC', 1: 'RBC', 2: 'Platelet'}
plot: True
results_dict: {'metrics/precision(B)': 0.9502005964573997, 'metrics/recall(B)': 0.959387054951998, 'metrics/mAP50(B)': 0.9800259
156602018, 'metrics/mAP50-95(B)': 0.8532780024296557, 'fitness': 0.8659527937527103}
save_dir: PosixPath('runs/detect/val')
speed: {'preprocess': 0.6318090243237546, 'inference': 128.39355093092308, 'loss': 5.540975204591329e-05, 'postprocess': 0.27607
85556448455}
task: 'detect'

```

Testing

In []: `from ultralytics import YOLO`

```

model = YOLO("runs/detect/train/weights/best.pt")

results = model.predict(source=".//TXL_PBC/images/test", save=True, save_txt=True)

print("Prediction complete, test result saved!")

```

image 1/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img1.jpg: 480x640 1 WBC, 27 RBCs, 48.6ms
image 2/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img10.jpg: 640x640 1 WBC, 15 RBCs, 1 Platelet, 59.7ms
image 3/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img100.jpg: 640x640 2 WBCs, 23 RBCs, 61.5ms
image 4/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img101.jpg: 640x640 1 WBC, 15 RB Cs, 108.2ms
image 5/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img102.jpg: 640x640 1 WBC, 21 RB Cs, 50.6ms
image 6/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img103.jpg: 640x640 1 WBC, 20 RB Cs, 1 Platelet, 49.9ms
image 7/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img104.jpg: 640x640 1 WBC, 32 RB Cs, 3 Platelets, 53.3ms
image 8/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img105.jpg: 640x640 1 WBC, 15 RB Cs, 1 Platelet, 50.5ms
image 9/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img106.jpg: 640x640 1 WBC, 24 RB Cs, 1 Platelet, 52.7ms
image 10/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img107.jpg: 640x640 1 WBC, 13 RBCs, 53.6ms
image 11/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img108.jpg: 480x640 1 WBC, 28 RBCs, 42.8ms
image 12/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img109.jpg: 640x640 1 WBC, 15 RBCs, 1 Platelet, 54.1ms
image 13/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img111.jpg: 640x640 1 WBC, 11 RB Cs, 50.1ms
image 14/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img110.jpg: 480x640 1 WBC, 25 RBCs, 2 Platelets, 39.4ms
image 15/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img111.jpg: 480x640 1 WBC, 31 RBCs, 2 Platelets, 39.9ms
image 16/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img112.jpg: 640x640 1 WBC, 28 RBCs, 1 Platelet, 52.6ms
image 17/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img113.jpg: 480x640 1 WBC, 34 RBCs, 39.5ms
image 18/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img114.jpg: 640x640 1 WBC, 15 RBCs, 1 Platelet, 52.2ms
image 19/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img115.jpg: 640x640 1 WBC, 21 RBCs, 56.2ms
image 20/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img116.jpg: 640x640 1 WBC, 15 RBCs, 52.1ms
image 21/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img117.jpg: 640x640 1 WBC, 20 RBCs, 51.1ms
image 22/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img118.jpg: 640x640 1 WBC, 22 RBCs, 1 Platelet, 52.7ms
image 23/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img119.jpg: 640x640 1 WBC, 17 RBCs, 50.9ms

image 24/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img12.jpg: 640x640 1 WBC, 11 RB Cs, 53.5ms
image 25/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img120.jpg: 640x640 1 WBC, 18 R BCs, 54.7ms
image 26/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img121.jpg: 480x640 1 WBC, 23 R BCs, 41.1ms
image 27/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img122.jpg: 640x640 1 WBC, 18 R BCs, 1 Platelet, 52.3ms
image 28/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img123.jpg: 640x640 1 WBC, 11 R BCs, 51.9ms
image 29/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img124.jpg: 640x640 1 WBC, 14 R BCs, 53.7ms
image 30/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img125.jpg: 640x640 1 WBC, 14 R BCs, 52.6ms
image 31/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img126.jpg: 640x640 1 WBC, 18 R BCs, 52.4ms
image 32/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img127.jpg: 640x640 1 WBC, 14 R BCs, 51.7ms
image 33/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img128.jpg: 640x640 1 WBC, 17 R BCs, 49.1ms
image 34/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img129.jpg: 640x640 1 WBC, 12 R BCs, 49.2ms
image 35/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img13.jpg: 640x640 1 WBC, 16 RB Cs, 51.8ms
image 36/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img130.jpg: 480x640 1 WBC, 24 R BCs, 1 Platelet, 39.2ms
image 37/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img131.jpg: 640x640 1 WBC, 17 R BCs, 1 Platelet, 52.6ms
image 38/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img132.jpg: 640x640 1 WBC, 17 R BCs, 1 Platelet, 54.1ms
image 39/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img133.jpg: 640x640 1 WBC, 20 R BCs, 53.7ms
image 40/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img134.jpg: 640x640 1 WBC, 17 R BCs, 51.4ms
image 41/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img135.jpg: 640x640 1 WBC, 17 R BCs, 53.5ms
image 42/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img136.jpg: 640x640 1 WBC, 16 R BCs, 51.2ms
image 43/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img137.jpg: 640x640 1 WBC, 19 R BCs, 2 Platelets, 52.8ms
image 44/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img138.jpg: 640x640 1 WBC, 24 R BCs, 5 Platelets, 52.4ms
image 45/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img139.jpg: 480x640 1 WBC, 20 R BCs, 1 Platelet, 40.6ms
image 46/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img14.jpg: 640x640 1 WBC, 17 RB Cs, 53.1ms

image 47/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img140.jpg: 640x640 1 WBC, 16 R BCs, 2 Platelets, 50.2ms
image 48/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img141.jpg: 640x640 1 WBC, 18 R BCs, 52.0ms
image 49/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img142.jpg: 640x640 1 WBC, 18 R BCs, 3 Platelets, 51.4ms
image 50/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img143.jpg: 640x640 1 WBC, 10 R BCs, 52.0ms
image 51/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img144.jpg: 640x640 1 WBC, 10 R BCs, 51.4ms
image 52/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img15.jpg: 640x640 1 WBC, 20 RB Cs, 53.7ms
image 53/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img16.jpg: 640x640 1 WBC, 21 RB Cs, 56.4ms
image 54/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img17.jpg: 640x640 1 WBC, 15 RB Cs, 59.6ms
image 55/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img18.jpg: 480x640 1 WBC, 30 RB Cs, 1 Platelet, 41.2ms
image 56/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img19.jpg: 640x640 1 WBC, 16 RB Cs, 53.0ms
image 57/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img2.jpg: 480x640 1 WBC, 26 RBCs, 39.7ms
image 58/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img20.jpg: 640x640 1 WBC, 21 RB Cs, 53.5ms
image 59/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img21.jpg: 640x640 1 WBC, 29 RB Cs, 2 Platelets, 50.3ms
image 60/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img22.jpg: 640x640 1 WBC, 22 RB Cs, 51.3ms
image 61/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img23.jpg: 480x640 1 WBC, 24 RB Cs, 37.5ms
image 62/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img24.jpg: 640x640 1 WBC, 19 RB Cs, 1 Platelet, 52.7ms
image 63/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img25.jpg: 480x640 1 WBC, 24 RB Cs, 1 Platelet, 38.8ms
image 64/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img26.jpg: 640x640 2 WBCs, 22 R BCs, 2 Platelets, 84.6ms
image 65/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img27.jpg: 640x640 1 WBC, 20 RB Cs, 51.8ms
image 66/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img28.jpg: 640x640 1 WBC, 17 RB Cs, 1 Platelet, 49.8ms
image 67/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img29.jpg: 480x640 1 WBC, 33 RB Cs, 2 Platelets, 38.9ms
image 68/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img3.jpg: 640x640 1 WBC, 21 RBCs, 49.9ms
image 69/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img30.jpg: 640x640 2 WBCs, 16 R BCs, 3 Platelets, 49.3ms

image 70/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img31.jpg: 640x640 1 WBC, 17 RB Cs, 3 Platelets, 48.8ms
image 71/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img32.jpg: 640x640 1 WBC, 18 RB Cs, 50.6ms
image 72/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img33.jpg: 640x640 1 WBC, 26 RB Cs, 50.7ms
image 73/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img34.jpg: 640x640 1 WBC, 18 RB Cs, 1 Platelet, 50.5ms
image 74/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img35.jpg: 640x640 1 WBC, 25 RB Cs, 52.4ms
image 75/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img36.jpg: 480x640 1 WBC, 29 RB Cs, 1 Platelet, 36.8ms
image 76/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img37.jpg: 640x640 1 WBC, 27 RB Cs, 50.8ms
image 77/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img38.jpg: 640x640 1 WBC, 10 RB Cs, 50.1ms
image 78/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img39.jpg: 640x640 1 WBC, 15 RB Cs, 49.8ms
image 79/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img40.jpg: 640x640 1 WBC, 8 RBCs, 50.1ms
image 80/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img40.jpg: 640x640 1 WBC, 15 RB Cs, 1 Platelet, 50.2ms
image 81/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img41.jpg: 640x640 1 WBC, 21 RB Cs, 53.9ms
image 82/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img42.jpg: 640x640 1 WBC, 23 RB Cs, 3 Platelets, 51.1ms
image 83/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img43.jpg: 640x640 1 WBC, 26 RB Cs, 2 Platelets, 50.9ms
image 84/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img44.jpg: 640x640 1 WBC, 13 RB Cs, 50.9ms
image 85/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img45.jpg: 640x640 1 WBC, 22 RB Cs, 50.6ms
image 86/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img46.jpg: 640x640 1 WBC, 17 RB Cs, 1 Platelet, 51.2ms
image 87/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img47.jpg: 480x640 1 WBC, 33 RB Cs, 2 Platelets, 38.3ms
image 88/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img48.jpg: 480x640 1 WBC, 20 RB Cs, 1 Platelet, 38.6ms
image 89/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img49.jpg: 480x640 1 WBC, 27 RB Cs, 38.3ms
image 90/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img50.jpg: 480x640 1 WBC, 32 RBCs, 1 Platelet, 37.3ms
image 91/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img50.jpg: 640x640 1 WBC, 10 RB Cs, 50.3ms
image 92/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img51.jpg: 480x640 2 WBCs, 35 RBCs, 2 Platelets, 38.0ms

image 93/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img52.jpg: 640x640 1 WBC, 15 RB Cs, 1 Platelet, 52.8ms
image 94/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img53.jpg: 480x640 1 WBC, 29 RB Cs, 36.3ms
image 95/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img54.jpg: 640x640 1 WBC, 16 RB Cs, 50.0ms
image 96/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img55.jpg: 640x640 1 WBC, 20 RB Cs, 48.7ms
image 97/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img56.jpg: 640x640 1 WBC, 17 RB Cs, 51.5ms
image 98/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img57.jpg: 640x640 1 WBC, 18 RB Cs, 48.9ms
image 99/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img58.jpg: 640x640 1 WBC, 11 RB Cs, 50.2ms
image 100/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img59.jpg: 640x640 1 WBC, 21 R BCs, 50.0ms
image 101/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img60.jpg: 640x640 1 WBC, 21 RB Cs, 49.8ms
image 102/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img61.jpg: 640x640 1 WBC, 31 R BCs, 1 Platelet, 50.0ms
image 103/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img62.jpg: 640x640 1 WBC, 17 R BCs, 49.4ms
image 104/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img63.jpg: 640x640 2 WBCs, 17 RBCs, 51.1ms
image 105/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img64.jpg: 640x640 1 WBC, 16 R BCs, 48.7ms
image 106/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img65.jpg: 480x640 1 WBC, 36 R BCs, 1 Platelet, 38.0ms
image 107/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img66.jpg: 640x640 1 WBC, 20 R BCs, 53.2ms
image 108/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img67.jpg: 640x640 1 WBC, 14 R BCs, 54.5ms
image 109/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img68.jpg: 480x640 1 WBC, 28 R BCs, 1 Platelet, 42.4ms
image 110/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img69.jpg: 480x640 1 WBC, 31 R BCs, 3 Platelets, 42.1ms
image 111/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img70.jpg: 640x640 1 WBC, 30 R BCs, 56.4ms
image 112/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img71.jpg: 640x640 1 WBC, 27 RB Cs, 1 Platelet, 60.8ms
image 113/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img72.jpg: 640x640 1 WBC, 15 R BCs, 53.2ms
image 114/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img73.jpg: 480x640 1 WBC, 21 R BCs, 3 Platelets, 39.5ms
image 115/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img74.jpg: 640x640 1 WBC, 15 R BCs, 53.2ms

image 116/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img73.jpg: 640x640 1 WBC, 19 R BCs, 55.8ms
image 117/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img74.jpg: 640x640 1 WBC, 22 R BCs, 57.4ms
image 118/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img75.jpg: 640x640 1 WBC, 15 R BCs, 56.7ms
image 119/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img76.jpg: 640x640 1 WBC, 16 R BCs, 54.4ms
image 120/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img77.jpg: 640x640 1 WBC, 13 R BCs, 53.7ms
image 121/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img78.jpg: 640x640 1 WBC, 11 R BCs, 59.0ms
image 122/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img79.jpg: 480x640 1 WBC, 26 R BCs, 1 Platelet, 44.4ms
image 123/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img80.jpg: 640x640 1 WBC, 13 RB Cs, 92.0ms
image 124/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img80.jpg: 640x640 1 WBC, 19 R BCs, 53.6ms
image 125/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img81.jpg: 640x640 1 WBC, 25 R BCs, 51.1ms
image 126/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img82.jpg: 640x640 1 WBC, 19 R BCs, 50.8ms
image 127/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img83.jpg: 640x640 1 WBC, 17 R BCs, 1 Platelet, 59.2ms
image 128/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img84.jpg: 480x640 1 WBC, 26 R BCs, 41.8ms
image 129/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img85.jpg: 640x640 1 WBC, 12 R BCs, 1 Platelet, 57.0ms
image 130/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img86.jpg: 640x640 1 WBC, 21 R BCs, 2 Platelets, 58.2ms
image 131/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img87.jpg: 640x640 1 WBC, 20 R BCs, 58.6ms
image 132/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img88.jpg: 640x640 1 WBC, 10 R BCs, 51.9ms
image 133/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img89.jpg: 640x640 1 WBC, 21 R BCs, 51.9ms
image 134/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img90.jpg: 640x640 1 WBC, 9 RBC s, 55.3ms
image 135/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img90.jpg: 640x640 1 WBC, 17 R BCs, 53.4ms
image 136/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img91.jpg: 480x640 1 WBC, 30 R BCs, 1 Platelet, 42.4ms
image 137/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img92.jpg: 640x640 1 WBC, 12 R BCs, 53.8ms
image 138/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img93.jpg: 640x640 1 WBC, 28 R BCs, 1 Platelet, 51.9ms

```
image 139/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img94.jpg: 640x640 1 WBC, 12 R BCs, 50.7ms
image 140/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img95.jpg: 640x640 1 WBC, 17 R BCs, 49.0ms
image 141/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img96.jpg: 640x640 1 WBC, 15 R BCs, 51.1ms
image 142/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img97.jpg: 640x640 1 WBC, 20 R BCs, 2 Platelets, 55.5ms
image 143/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img98.jpg: 640x640 1 WBC, 13 R BCs, 50.5ms
image 144/144 /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img99.jpg: 640x640 1 WBC, 11 R BCs, 50.9ms
Speed: 1.3ms preprocess, 51.1ms inference, 0.4ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/predict
144 labels saved to runs/detect/predict/labels
Prediction complete, test result saved!
```

In []: `from ultralytics import YOLO`

```
# Load the trained model
model = YOLO("runs/detect/train/weights/best.pt")

# Run the full evaluation on the 'test' dataset and save it in 'runs/detect/test/'
metrics_test = model.val(
    data="/Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/data.yaml",
    split="test",
    save_json=True,
    project="runs/detect",
    name="test"
)

print("Test evaluation completed and saved in runs/detect/test/")

print(metrics_test)
```

Ultralytics 8.3.90 🚀 Python-3.10.13 torch-2.6.0 CPU (Apple M2)

Model summary (fused): 72 layers, 3,006,233 parameters, 0 gradients

val: Scanning /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/labels/test.cache... 144 images, 0 backgrounds, 0 corrupt: 100%|██████████| 144/144 [00:00<?, ?it/s]

val: WARNING ⚠ /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img56.jpg: 20 duplicate labels removed

val: WARNING ⚠ /Users/yilin/Desktop/宜林/大学/大三Winter/CS175/HW5/Final Project/TXL_PBC/images/test/img65.jpg: 16 duplicate labels removed

| | Class | Images | Instances | Box(P | R | mAP50 | mAP50-95): 100% ██████████ 9/9 [00:19<00:00, 2. |
|---------|-------|--------|-----------|-------|---|-------|--|
| 15s/it] | | | | | | | |

| | | | | | | |
|----------|-----|------|-------|-------|-------|-------|
| all | 144 | 2651 | 0.958 | 0.951 | 0.973 | 0.853 |
| WBC | 141 | 150 | 0.974 | 0.96 | 0.962 | 0.849 |
| RBC | 144 | 2425 | 0.954 | 0.972 | 0.991 | 0.911 |
| Platelet | 52 | 76 | 0.946 | 0.92 | 0.966 | 0.799 |

Speed: 0.7ms preprocess, 130.0ms inference, 0.0ms loss, 0.3ms postprocess per image

Saving runs/detect/test/predictions.json...

Results saved to **runs/detect/test**

Test evaluation completed and saved in runs/detect/test/
ultralytics.utils.metrics.DetMetrics object with attributes:

```

ap_class_index: array([0, 1, 2])
box: ultralytics.utils.metrics.Metric object
confusion_matrix: <ultralytics.utils.metrics.ConfusionMatrix object at 0x16aed8670>
curves: ['Precision-Recall(B)', 'F1-Confidence(B)', 'Precision-Confidence(B)', 'Recall-Confidence(B)']
curves_results: [[array([
    0, 0.001001, 0.002002, 0.003003, 0.004004, 0.005005, 0.006006, 0.007007,
    0.008008, 0.009009, 0.01001, 0.011011, 0.012012, 0.013013, 0.014014, 0.015015, 0.016016, 0.017017,
    0.018018, 0.019019, 0.02002, 0.021021, 0.022022, 0.023023,
    0.024024, 0.025025, 0.026026, 0.027027, 0.028028, 0.029029, 0.03003, 0.031031, 0.032032,
    0.033033, 0.034034, 0.035035, 0.036036, 0.037037, 0.038038, 0.039039, 0.04004, 0.041041, 0.042042,
    0.043043, 0.044044, 0.045045, 0.046046, 0.047047,
    0.048048, 0.049049, 0.05005, 0.051051, 0.052052, 0.053053, 0.054054, 0.055055, 0.056056,
    0.057057, 0.058058, 0.059059, 0.06006, 0.061061, 0.062062, 0.063063, 0.064064, 0.065065, 0.066066,
    0.067067, 0.068068, 0.069069, 0.07007, 0.071071,
    0.072072, 0.073073, 0.074074, 0.075075, 0.076076, 0.077077, 0.078078, 0.079079, 0.08008,
    0.081081, 0.082082, 0.083083, 0.084084, 0.085085, 0.086086, 0.087087, 0.088088, 0.089089, 0.09009,
    0.091091, 0.092092, 0.093093, 0.094094, 0.095095,
    0.096096, 0.097097, 0.098098, 0.099099, 0.1001, 0.1011, 0.1021, 0.1031, 0.1041,
    0.10511, 0.10611, 0.10711, 0.10811, 0.10911, 0.11011, 0.11111, 0.11211, 0.11311, 0.11411,
    0.11512, 0.11612, 0.11712, 0.11812, 0.11912,
    0.12012, 0.12112, 0.12212, 0.12312, 0.12412, 0.12513, 0.12613, 0.12713, 0.12813,
    0.12913, 0.13013, 0.13113, 0.13213, 0.13313, 0.13413, 0.13514, 0.13614, 0.13714, 0.13814,
    0.13914, 0.14014, 0.14114, 0.14214, 0.14314,
    0.14414, 0.14515, 0.14615, 0.14715, 0.14815, 0.14915, 0.15015, 0.15115, 0.15215,
    0.15315, 0.15415, 0.15516, 0.15616, 0.15716, 0.15816, 0.15916, 0.16016, 0.16116, 0.16216,
    0.16316, 0.16416, 0.16517, 0.16617, 0.16717,
    0.16817, 0.16917, 0.17017, 0.17117, 0.17217, 0.17317, 0.17417, 0.17518, 0.17618,
    0.17718, 0.17818, 0.17918, 0.18018, 0.18118, 0.18218, 0.18318, 0.18418, 0.18519, 0.18619,
    0.18719, 0.18819, 0.18919, 0.19019, 0.19119,
    0.19219, 0.19319, 0.19419, 0.1952, 0.1962, 0.1972, 0.1982, 0.1992, 0.2002,
    0.2012, 0.2022, 0.2032, 0.2042, 0.20521, 0.20621, 0.20721, 0.20821, 0.20921, 0.21021,
    0.21121, 0.21221, 0.21321, 0.21421, 0.21522,
    0.21622, 0.21722, 0.21822, 0.21922, 0.22022, 0.22122, 0.22222, 0.22322, 0.22422,
    0.22523, 0.22623, 0.22723, 0.22823, 0.22923, 0.23023, 0.23123, 0.23223, 0.23323, 0.23423,
    0.23524, 0.23624, 0.23724, 0.23824, 0.23924,
    0.24024, 0.24124, 0.24224, 0.24324, 0.24424, 0.24525, 0.24625, 0.24725, 0.24825,
    0.24925, 0.25025, 0.25125, 0.25225, 0.25325, 0.25425, 0.25526, 0.25626, 0.25726, 0.25826,
])]]]

```

| | | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--|
| 0.25926, | 0.26026, | 0.26126, | 0.26226, | 0.26326, | | | | | | |
| | 0.26426, | 0.26527, | 0.26627, | 0.26727, | 0.26827, | 0.26927, | 0.27027, | 0.27127, | 0.27227, | |
| 0.27327, | 0.27427, | 0.27528, | 0.27628, | 0.27728, | 0.27828, | 0.27928, | 0.28028, | 0.28128, | 0.28228, | |
| 0.28328, | 0.28428, | 0.28529, | 0.28629, | 0.28729, | | | | | | |
| | 0.28829, | 0.28929, | 0.29029, | 0.29129, | 0.29229, | 0.29329, | 0.29429, | 0.2953, | 0.2963, | |
| 0.2973, | 0.2983, | 0.2993, | 0.3003, | 0.3013, | 0.3023, | 0.3033, | 0.3043, | 0.30531, | 0.30631, | |
| 0.30731, | 0.30831, | 0.30931, | 0.31031, | 0.31131, | | | | | | |
| | 0.31231, | 0.31331, | 0.31431, | 0.31532, | 0.31632, | 0.31732, | 0.31832, | 0.31932, | 0.32032, | |
| 0.32132, | 0.32232, | 0.32332, | 0.32432, | 0.32533, | 0.32633, | 0.32733, | 0.32833, | 0.32933, | 0.33033, | |
| 0.33133, | 0.33233, | 0.33333, | 0.33433, | 0.33534, | | | | | | |
| | 0.33634, | 0.33734, | 0.33834, | 0.33934, | 0.34034, | 0.34134, | 0.34234, | 0.34334, | 0.34434, | |
| 0.34535, | 0.34635, | 0.34735, | 0.34835, | 0.34935, | 0.35035, | 0.35135, | 0.35235, | 0.35335, | 0.35435, | |
| 0.35536, | 0.35636, | 0.35736, | 0.35836, | 0.35936, | | | | | | |
| | 0.36036, | 0.36136, | 0.36236, | 0.36336, | 0.36436, | 0.36537, | 0.36637, | 0.36737, | 0.36837, | |
| 0.36937, | 0.37037, | 0.37137, | 0.37237, | 0.37337, | 0.37437, | 0.37538, | 0.37638, | 0.37738, | 0.37838, | |
| 0.37938, | 0.38038, | 0.38138, | 0.38238, | 0.38338, | | | | | | |
| | 0.38438, | 0.38539, | 0.38639, | 0.38739, | 0.38839, | 0.38939, | 0.39039, | 0.39139, | 0.39239, | |
| 0.39339, | 0.39439, | 0.39539, | 0.39639, | 0.39739, | 0.39839, | 0.39939, | 0.40039, | 0.40139, | 0.40239, | |
| 0.4034, | 0.4044, | 0.40541, | 0.40641, | 0.40741, | | | | | | |
| | 0.40841, | 0.40941, | 0.41041, | 0.41141, | 0.41241, | 0.41341, | 0.41441, | 0.41542, | 0.41642, | |
| 0.41742, | 0.41842, | 0.41942, | 0.42042, | 0.42142, | 0.42242, | 0.42342, | 0.42442, | 0.42543, | 0.42643, | |
| 0.42743, | 0.42843, | 0.42943, | 0.43043, | 0.43143, | | | | | | |
| | 0.43243, | 0.43343, | 0.43443, | 0.43544, | 0.43644, | 0.43744, | 0.43844, | 0.43944, | 0.44044, | |
| 0.44144, | 0.44244, | 0.44344, | 0.44444, | 0.44545, | 0.44645, | 0.44745, | 0.44845, | 0.44945, | 0.45045, | |
| 0.45145, | 0.45245, | 0.45345, | 0.45445, | 0.45546, | | | | | | |
| | 0.45646, | 0.45746, | 0.45846, | 0.45946, | 0.46046, | 0.46146, | 0.46246, | 0.46346, | 0.46446, | |
| 0.46547, | 0.46647, | 0.46747, | 0.46847, | 0.46947, | 0.47047, | 0.47147, | 0.47247, | 0.47347, | 0.47447, | |
| 0.47548, | 0.47648, | 0.47748, | 0.47848, | 0.47948, | | | | | | |
| | 0.48048, | 0.48148, | 0.48248, | 0.48348, | 0.48448, | 0.48549, | 0.48649, | 0.48749, | 0.48849, | |
| 0.48949, | 0.49049, | 0.49149, | 0.49249, | 0.49349, | 0.49449, | 0.4955, | 0.4965, | 0.4975, | 0.4985, | |
| 0.4995, | 0.5005, | 0.5015, | 0.5025, | 0.5035, | | | | | | |
| | 0.5045, | 0.50551, | 0.50651, | 0.50751, | 0.50851, | 0.50951, | 0.51051, | 0.51151, | 0.51251, | |
| 0.51351, | 0.51451, | 0.51552, | 0.51652, | 0.51752, | 0.51852, | 0.51952, | 0.52052, | 0.52152, | 0.52252, | |
| 0.52352, | 0.52452, | 0.52553, | 0.52653, | 0.52753, | | | | | | |
| | 0.52853, | 0.52953, | 0.53053, | 0.53153, | 0.53253, | 0.53353, | 0.53453, | 0.53554, | 0.53654, | |
| 0.53754, | 0.53854, | 0.53954, | 0.54054, | 0.54154, | 0.54254, | 0.54354, | 0.54454, | 0.54555, | 0.54655, | |
| 0.54755, | 0.54855, | 0.54955, | 0.55055, | 0.55155, | | | | | | |
| | 0.55255, | 0.55355, | 0.55455, | 0.55556, | 0.55656, | 0.55756, | 0.55856, | 0.55956, | 0.56056, | |
| 0.56156, | 0.56256, | 0.56356, | 0.56456, | 0.56557, | 0.56657, | 0.56757, | 0.56857, | 0.56957, | 0.57057, | |
| 0.57157, | 0.57257, | 0.57357, | 0.57457, | 0.57558, | | | | | | |
| | 0.57658, | 0.57758, | 0.57858, | 0.57958, | 0.58058, | 0.58158, | 0.58258, | 0.58358, | 0.58458, | |
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| 0.5956, | 0.5966, | 0.5976, | 0.5986, | 0.5996, | | | | | | |
| | 0.6006, | 0.6016, | 0.6026, | 0.6036, | 0.6046, | 0.60561, | 0.60661, | 0.60761, | 0.60861, | |
| 0.60961, | 0.61061, | 0.61161, | 0.61261, | 0.61361, | 0.61461, | 0.61562, | 0.61662, | 0.61762, | 0.61862, | |
| 0.61962, | 0.62062, | 0.62162, | 0.62262, | 0.62362, | | | | | | |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | 0.62462, | 0.62563, | 0.62663, | 0.62763, | 0.62863, | 0.62963, | 0.63063, | 0.63163, | 0.63263, |
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| 0.64364, | 0.64464, | 0.64565, | 0.64665, | 0.64765, | | | | | |
| | 0.64865, | 0.64965, | 0.65065, | 0.65165, | 0.65265, | 0.65365, | 0.65465, | 0.65566, | 0.65666, |
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| | 0.67267, | 0.67367, | 0.67467, | 0.67568, | 0.67668, | 0.67768, | 0.67868, | 0.67968, | 0.68068, |
| 0.68168, | 0.68268, | 0.68368, | 0.68468, | 0.68569, | 0.68669, | 0.68769, | 0.68869, | 0.68969, | 0.69069, |
| 0.69169, | 0.69269, | 0.69369, | 0.69469, | 0.6957, | | | | | |
| | 0.6967, | 0.6977, | 0.6987, | 0.6997, | 0.7007, | 0.7017, | 0.7027, | 0.7037, | 0.7047, |
| 0.70571, | 0.70671, | 0.70771, | 0.70871, | 0.70971, | 0.71071, | 0.71171, | 0.71271, | 0.71371, | 0.71471, |
| 0.71572, | 0.71672, | 0.71772, | 0.71872, | 0.71972, | | | | | |
| | 0.72072, | 0.72172, | 0.72272, | 0.72372, | 0.72472, | 0.72573, | 0.72673, | 0.72773, | 0.72873, |
| 0.72973, | 0.73073, | 0.73173, | 0.73273, | 0.73373, | 0.73473, | 0.73574, | 0.73674, | 0.73774, | 0.73874, |
| 0.73974, | 0.74074, | 0.74174, | 0.74274, | 0.74374, | | | | | |
| | 0.74474, | 0.74575, | 0.74675, | 0.74775, | 0.74875, | 0.74975, | 0.75075, | 0.75175, | 0.75275, |
| 0.75375, | 0.75475, | 0.75576, | 0.75676, | 0.75776, | 0.75876, | 0.75976, | 0.76076, | 0.76176, | 0.76276, |
| 0.76376, | 0.76476, | 0.76577, | 0.76677, | 0.76777, | | | | | |
| | 0.76877, | 0.76977, | 0.77077, | 0.77177, | 0.77277, | 0.77377, | 0.77477, | 0.77578, | 0.77678, |
| 0.77778, | 0.77878, | 0.77978, | 0.78078, | 0.78178, | 0.78278, | 0.78378, | 0.78478, | 0.78579, | 0.78679, |
| 0.78779, | 0.78879, | 0.78979, | 0.79079, | 0.79179, | | | | | |
| | 0.79279, | 0.79379, | 0.79479, | 0.7958, | 0.7968, | 0.7978, | 0.7988, | 0.7998, | 0.8008, |
| 0.8018, | 0.8028, | 0.8038, | 0.8048, | 0.80581, | 0.80681, | 0.80781, | 0.80881, | 0.80981, | 0.81081, |
| 0.81181, | 0.81281, | 0.81381, | 0.81481, | 0.81582, | | | | | |
| | 0.81682, | 0.81782, | 0.81882, | 0.81982, | 0.82082, | 0.82182, | 0.82282, | 0.82382, | 0.82482, |
| 0.82583, | 0.82683, | 0.82783, | 0.82883, | 0.82983, | 0.83083, | 0.83183, | 0.83283, | 0.83383, | 0.83483, |
| 0.83584, | 0.83684, | 0.83784, | 0.83884, | 0.83984, | | | | | |
| | 0.84084, | 0.84184, | 0.84284, | 0.84384, | 0.84484, | 0.84585, | 0.84685, | 0.84785, | 0.84885, |
| 0.84985, | 0.85085, | 0.85185, | 0.85285, | 0.85385, | 0.85485, | 0.85586, | 0.85686, | 0.85786, | 0.85886, |
| 0.85986, | 0.86086, | 0.86186, | 0.86286, | 0.86386, | | | | | |
| | 0.86486, | 0.86587, | 0.86687, | 0.86787, | 0.86887, | 0.86987, | 0.87087, | 0.87187, | 0.87287, |
| 0.87387, | 0.87487, | 0.87588, | 0.87688, | 0.87788, | 0.87888, | 0.87988, | 0.88088, | 0.88188, | 0.88288, |
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| | 0.88889, | 0.88989, | 0.89089, | 0.89189, | 0.89289, | 0.89389, | 0.89489, | 0.8959, | 0.8969, |
| 0.8979, | 0.8989, | 0.8999, | 0.9009, | 0.9019, | 0.9029, | 0.9039, | 0.9049, | 0.90591, | 0.90691, |
| 0.90791, | 0.90891, | 0.90991, | 0.91091, | 0.91191, | | | | | |
| | 0.91291, | 0.91391, | 0.91491, | 0.91592, | 0.91692, | 0.91792, | 0.91892, | 0.91992, | 0.92092, |
| 0.92192, | 0.92292, | 0.92392, | 0.92492, | 0.92593, | 0.92693, | 0.92793, | 0.92893, | 0.92993, | 0.93093, |
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| | 0.93694, | 0.93794, | 0.93894, | 0.93994, | 0.94094, | 0.94194, | 0.94294, | 0.94394, | 0.94494, |
| 0.94595, | 0.94695, | 0.94795, | 0.94895, | 0.94995, | 0.95095, | 0.95195, | 0.95295, | 0.95395, | 0.95495, |
| 0.95596, | 0.95696, | 0.95796, | 0.95896, | 0.95996, | | | | | |
| | 0.96096, | 0.96196, | 0.96296, | 0.96396, | 0.96496, | 0.96597, | 0.96697, | 0.96797, | 0.96897, |
| 0.96997, | 0.97097, | 0.97197, | 0.97297, | 0.97397, | 0.97497, | 0.97598, | 0.97698, | 0.97798, | 0.97898, |
| 0.97998, | 0.98098, | 0.98198, | 0.98298, | 0.98398, | | | | | |
| | 0.98498, | 0.98599, | 0.98699, | 0.98799, | 0.98899, | 0.98999, | 0.99099, | 0.99199, | 0.99299, |

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| 0.02002, | 0.021021, | 0.022022, | 0.023023, | | | | | 0.019019, |
| | 0.024024, | 0.025025, | 0.026026, | 0.027027, | 0.028028, | 0.029029, | 0.03003, | 0.031031, |
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| | 0.048048, | 0.049049, | 0.05005, | 0.051051, | 0.052052, | 0.053053, | 0.054054, | 0.055055, |
| 0.057057, | 0.058058, | 0.059059, | 0.06006, | 0.061061, | 0.062062, | 0.063063, | 0.064064, | 0.065065, |
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| | 0.072072, | 0.073073, | 0.074074, | 0.075075, | 0.076076, | 0.077077, | 0.078078, | 0.079079, |
| 0.081081, | 0.082082, | 0.083083, | 0.084084, | 0.085085, | 0.086086, | 0.087087, | 0.088088, | 0.089089, |
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| | 0.096096, | 0.097097, | 0.098098, | 0.099099, | 0.1001, | 0.1011, | 0.1021, | 0.1031, |
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| | 0.12012, | 0.12112, | 0.12212, | 0.12312, | 0.12412, | 0.12513, | 0.12613, | 0.12713, |
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| | 0.16817, | 0.16917, | 0.17017, | 0.17117, | 0.17217, | 0.17317, | 0.17417, | 0.17518, |
| 0.17718, | 0.17818, | 0.17918, | 0.18018, | 0.18118, | 0.18218, | 0.18318, | 0.18418, | 0.18519, |
| 0.18719, | 0.18819, | 0.18919, | 0.19019, | 0.19119, | | | | 0.18619, |
| | 0.19219, | 0.19319, | 0.19419, | 0.1952, | 0.1962, | 0.1972, | 0.1982, | 0.1992, |
| 0.2012, | 0.2022, | 0.2032, | 0.2042, | 0.20521, | 0.20621, | 0.20721, | 0.20821, | 0.20921, |
| 0.21121, | 0.21221, | 0.21321, | 0.21421, | 0.21522, | | | | 0.21021, |
| | 0.21622, | 0.21722, | 0.21822, | 0.21922, | 0.22022, | 0.22122, | 0.22222, | 0.22322, |
| 0.22523, | 0.22623, | 0.22723, | 0.22823, | 0.22923, | 0.23023, | 0.23123, | 0.23223, | 0.23323, |
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| | 0.24024, | 0.24124, | 0.24224, | 0.24324, | 0.24424, | 0.24525, | 0.24625, | 0.24725, |
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| | 0.31231, | 0.31331, | 0.31431, | 0.31532, | 0.31632, | 0.31732, | 0.31832, | 0.31932, |
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| 0.33133, | 0.33233, | 0.33333, | 0.33433, | 0.33534, | | | | 0.33033, |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
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| | 0.38438, | 0.38539, | 0.38639, | 0.38739, | 0.38839, | 0.38939, | 0.39039, | 0.39139, | 0.39239, |
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| | 0.43243, | 0.43343, | 0.43443, | 0.43544, | 0.43644, | 0.43744, | 0.43844, | 0.43944, | 0.44044, |
| 0.44144, | 0.44244, | 0.44344, | 0.44444, | 0.44545, | 0.44645, | 0.44745, | 0.44845, | 0.44945, | 0.45045, |
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| | 0.45646, | 0.45746, | 0.45846, | 0.45946, | 0.46046, | 0.46146, | 0.46246, | 0.46346, | 0.46446, |
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| 0.81181, | 0.81281, | 0.81381, | 0.81481, | 0.81582, | | | | | | |
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| 0.84985, | 0.85085, | 0.85185, | 0.85285, | 0.85385, | 0.85485, | 0.85586, | 0.85686, | 0.85786, | 0.85886, | |
| 0.85986, | 0.86086, | 0.86186, | 0.86286, | 0.86386, | | | | | | |
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| 0.87387, | 0.87487, | 0.87588, | 0.87688, | 0.87788, | 0.87888, | 0.87988, | 0.88088, | 0.88188, | 0.88288, | |
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| | 0.98498, | 0.98599, | 0.98699, | 0.98799, | 0.98899, | 0.98999, | 0.99099, | 0.99199, | 0.99299, | |
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| 001, | 0.011011, | 0.012012, | 0.013013, | 0.014014, | 0.015015, | 0.016016, | 0.017017, | 0.018018, | 0.019019, | 0. |
| 02002, | 0.021021, | 0.022022, | 0.023023, | | | | | | | |
| | 0.024024, | 0.025025, | 0.026026, | 0.027027, | 0.028028, | 0.029029, | 0.03003, | 0.031031, | 0.032032, | |
| 0.033033, | 0.034034, | 0.035035, | 0.036036, | 0.037037, | 0.038038, | 0.039039, | 0.04004, | 0.041041, | 0.042042, | |
| 0.043043, | 0.044044, | 0.045045, | 0.046046, | 0.047047, | | | | | | |

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| | 0.048048, | 0.049049, | 0.05005, | 0.051051, | 0.052052, | 0.053053, | 0.054054, | 0.055055, | 0.056056, |
| 0.057057, | 0.058058, | 0.059059, | 0.06006, | 0.061061, | 0.062062, | 0.063063, | 0.064064, | 0.065065, | 0.066066, |
| 0.067067, | 0.068068, | 0.069069, | 0.07007, | 0.071071, | | | | | |
| | 0.072072, | 0.073073, | 0.074074, | 0.075075, | 0.076076, | 0.077077, | 0.078078, | 0.079079, | 0.08008, |
| 0.081081, | 0.082082, | 0.083083, | 0.084084, | 0.085085, | 0.086086, | 0.087087, | 0.088088, | 0.089089, | 0.09009, |
| 0.091091, | 0.092092, | 0.093093, | 0.094094, | 0.095095, | | | | | |
| | 0.096096, | 0.097097, | 0.098098, | 0.099099, | 0.1001, | 0.1011, | 0.1021, | 0.1031, | 0.1041, |
| 0.10511, | 0.10611, | 0.10711, | 0.10811, | 0.10911, | 0.11011, | 0.11111, | 0.11211, | 0.11311, | 0.11411, |
| 0.11512, | 0.11612, | 0.11712, | 0.11812, | 0.11912, | | | | | |
| | 0.12012, | 0.12112, | 0.12212, | 0.12312, | 0.12412, | 0.12513, | 0.12613, | 0.12713, | 0.12813, |
| 0.12913, | 0.13013, | 0.13113, | 0.13213, | 0.13313, | 0.13413, | 0.13514, | 0.13614, | 0.13714, | 0.13814, |
| 0.13914, | 0.14014, | 0.14114, | 0.14214, | 0.14314, | | | | | |
| | 0.14414, | 0.14515, | 0.14615, | 0.14715, | 0.14815, | 0.14915, | 0.15015, | 0.15115, | 0.15215, |
| 0.15315, | 0.15415, | 0.15516, | 0.15616, | 0.15716, | 0.15816, | 0.15916, | 0.16016, | 0.16116, | 0.16216, |
| 0.16316, | 0.16416, | 0.16517, | 0.16617, | 0.16717, | | | | | |
| | 0.16817, | 0.16917, | 0.17017, | 0.17117, | 0.17217, | 0.17317, | 0.17417, | 0.17518, | 0.17618, |
| 0.17718, | 0.17818, | 0.17918, | 0.18018, | 0.18118, | 0.18218, | 0.18318, | 0.18418, | 0.18519, | 0.18619, |
| 0.18719, | 0.18819, | 0.18919, | 0.19019, | 0.19119, | | | | | |
| | 0.19219, | 0.19319, | 0.19419, | 0.1952, | 0.1962, | 0.1972, | 0.1982, | 0.1992, | 0.2002, |
| 0.2012, | 0.2022, | 0.2032, | 0.2042, | 0.20521, | 0.20621, | 0.20721, | 0.20821, | 0.20921, | 0.21021, |
| 0.21121, | 0.21221, | 0.21321, | 0.21421, | 0.21522, | | | | | |
| | 0.21622, | 0.21722, | 0.21822, | 0.21922, | 0.22022, | 0.22122, | 0.22222, | 0.22322, | 0.22422, |
| 0.22523, | 0.22623, | 0.22723, | 0.22823, | 0.22923, | 0.23023, | 0.23123, | 0.23223, | 0.23323, | 0.23423, |
| 0.23524, | 0.23624, | 0.23724, | 0.23824, | 0.23924, | | | | | |
| | 0.24024, | 0.24124, | 0.24224, | 0.24324, | 0.24424, | 0.24525, | 0.24625, | 0.24725, | 0.24825, |
| 0.24925, | 0.25025, | 0.25125, | 0.25225, | 0.25325, | 0.25425, | 0.25526, | 0.25626, | 0.25726, | 0.25826, |
| 0.25926, | 0.26026, | 0.26126, | 0.26226, | 0.26326, | | | | | |
| | 0.26426, | 0.26527, | 0.26627, | 0.26727, | 0.26827, | 0.26927, | 0.27027, | 0.27127, | 0.27227, |
| 0.27327, | 0.27427, | 0.27528, | 0.27628, | 0.27728, | 0.27828, | 0.27928, | 0.28028, | 0.28128, | 0.28228, |
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| | 0.28829, | 0.28929, | 0.29029, | 0.29129, | 0.29229, | 0.29329, | 0.29429, | 0.2953, | 0.2963, |
| 0.2973, | 0.2983, | 0.2993, | 0.3003, | 0.3013, | 0.3023, | 0.3033, | 0.3043, | 0.30531, | 0.30631, |
| 0.30731, | 0.30831, | 0.30931, | 0.31031, | 0.31131, | | | | | |
| | 0.31231, | 0.31331, | 0.31431, | 0.31532, | 0.31632, | 0.31732, | 0.31832, | 0.31932, | 0.32032, |
| 0.32132, | 0.32232, | 0.32332, | 0.32432, | 0.32533, | 0.32633, | 0.32733, | 0.32833, | 0.32933, | 0.33033, |
| 0.33133, | 0.33233, | 0.33333, | 0.33433, | 0.33534, | | | | | |
| | 0.33634, | 0.33734, | 0.33834, | 0.33934, | 0.34034, | 0.34134, | 0.34234, | 0.34334, | 0.34434, |
| 0.34535, | 0.34635, | 0.34735, | 0.34835, | 0.34935, | 0.35035, | 0.35135, | 0.35235, | 0.35335, | 0.35435, |
| 0.35536, | 0.35636, | 0.35736, | 0.35836, | 0.35936, | | | | | |
| | 0.36036, | 0.36136, | 0.36236, | 0.36336, | 0.36436, | 0.36537, | 0.36637, | 0.36737, | 0.36837, |
| 0.36937, | 0.37037, | 0.37137, | 0.37237, | 0.37337, | 0.37437, | 0.37538, | 0.37638, | 0.37738, | 0.37838, |
| 0.37938, | 0.38038, | 0.38138, | 0.38238, | 0.38338, | | | | | |
| | 0.38438, | 0.38539, | 0.38639, | 0.38739, | 0.38839, | 0.38939, | 0.39039, | 0.39139, | 0.39239, |
| 0.39339, | 0.39439, | 0.3954, | 0.3964, | 0.3974, | 0.3984, | 0.3994, | 0.4004, | 0.4014, | 0.4024, |
| 0.4034, | 0.4044, | 0.40541, | 0.40641, | 0.40741, | | | | | |
| | 0.40841, | 0.40941, | 0.41041, | 0.41141, | 0.41241, | 0.41341, | 0.41441, | 0.41542, | 0.41642, |

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|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 0.41742, | 0.41842, | 0.41942, | 0.42042, | 0.42142, | 0.42242, | 0.42342, | 0.42442, | 0.42543, | 0.42643, |
| 0.42743, | 0.42843, | 0.42943, | 0.43043, | 0.43143, | | | | | |
| | 0.43243, | 0.43343, | 0.43443, | 0.43544, | 0.43644, | 0.43744, | 0.43844, | 0.43944, | 0.44044, |
| 0.44144, | 0.44244, | 0.44344, | 0.44444, | 0.44545, | 0.44645, | 0.44745, | 0.44845, | 0.44945, | 0.45045, |
| 0.45145, | 0.45245, | 0.45345, | 0.45445, | 0.45546, | | | | | |
| | 0.45646, | 0.45746, | 0.45846, | 0.45946, | 0.46046, | 0.46146, | 0.46246, | 0.46346, | 0.46446, |
| 0.46547, | 0.46647, | 0.46747, | 0.46847, | 0.46947, | 0.47047, | 0.47147, | 0.47247, | 0.47347, | 0.47447, |
| 0.47548, | 0.47648, | 0.47748, | 0.47848, | 0.47948, | | | | | |
| | 0.48048, | 0.48148, | 0.48248, | 0.48348, | 0.48448, | 0.48549, | 0.48649, | 0.48749, | 0.48849, |
| 0.48949, | 0.49049, | 0.49149, | 0.49249, | 0.49349, | 0.49449, | 0.4955, | 0.4965, | 0.4975, | 0.4985, |
| 0.4995, | 0.5005, | 0.5015, | 0.5025, | 0.5035, | | | | | |
| | 0.5045, | 0.50551, | 0.50651, | 0.50751, | 0.50851, | 0.50951, | 0.51051, | 0.51151, | 0.51251, |
| 0.51351, | 0.51451, | 0.51552, | 0.51652, | 0.51752, | 0.51852, | 0.51952, | 0.52052, | 0.52152, | 0.52252, |
| 0.52352, | 0.52452, | 0.52553, | 0.52653, | 0.52753, | | | | | |
| | 0.52853, | 0.52953, | 0.53053, | 0.53153, | 0.53253, | 0.53353, | 0.53453, | 0.53554, | 0.53654, |
| 0.53754, | 0.53854, | 0.53954, | 0.54054, | 0.54154, | 0.54254, | 0.54354, | 0.54454, | 0.54555, | 0.54655, |
| 0.54755, | 0.54855, | 0.54955, | 0.55055, | 0.55155, | | | | | |
| | 0.55255, | 0.55355, | 0.55455, | 0.55556, | 0.55656, | 0.55756, | 0.55856, | 0.55956, | 0.56056, |
| 0.56156, | 0.56256, | 0.56356, | 0.56456, | 0.56557, | 0.56657, | 0.56757, | 0.56857, | 0.56957, | 0.57057, |
| 0.57157, | 0.57257, | 0.57357, | 0.57457, | 0.57558, | | | | | |
| | 0.57658, | 0.57758, | 0.57858, | 0.57958, | 0.58058, | 0.58158, | 0.58258, | 0.58358, | 0.58458, |
| 0.58559, | 0.58659, | 0.58759, | 0.58859, | 0.58959, | 0.59059, | 0.59159, | 0.59259, | 0.59359, | 0.59459, |
| 0.5956, | 0.5966, | 0.5976, | 0.5986, | 0.5996, | | | | | |
| | 0.6006, | 0.6016, | 0.6026, | 0.6036, | 0.6046, | 0.60561, | 0.60661, | 0.60761, | 0.60861, |
| 0.60961, | 0.61061, | 0.61161, | 0.61261, | 0.61361, | 0.61461, | 0.61562, | 0.61662, | 0.61762, | 0.61862, |
| 0.61962, | 0.62062, | 0.62162, | 0.62262, | 0.62362, | | | | | |
| | 0.62462, | 0.62563, | 0.62663, | 0.62763, | 0.62863, | 0.62963, | 0.63063, | 0.63163, | 0.63263, |
| 0.63363, | 0.63463, | 0.63564, | 0.63664, | 0.63764, | 0.63864, | 0.63964, | 0.64064, | 0.64164, | 0.64264, |
| 0.64364, | 0.64464, | 0.64565, | 0.64665, | 0.64765, | | | | | |
| | 0.64865, | 0.64965, | 0.65065, | 0.65165, | 0.65265, | 0.65365, | 0.65465, | 0.65566, | 0.65666, |
| 0.65766, | 0.65866, | 0.65966, | 0.66066, | 0.66166, | 0.66266, | 0.66366, | 0.66466, | 0.66567, | 0.66667, |
| 0.66767, | 0.66867, | 0.66967, | 0.67067, | 0.67167, | | | | | |
| | 0.67267, | 0.67367, | 0.67467, | 0.67568, | 0.67668, | 0.67768, | 0.67868, | 0.67968, | 0.68068, |
| 0.68168, | 0.68268, | 0.68368, | 0.68468, | 0.68569, | 0.68669, | 0.68769, | 0.68869, | 0.68969, | 0.69069, |
| 0.69169, | 0.69269, | 0.69369, | 0.69469, | 0.6957, | | | | | |
| | 0.6967, | 0.6977, | 0.6987, | 0.6997, | 0.7007, | 0.7017, | 0.7027, | 0.7037, | 0.7047, |
| 0.70571, | 0.70671, | 0.70771, | 0.70871, | 0.70971, | 0.71071, | 0.71171, | 0.71271, | 0.71371, | 0.71471, |
| 0.71572, | 0.71672, | 0.71772, | 0.71872, | 0.71972, | | | | | |
| | 0.72072, | 0.72172, | 0.72272, | 0.72372, | 0.72472, | 0.72573, | 0.72673, | 0.72773, | 0.72873, |
| 0.72973, | 0.73073, | 0.73173, | 0.73273, | 0.73373, | 0.73473, | 0.73574, | 0.73674, | 0.73774, | 0.73874, |
| 0.73974, | 0.74074, | 0.74174, | 0.74274, | 0.74374, | | | | | |
| | 0.74474, | 0.74575, | 0.74675, | 0.74775, | 0.74875, | 0.74975, | 0.75075, | 0.75175, | 0.75275, |
| 0.75375, | 0.75475, | 0.75576, | 0.75676, | 0.75776, | 0.75876, | 0.75976, | 0.76076, | 0.76176, | 0.76276, |
| 0.76376, | 0.76476, | 0.76577, | 0.76677, | 0.76777, | | | | | |
| | 0.76877, | 0.76977, | 0.77077, | 0.77177, | 0.77277, | 0.77377, | 0.77477, | 0.77578, | 0.77678, |
| 0.77778, | 0.77878, | 0.77978, | 0.78078, | 0.78178, | 0.78278, | 0.78378, | 0.78478, | 0.78579, | 0.78679, |

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|-----------|------------|-----------|-----------|-----------|-----------|-----------|-----------|---------------|---------------|
| 0.78779, | 0.78879, | 0.78979, | 0.79079, | 0.79179, | | | | | |
| | 0.79279, | 0.79379, | 0.79479, | 0.7958, | 0.7968, | 0.7978, | 0.7988, | 0.7998, | 0.8008, |
| 0.8018, | 0.8028, | 0.8038, | 0.8048, | 0.80581, | 0.80681, | 0.80781, | 0.80881, | 0.80981, | 0.81081, |
| 0.81181, | 0.81281, | 0.81381, | 0.81481, | 0.81582, | | | | | |
| | 0.81682, | 0.81782, | 0.81882, | 0.81982, | 0.82082, | 0.82182, | 0.82282, | 0.82382, | 0.82482, |
| 0.82583, | 0.82683, | 0.82783, | 0.82883, | 0.82983, | 0.83083, | 0.83183, | 0.83283, | 0.83383, | 0.83483, |
| 0.83584, | 0.83684, | 0.83784, | 0.83884, | 0.83984, | | | | | |
| | 0.84084, | 0.84184, | 0.84284, | 0.84384, | 0.84484, | 0.84585, | 0.84685, | 0.84785, | 0.84885, |
| 0.84985, | 0.85085, | 0.85185, | 0.85285, | 0.85385, | 0.85485, | 0.85586, | 0.85686, | 0.85786, | 0.85886, |
| 0.85986, | 0.86086, | 0.86186, | 0.86286, | 0.86386, | | | | | |
| | 0.86486, | 0.86587, | 0.86687, | 0.86787, | 0.86887, | 0.86987, | 0.87087, | 0.87187, | 0.87287, |
| 0.87387, | 0.87487, | 0.87588, | 0.87688, | 0.87788, | 0.87888, | 0.87988, | 0.88088, | 0.88188, | 0.88288, |
| 0.88388, | 0.88488, | 0.88589, | 0.88689, | 0.88789, | | | | | |
| | 0.88889, | 0.88989, | 0.89089, | 0.89189, | 0.89289, | 0.89389, | 0.89489, | 0.8959, | 0.8969, |
| 0.8979, | 0.8989, | 0.8999, | 0.9009, | 0.9019, | 0.9029, | 0.9039, | 0.9049, | 0.90591, | 0.90691, |
| 0.90791, | 0.90891, | 0.90991, | 0.91091, | 0.91191, | | | | | |
| | 0.91291, | 0.91391, | 0.91491, | 0.91592, | 0.91692, | 0.91792, | 0.91892, | 0.91992, | 0.92092, |
| 0.92192, | 0.92292, | 0.92392, | 0.92492, | 0.92593, | 0.92693, | 0.92793, | 0.92893, | 0.92993, | 0.93093, |
| 0.93193, | 0.93293, | 0.93393, | 0.93493, | 0.93594, | | | | | |
| | 0.93694, | 0.93794, | 0.93894, | 0.93994, | 0.94094, | 0.94194, | 0.94294, | 0.94394, | 0.94494, |
| 0.94595, | 0.94695, | 0.94795, | 0.94895, | 0.94995, | 0.95095, | 0.95195, | 0.95295, | 0.95395, | 0.95495, |
| 0.95596, | 0.95696, | 0.95796, | 0.95896, | 0.95996, | | | | | |
| | 0.96096, | 0.96196, | 0.96296, | 0.96396, | 0.96496, | 0.96597, | 0.96697, | 0.96797, | 0.96897, |
| 0.96997, | 0.97097, | 0.97197, | 0.97297, | 0.97397, | 0.97497, | 0.97598, | 0.97698, | 0.97798, | 0.97898, |
| 0.97998, | 0.98098, | 0.98198, | 0.98298, | 0.98398, | | | | | |
| | 0.98498, | 0.98599, | 0.98699, | 0.98799, | 0.98899, | 0.98999, | 0.99099, | 0.99199, | 0.99299, |
| 0.99399, | 0.99499, | 0.996, | 0.997, | 0.998, | 0.999, | 1], | array([[| 0.2272, | 0.22748, |
| 0.42765, | ..., | 1, | 1, | 1], | | | | | |
| | [0.3758, | 0.37595, | 0.57415, | ..., | 1, | 1, | 1], | | |
| | [0.23948, | 0.2404, | 0.32229, | ..., | 1, | 1, | 1]], | 'Confidence', | 'Precision'], |
| ([| 0, | 0.001001, | 0.002002, | 0.003003, | 0.004004, | 0.005005, | 0.006006, | 0.007007, | 0.008008, |
| 09, | 0.01001, | 0.011011, | 0.012012, | 0.013013, | 0.014014, | 0.015015, | 0.016016, | 0.017017, | 0.018018, |
| 9019, | 0.02002, | 0.021021, | 0.022022, | 0.023023, | | | | | |
| | 0.024024, | 0.025025, | 0.026026, | 0.027027, | 0.028028, | 0.029029, | 0.03003, | 0.031031, | 0.032032, |
| 0.033033, | 0.034034, | 0.035035, | 0.036036, | 0.037037, | 0.038038, | 0.039039, | 0.04004, | 0.041041, | 0.042042, |
| 0.043043, | 0.044044, | 0.045045, | 0.046046, | 0.047047, | | | | | |
| | 0.048048, | 0.049049, | 0.05005, | 0.051051, | 0.052052, | 0.053053, | 0.054054, | 0.055055, | 0.056056, |
| 0.057057, | 0.058058, | 0.059059, | 0.06006, | 0.061061, | 0.062062, | 0.063063, | 0.064064, | 0.065065, | 0.066066, |
| 0.067067, | 0.068068, | 0.069069, | 0.07007, | 0.071071, | | | | | |
| | 0.072072, | 0.073073, | 0.074074, | 0.075075, | 0.076076, | 0.077077, | 0.078078, | 0.079079, | 0.08008, |
| 0.081081, | 0.082082, | 0.083083, | 0.084084, | 0.085085, | 0.086086, | 0.087087, | 0.088088, | 0.089089, | 0.09009, |
| 0.091091, | 0.092092, | 0.093093, | 0.094094, | 0.095095, | | | | | |
| | 0.096096, | 0.097097, | 0.098098, | 0.099099, | 0.1001, | 0.1011, | 0.1021, | 0.1031, | 0.1041, |
| 0.10511, | 0.10611, | 0.10711, | 0.10811, | 0.10911, | 0.11011, | 0.11111, | 0.11211, | 0.11311, | 0.11411, |
| 0.11512, | 0.11612, | 0.11712, | 0.11812, | 0.11912, | | | | | |
| | 0.12012, | 0.12112, | 0.12212, | 0.12312, | 0.12412, | 0.12513, | 0.12613, | 0.12713, | 0.12813, |

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| 0.12913, | 0.13013, | 0.13113, | 0.13213, | 0.13313, | 0.13413, | 0.13514, | 0.13614, | 0.13714, | 0.13814, |
| 0.13914, | 0.14014, | 0.14114, | 0.14214, | 0.14314, | | | | | |
| | 0.14414, | 0.14515, | 0.14615, | 0.14715, | 0.14815, | 0.14915, | 0.15015, | 0.15115, | 0.15215, |
| 0.15315, | 0.15415, | 0.15516, | 0.15616, | 0.15716, | 0.15816, | 0.15916, | 0.16016, | 0.16116, | 0.16216, |
| 0.16316, | 0.16416, | 0.16517, | 0.16617, | 0.16717, | | | | | |
| | 0.16817, | 0.16917, | 0.17017, | 0.17117, | 0.17217, | 0.17317, | 0.17417, | 0.17518, | 0.17618, |
| 0.17718, | 0.17818, | 0.17918, | 0.18018, | 0.18118, | 0.18218, | 0.18318, | 0.18418, | 0.18519, | 0.18619, |
| 0.18719, | 0.18819, | 0.18919, | 0.19019, | 0.19119, | | | | | |
| | 0.19219, | 0.19319, | 0.19419, | 0.1952, | 0.1962, | 0.1972, | 0.1982, | 0.1992, | 0.2002, |
| 0.2012, | 0.2022, | 0.2032, | 0.2042, | 0.20521, | 0.20621, | 0.20721, | 0.20821, | 0.20921, | 0.21021, |
| 0.21121, | 0.21221, | 0.21321, | 0.21421, | 0.21522, | | | | | |
| | 0.21622, | 0.21722, | 0.21822, | 0.21922, | 0.22022, | 0.22122, | 0.22222, | 0.22322, | 0.22422, |
| 0.22523, | 0.22623, | 0.22723, | 0.22823, | 0.22923, | 0.23023, | 0.23123, | 0.23223, | 0.23323, | 0.23423, |
| 0.23524, | 0.23624, | 0.23724, | 0.23824, | 0.23924, | | | | | |
| | 0.24024, | 0.24124, | 0.24224, | 0.24324, | 0.24424, | 0.24525, | 0.24625, | 0.24725, | 0.24825, |
| 0.24925, | 0.25025, | 0.25125, | 0.25225, | 0.25325, | 0.25425, | 0.25526, | 0.25626, | 0.25726, | 0.25826, |
| 0.25926, | 0.26026, | 0.26126, | 0.26226, | 0.26326, | | | | | |
| | 0.26426, | 0.26527, | 0.26627, | 0.26727, | 0.26827, | 0.26927, | 0.27027, | 0.27127, | 0.27227, |
| 0.27327, | 0.27427, | 0.27528, | 0.27628, | 0.27728, | 0.27828, | 0.27928, | 0.28028, | 0.28128, | 0.28228, |
| 0.28328, | 0.28428, | 0.28529, | 0.28629, | 0.28729, | | | | | |
| | 0.28829, | 0.28929, | 0.29029, | 0.29129, | 0.29229, | 0.29329, | 0.29429, | 0.2953, | 0.2963, |
| 0.2973, | 0.2983, | 0.2993, | 0.3003, | 0.3013, | 0.3023, | 0.3033, | 0.3043, | 0.30531, | 0.30631, |
| 0.30731, | 0.30831, | 0.30931, | 0.31031, | 0.31131, | | | | | |
| | 0.31231, | 0.31331, | 0.31431, | 0.31532, | 0.31632, | 0.31732, | 0.31832, | 0.31932, | 0.32032, |
| 0.32132, | 0.32232, | 0.32332, | 0.32432, | 0.32533, | 0.32633, | 0.32733, | 0.32833, | 0.32933, | 0.33033, |
| 0.33133, | 0.33233, | 0.33333, | 0.33433, | 0.33534, | | | | | |
| | 0.33634, | 0.33734, | 0.33834, | 0.33934, | 0.34034, | 0.34134, | 0.34234, | 0.34334, | 0.34434, |
| 0.34535, | 0.34635, | 0.34735, | 0.34835, | 0.34935, | 0.35035, | 0.35135, | 0.35235, | 0.35335, | 0.35435, |
| 0.35536, | 0.35636, | 0.35736, | 0.35836, | 0.35936, | | | | | |
| | 0.36036, | 0.36136, | 0.36236, | 0.36336, | 0.36436, | 0.36537, | 0.36637, | 0.36737, | 0.36837, |
| 0.36937, | 0.37037, | 0.37137, | 0.37237, | 0.37337, | 0.37437, | 0.37538, | 0.37638, | 0.37738, | 0.37838, |
| 0.37938, | 0.38038, | 0.38138, | 0.38238, | 0.38338, | | | | | |
| | 0.38438, | 0.38539, | 0.38639, | 0.38739, | 0.38839, | 0.38939, | 0.39039, | 0.39139, | 0.39239, |
| 0.39339, | 0.39439, | 0.3954, | 0.3964, | 0.3974, | 0.3984, | 0.3994, | 0.4004, | 0.4014, | 0.4024, |
| 0.4034, | 0.4044, | 0.40541, | 0.40641, | 0.40741, | | | | | |
| | 0.40841, | 0.40941, | 0.41041, | 0.41141, | 0.41241, | 0.41341, | 0.41441, | 0.41542, | 0.41642, |
| 0.41742, | 0.41842, | 0.41942, | 0.42042, | 0.42142, | 0.42242, | 0.42342, | 0.42442, | 0.42543, | 0.42643, |
| 0.42743, | 0.42843, | 0.42943, | 0.43043, | 0.43143, | | | | | |
| | 0.43243, | 0.43343, | 0.43443, | 0.43544, | 0.43644, | 0.43744, | 0.43844, | 0.43944, | 0.44044, |
| 0.44144, | 0.44244, | 0.44344, | 0.44444, | 0.44545, | 0.44645, | 0.44745, | 0.44845, | 0.44945, | 0.45045, |
| 0.45145, | 0.45245, | 0.45345, | 0.45445, | 0.45546, | | | | | |
| | 0.45646, | 0.45746, | 0.45846, | 0.45946, | 0.46046, | 0.46146, | 0.46246, | 0.46346, | 0.46446, |
| 0.46547, | 0.46647, | 0.46747, | 0.46847, | 0.46947, | 0.47047, | 0.47147, | 0.47247, | 0.47347, | 0.47447, |
| 0.47548, | 0.47648, | 0.47748, | 0.47848, | 0.47948, | | | | | |
| | 0.48048, | 0.48148, | 0.48248, | 0.48348, | 0.48448, | 0.48549, | 0.48649, | 0.48749, | 0.48849, |
| 0.48949, | 0.49049, | 0.49149, | 0.49249, | 0.49349, | 0.49449, | 0.4955, | 0.4965, | 0.4975, | 0.4985, |

| | | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 0.4995, | 0.5005, | 0.5015, | 0.5025, | 0.5035, | | | | | |
| | 0.5045, | 0.50551, | 0.50651, | 0.50751, | 0.50851, | 0.50951, | 0.51051, | 0.51151, | 0.51251, |
| 0.51351, | 0.51451, | 0.51552, | 0.51652, | 0.51752, | 0.51852, | 0.51952, | 0.52052, | 0.52152, | 0.52252, |
| 0.52352, | 0.52452, | 0.52553, | 0.52653, | 0.52753, | | | | | |
| | 0.52853, | 0.52953, | 0.53053, | 0.53153, | 0.53253, | 0.53353, | 0.53453, | 0.53554, | 0.53654, |
| 0.53754, | 0.53854, | 0.53954, | 0.54054, | 0.54154, | 0.54254, | 0.54354, | 0.54454, | 0.54555, | 0.54655, |
| 0.54755, | 0.54855, | 0.54955, | 0.55055, | 0.55155, | | | | | |
| | 0.55255, | 0.55355, | 0.55455, | 0.55556, | 0.55656, | 0.55756, | 0.55856, | 0.55956, | 0.56056, |
| 0.56156, | 0.56256, | 0.56356, | 0.56456, | 0.56557, | 0.56657, | 0.56757, | 0.56857, | 0.56957, | 0.57057, |
| 0.57157, | 0.57257, | 0.57357, | 0.57457, | 0.57558, | | | | | |
| | 0.57658, | 0.57758, | 0.57858, | 0.57958, | 0.58058, | 0.58158, | 0.58258, | 0.58358, | 0.58458, |
| 0.58559, | 0.58659, | 0.58759, | 0.58859, | 0.58959, | 0.59059, | 0.59159, | 0.59259, | 0.59359, | 0.59459, |
| 0.5956, | 0.5966, | 0.5976, | 0.5986, | 0.5996, | | | | | |
| | 0.6006, | 0.6016, | 0.6026, | 0.6036, | 0.6046, | 0.60561, | 0.60661, | 0.60761, | 0.60861, |
| 0.60961, | 0.61061, | 0.61161, | 0.61261, | 0.61361, | 0.61461, | 0.61562, | 0.61662, | 0.61762, | 0.61862, |
| 0.61962, | 0.62062, | 0.62162, | 0.62262, | 0.62362, | | | | | |
| | 0.62462, | 0.62563, | 0.62663, | 0.62763, | 0.62863, | 0.62963, | 0.63063, | 0.63163, | 0.63263, |
| 0.63363, | 0.63463, | 0.63564, | 0.63664, | 0.63764, | 0.63864, | 0.63964, | 0.64064, | 0.64164, | 0.64264, |
| 0.64364, | 0.64464, | 0.64565, | 0.64665, | 0.64765, | | | | | |
| | 0.64865, | 0.64965, | 0.65065, | 0.65165, | 0.65265, | 0.65365, | 0.65465, | 0.65566, | 0.65666, |
| 0.65766, | 0.65866, | 0.65966, | 0.66066, | 0.66166, | 0.66266, | 0.66366, | 0.66466, | 0.66567, | 0.66667, |
| 0.66767, | 0.66867, | 0.66967, | 0.67067, | 0.67167, | | | | | |
| | 0.67267, | 0.67367, | 0.67467, | 0.67568, | 0.67668, | 0.67768, | 0.67868, | 0.67968, | 0.68068, |
| 0.68168, | 0.68268, | 0.68368, | 0.68468, | 0.68569, | 0.68669, | 0.68769, | 0.68869, | 0.68969, | 0.69069, |
| 0.69169, | 0.69269, | 0.69369, | 0.69469, | 0.6957, | | | | | |
| | 0.6967, | 0.6977, | 0.6987, | 0.6997, | 0.7007, | 0.7017, | 0.7027, | 0.7037, | 0.7047, |
| 0.70571, | 0.70671, | 0.70771, | 0.70871, | 0.70971, | 0.71071, | 0.71171, | 0.71271, | 0.71371, | 0.71471, |
| 0.71572, | 0.71672, | 0.71772, | 0.71872, | 0.71972, | | | | | |
| | 0.72072, | 0.72172, | 0.72272, | 0.72372, | 0.72472, | 0.72573, | 0.72673, | 0.72773, | 0.72873, |
| 0.72973, | 0.73073, | 0.73173, | 0.73273, | 0.73373, | 0.73473, | 0.73574, | 0.73674, | 0.73774, | 0.73874, |
| 0.73974, | 0.74074, | 0.74174, | 0.74274, | 0.74374, | | | | | |
| | 0.74474, | 0.74575, | 0.74675, | 0.74775, | 0.74875, | 0.74975, | 0.75075, | 0.75175, | 0.75275, |
| 0.75375, | 0.75475, | 0.75576, | 0.75676, | 0.75776, | 0.75876, | 0.75976, | 0.76076, | 0.76176, | 0.76276, |
| 0.76376, | 0.76476, | 0.76577, | 0.76677, | 0.76777, | | | | | |
| | 0.76877, | 0.76977, | 0.77077, | 0.77177, | 0.77277, | 0.77377, | 0.77477, | 0.77578, | 0.77678, |
| 0.77778, | 0.77878, | 0.77978, | 0.78078, | 0.78178, | 0.78278, | 0.78378, | 0.78478, | 0.78579, | 0.78679, |
| 0.78779, | 0.78879, | 0.78979, | 0.79079, | 0.79179, | | | | | |
| | 0.79279, | 0.79379, | 0.79479, | 0.7958, | 0.7968, | 0.7978, | 0.7988, | 0.7998, | 0.8008, |
| 0.8018, | 0.8028, | 0.8038, | 0.8048, | 0.80581, | 0.80681, | 0.80781, | 0.80881, | 0.80981, | 0.81081, |
| 0.81181, | 0.81281, | 0.81381, | 0.81481, | 0.81582, | | | | | |
| | 0.81682, | 0.81782, | 0.81882, | 0.81982, | 0.82082, | 0.82182, | 0.82282, | 0.82382, | 0.82482, |
| 0.82583, | 0.82683, | 0.82783, | 0.82883, | 0.82983, | 0.83083, | 0.83183, | 0.83283, | 0.83383, | 0.83483, |
| 0.83584, | 0.83684, | 0.83784, | 0.83884, | 0.83984, | | | | | |
| | 0.84084, | 0.84184, | 0.84284, | 0.84384, | 0.84484, | 0.84585, | 0.84685, | 0.84785, | 0.84885, |
| 0.84985, | 0.85085, | 0.85185, | 0.85285, | 0.85385, | 0.85485, | 0.85586, | 0.85686, | 0.85786, | 0.85886, |
| 0.85986, | 0.86086, | 0.86186, | 0.86286, | 0.86386, | | | | | |

```

0.86486,    0.86587,    0.86687,    0.86787,    0.86887,    0.86987,    0.87087,    0.87187,    0.87287,
0.87387,    0.87487,    0.87588,    0.87688,    0.87788,    0.87888,    0.87988,    0.88088,    0.88188,    0.88288,
0.88388,    0.88488,    0.88589,    0.88689,    0.88789,
0.88889,    0.88989,    0.89089,    0.89189,    0.89289,    0.89389,    0.89489,    0.8959,     0.8969,
0.8979,     0.8989,     0.8999,     0.9009,     0.9019,     0.9029,     0.9039,     0.9049,     0.90591,    0.90691,
0.90791,    0.90891,    0.90991,    0.91091,    0.91191,
0.91291,    0.91391,    0.91491,    0.91592,    0.91692,    0.91792,    0.91892,    0.91992,    0.92092,
0.92192,    0.92292,    0.92392,    0.92492,    0.92593,    0.92693,    0.92793,    0.92893,    0.92993,    0.93093,
0.93193,    0.93293,    0.93393,    0.93493,    0.93594,
0.93694,    0.93794,    0.93894,    0.93994,    0.94094,    0.94194,    0.94294,    0.94394,    0.94494,
0.94595,    0.94695,    0.94795,    0.94895,    0.94995,    0.95095,    0.95195,    0.95295,    0.95395,    0.95495,
0.95596,    0.95696,    0.95796,    0.95896,    0.95996,
0.96096,    0.96196,    0.96296,    0.96396,    0.96496,    0.96597,    0.96697,    0.96797,    0.96897,
0.96997,    0.97097,    0.97197,    0.97297,    0.97397,    0.97497,    0.97598,    0.97698,    0.97798,    0.97898,
0.97998,    0.98098,    0.98198,    0.98298,    0.98398,
0.98498,    0.98599,    0.98699,    0.98799,    0.98899,    0.98999,    0.99099,    0.99199,    0.99299,
0.99399,    0.99499,    0.996,      0.997,      0.998,      0.999,      1]), array([[ 0.98,      0.98,
0.98, ..., 0, 0, 0], [ 0.99876, 0.99876, 0.99794, ..., 0, 0, 0], [ 0.97368, 0.97368, 0.97368, ..., 0, 0, 0]]), 'Confidence', 'Recall'])
fitness: 0.8650492022028538
keys: ['metrics/precision(B)', 'metrics/recall(B)', 'metrics/mAP50(B)', 'metrics/mAP50-95(B)']
maps: array([ 0.84871, 0.91148, 0.79904])
names: {0: 'WBC', 1: 'RBC', 2: 'Platelet'}
plot: True
results_dict: {'metrics/precision(B)': 0.9579761327942996, 'metrics/recall(B)': 0.9506282740603474, 'metrics/mAP50(B)': 0.9728153069360328, 'metrics/mAP50-95(B)': 0.8530751905658339, 'fitness': 0.8650492022028538}
save_dir: PosixPath('runs/detect/test')
speed: {'preprocess': 0.7150578538938942, 'inference': 129.97638772907928, 'loss': 7.697235560044646e-05, 'postprocess': 0.2687789373238856}
task: 'detect'

```

Visualization

In [7]: # First 5 predictions information for test

```

import json

# Load the predictions.json file
with open("runs/detect/test/predictions.json", "r") as f:
    predictions = json.load(f)

# Print the first few records to understand the structure
print(json.dumps(predictions[:5], indent=4))

```

```
[  
  {  
    "image_id": "img1",  
    "category_id": 2,  
    "bbox": [  
      30.723,  
      322.818,  
      109.603,  
      100.807  
    ],  
    "score": 0.96949  
,  
  {  
    "image_id": "img1",  
    "category_id": 2,  
    "bbox": [  
      14.066,  
      66.094,  
      117.125,  
      102.744  
    ],  
    "score": 0.96736  
,  
  {  
    "image_id": "img1",  
    "category_id": 2,  
    "bbox": [  
      28.868,  
      169.218,  
      102.979,  
      90.468  
    ],  
    "score": 0.96245  
,  
  {  
    "image_id": "img1",  
    "category_id": 2,  
    "bbox": [  
      361.073,  
      355.962,  
      106.738,  
      99.723  
    ],  
    "score": 0.96031  
,  
  {
```

```
"image_id": "img1",
"category_id": 2,
"bbox": [
    98.41,
    249.059,
    107.522,
    104.88
],
"score": 0.95996
}
]
```

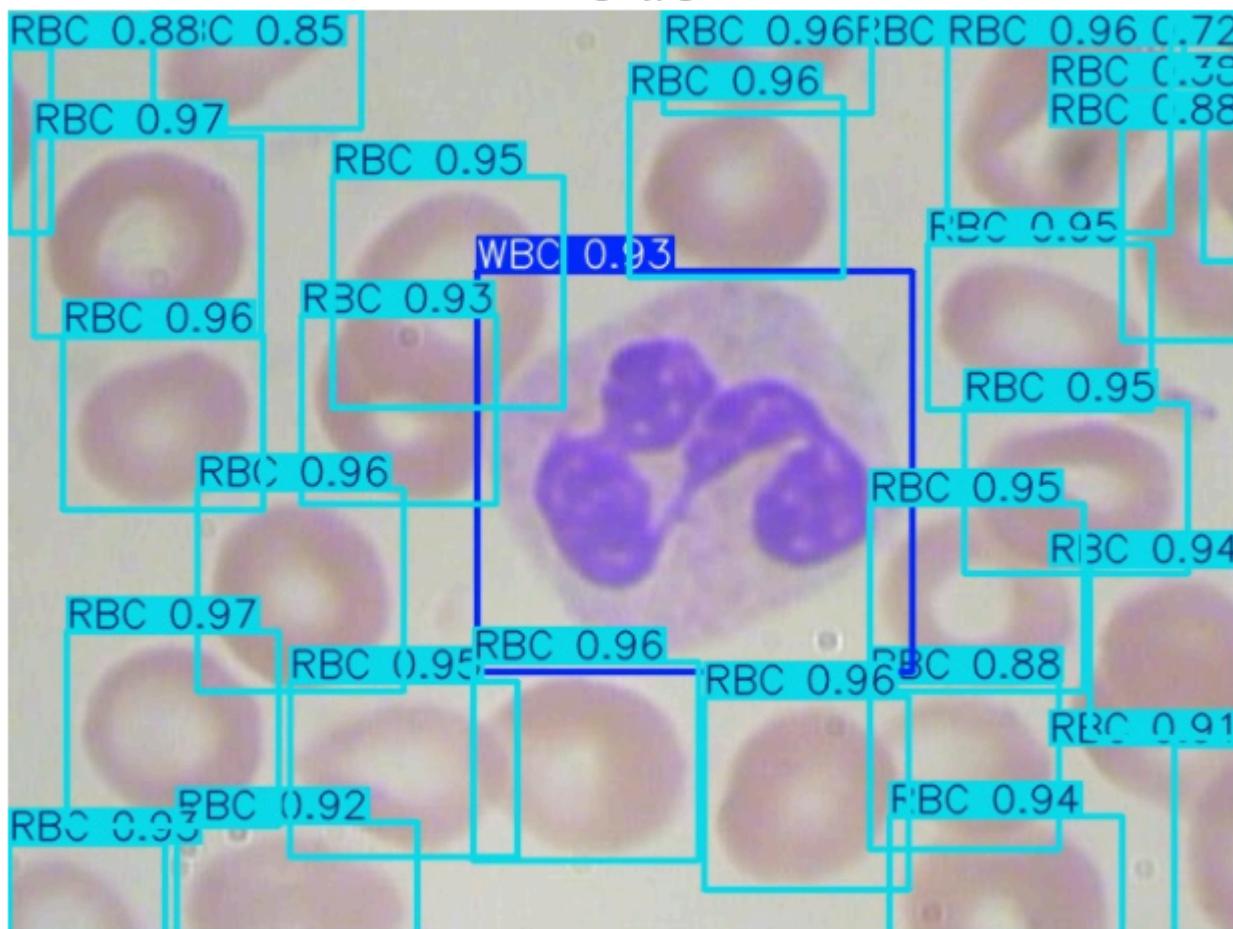
In [8]: # Visualization of first 5 predictions

```
import matplotlib.pyplot as plt
import os

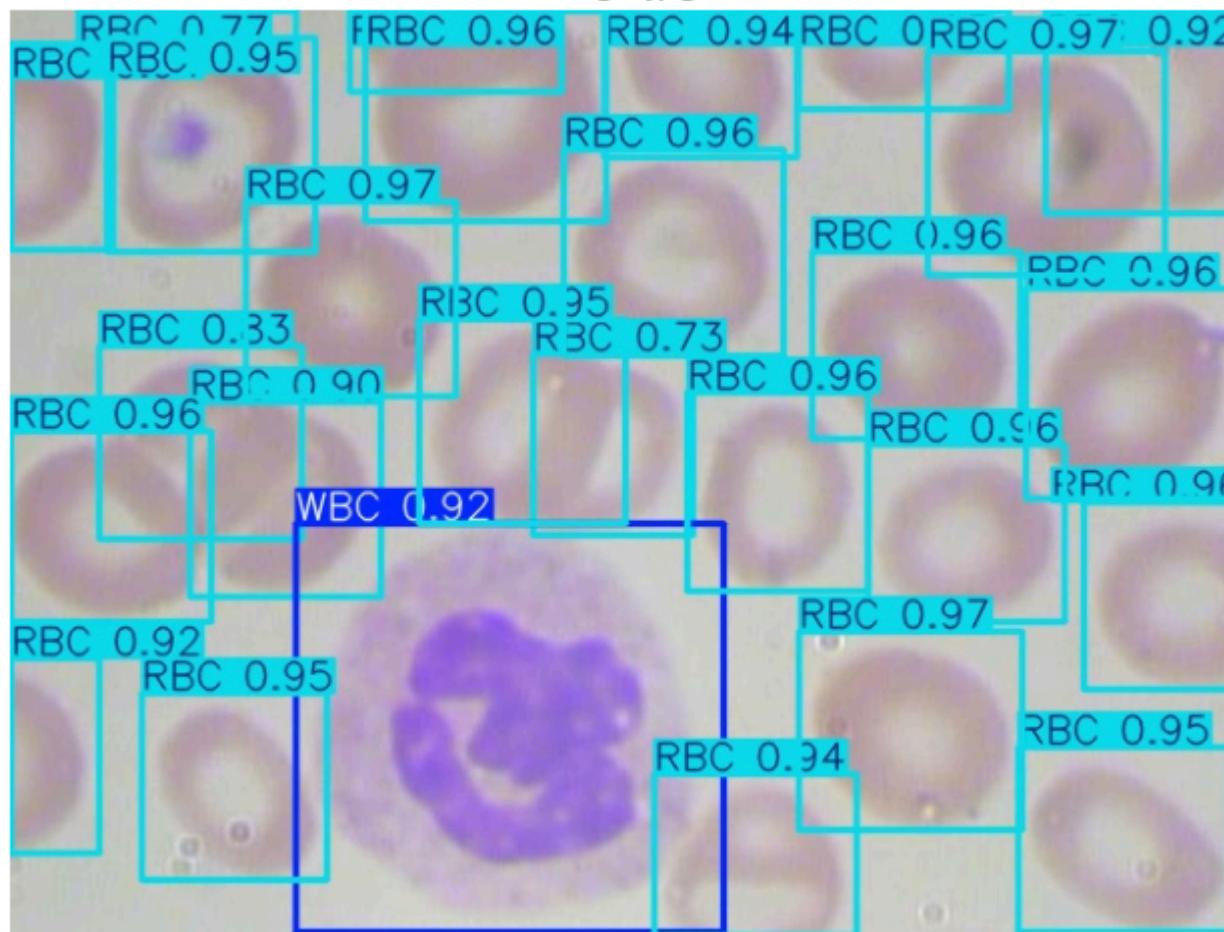
image_paths = [
    "runs/detect/predict/img1.jpg",
    "runs/detect/predict/img2.jpg",
    "runs/detect/predict/img3.jpg",
    "runs/detect/predict/img4.jpg",
    "runs/detect/predict/img5.jpg"
]

for img_path in image_paths:
    if os.path.exists(img_path):
        img = plt.imread(img_path)
        plt.figure(figsize=(8, 6))
        plt.imshow(img)
        plt.axis('off')
        plt.title(os.path.basename(img_path))
        plt.show()
    else:
        print(f"file not found: {img_path}")
```

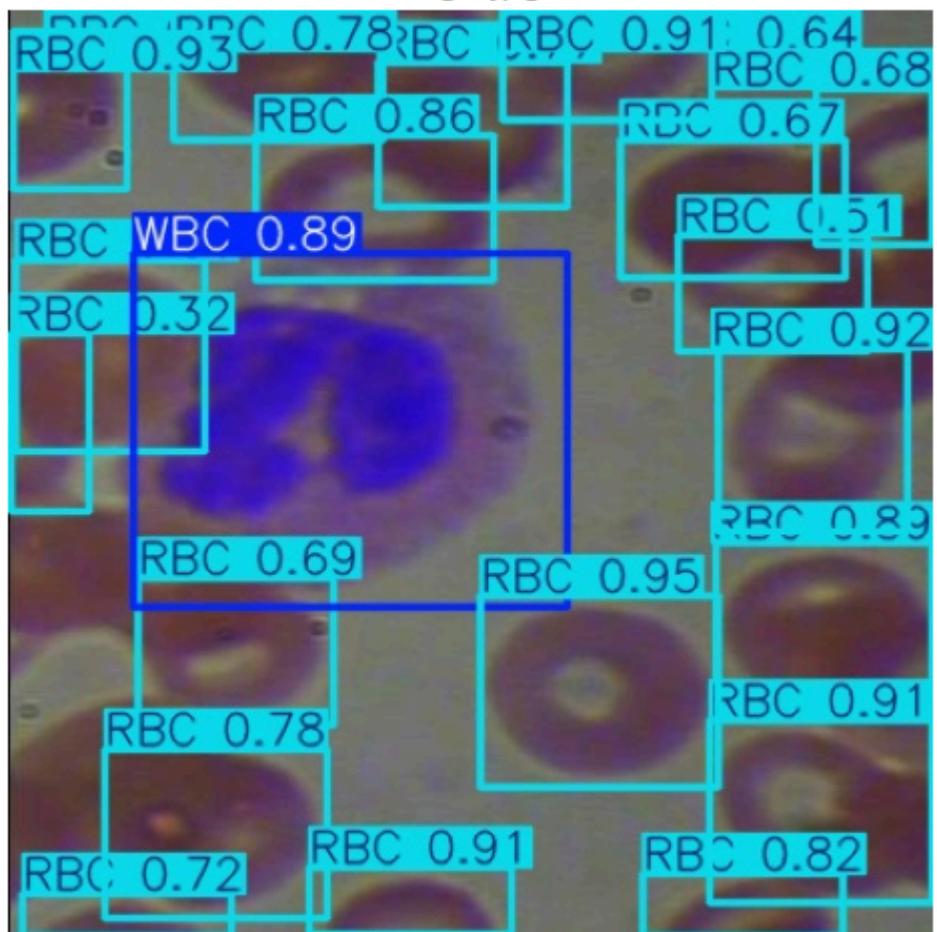
img1.jpg



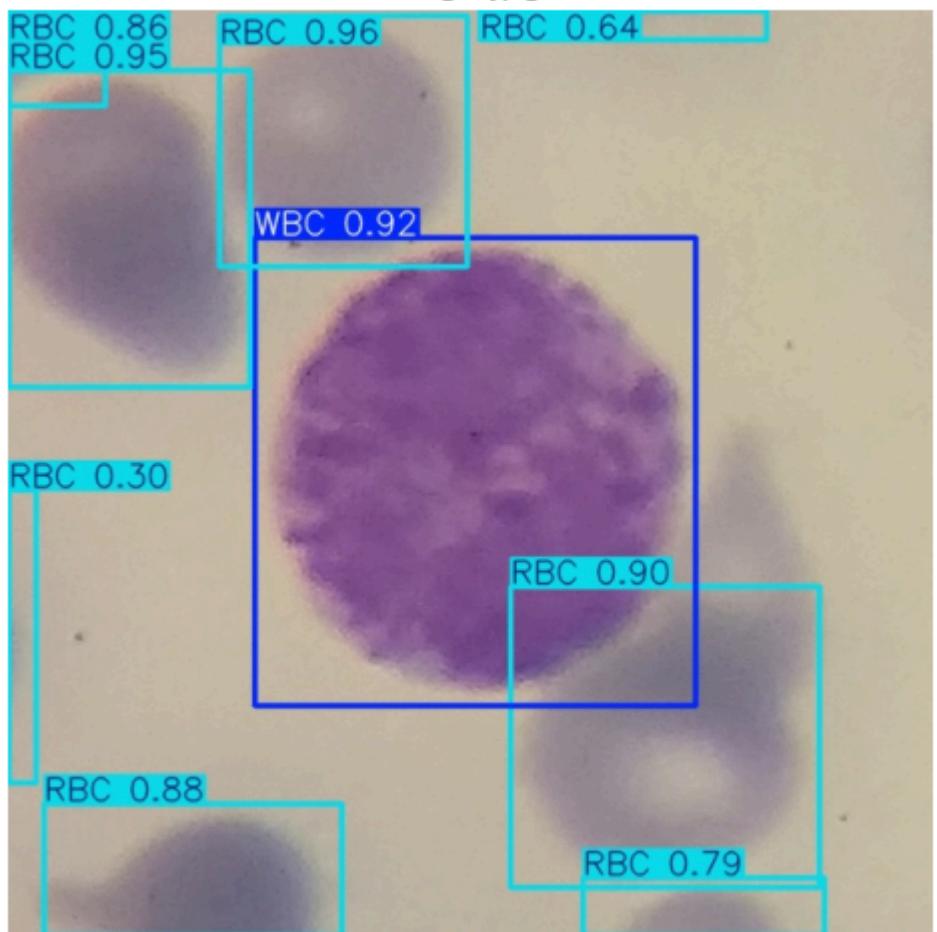
img2.jpg



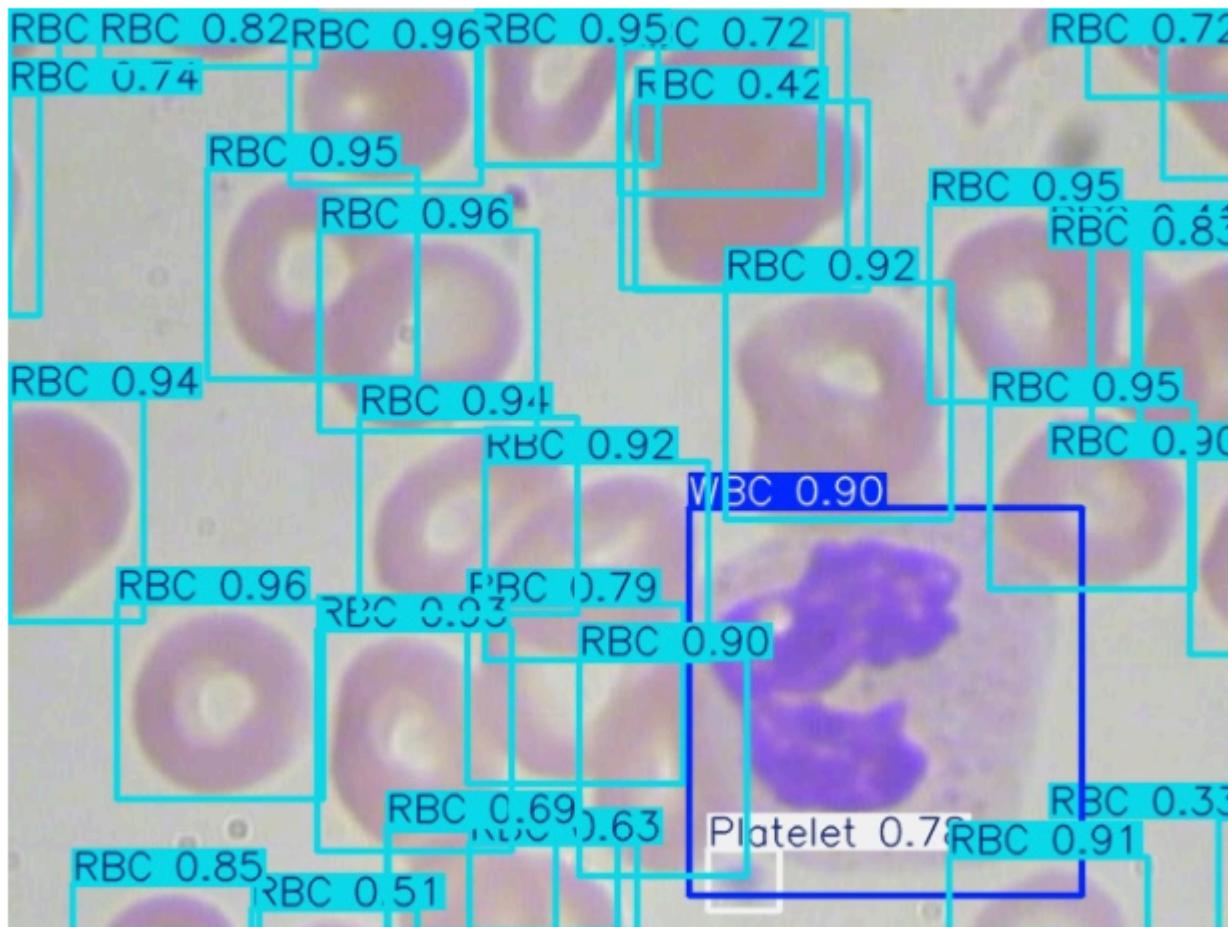
img3.jpg



img4.jpg



img5.jpg



In [9]: # Visualization Plot Score Distribution, confusion_matrix, F1_curve and PR_curve for test predictions

```
import matplotlib.pyplot as plt
import os

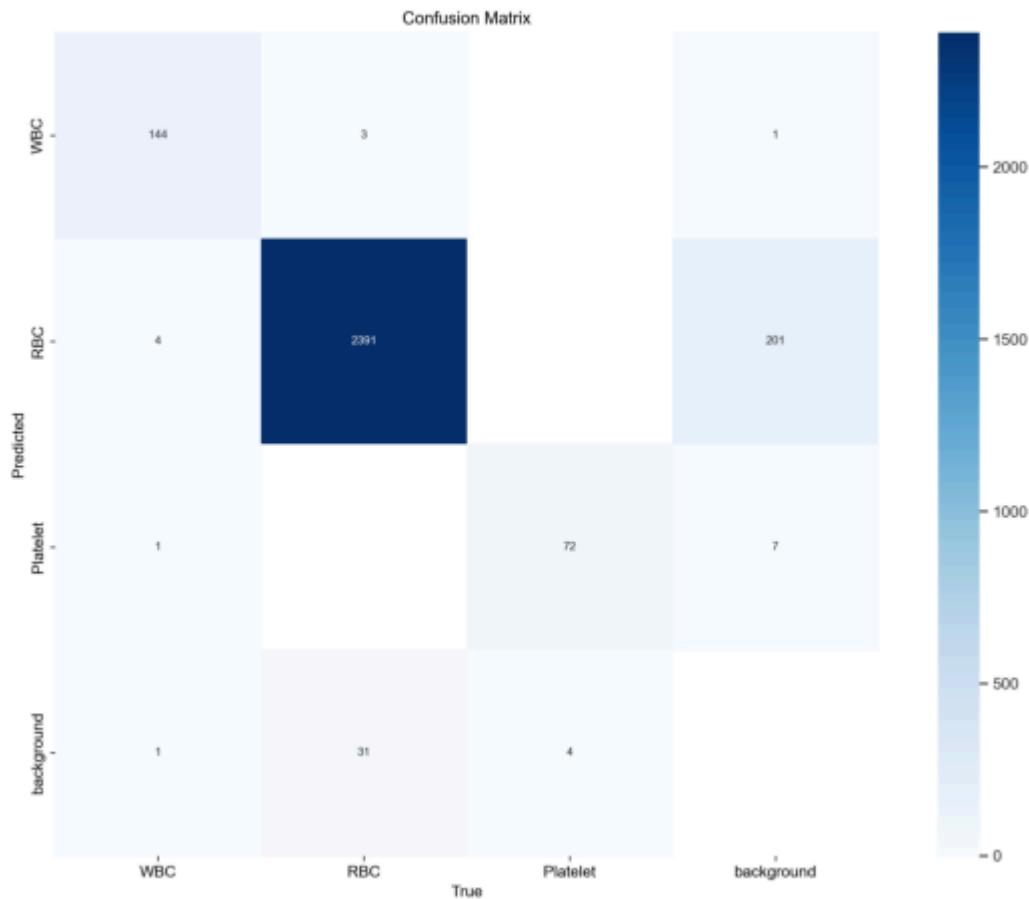
image_paths = [
    "runs/detect/test/confusion_matrix.png",
    "runs/detect/test/confusion_matrix_normalized.png",
    "runs/detect/test/F1_curve.png",
    "runs/detect/test/P_curve.png",
    "runs/detect/test/PR_curve.png",
    "runs/detect/test/R_curve.png"
]

for img_path in image_paths:
    if os.path.exists(img_path):
```

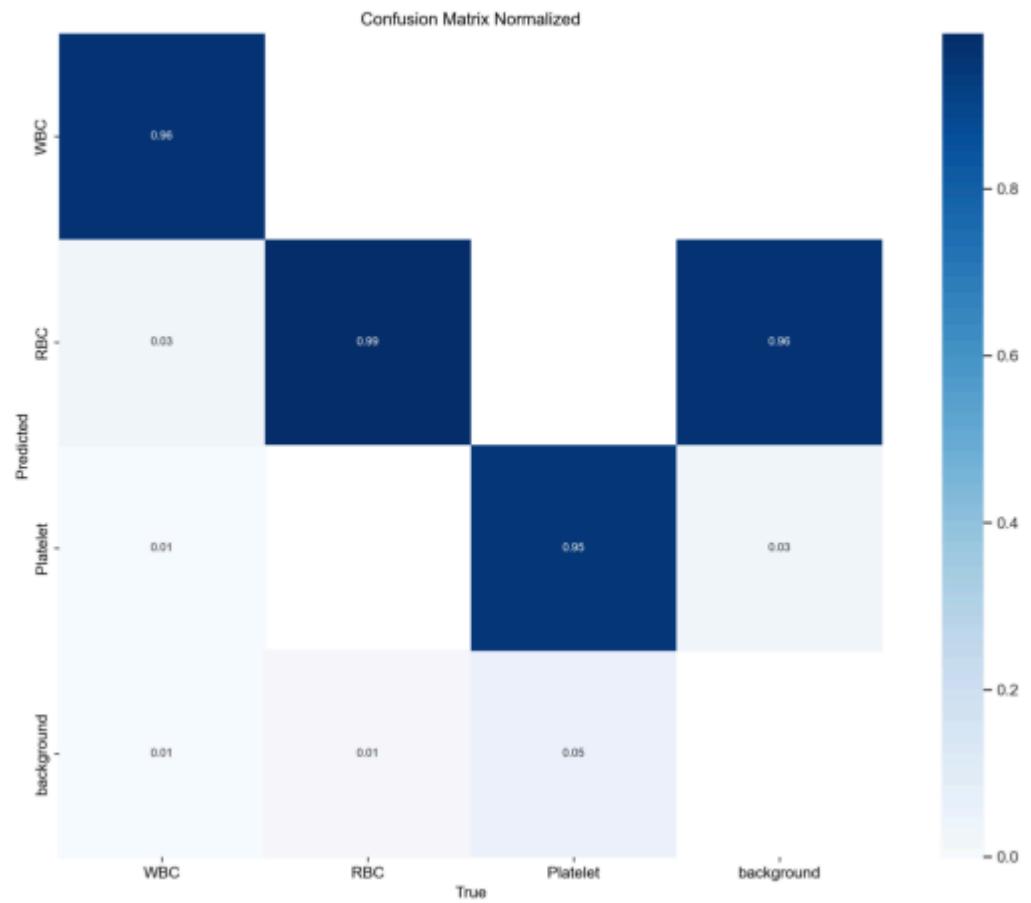
```
img = plt.imread(img_path)
plt.figure(figsize=(8, 6))
plt.imshow(img)
plt.axis('off')
plt.title(os.path.basename(img_path))
plt.show()

else:
    print(f"file not found: {img_path}")
```

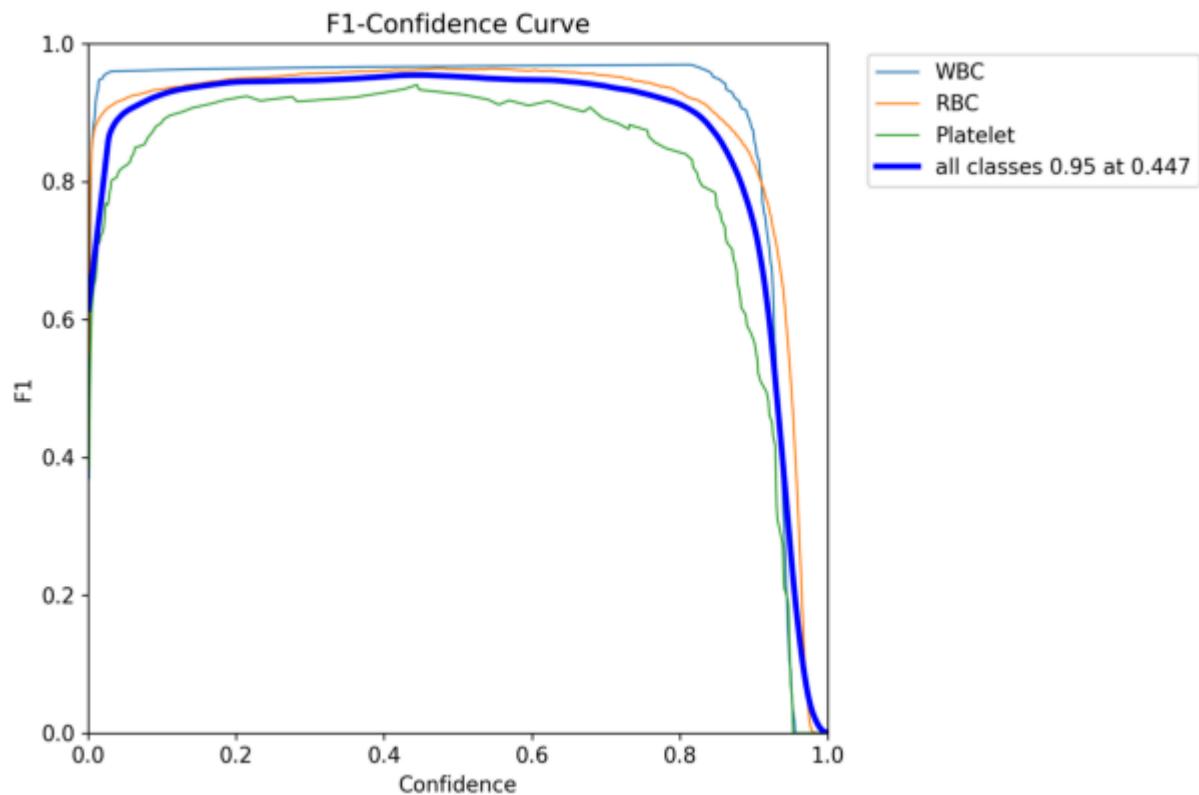
confusion_matrix.png



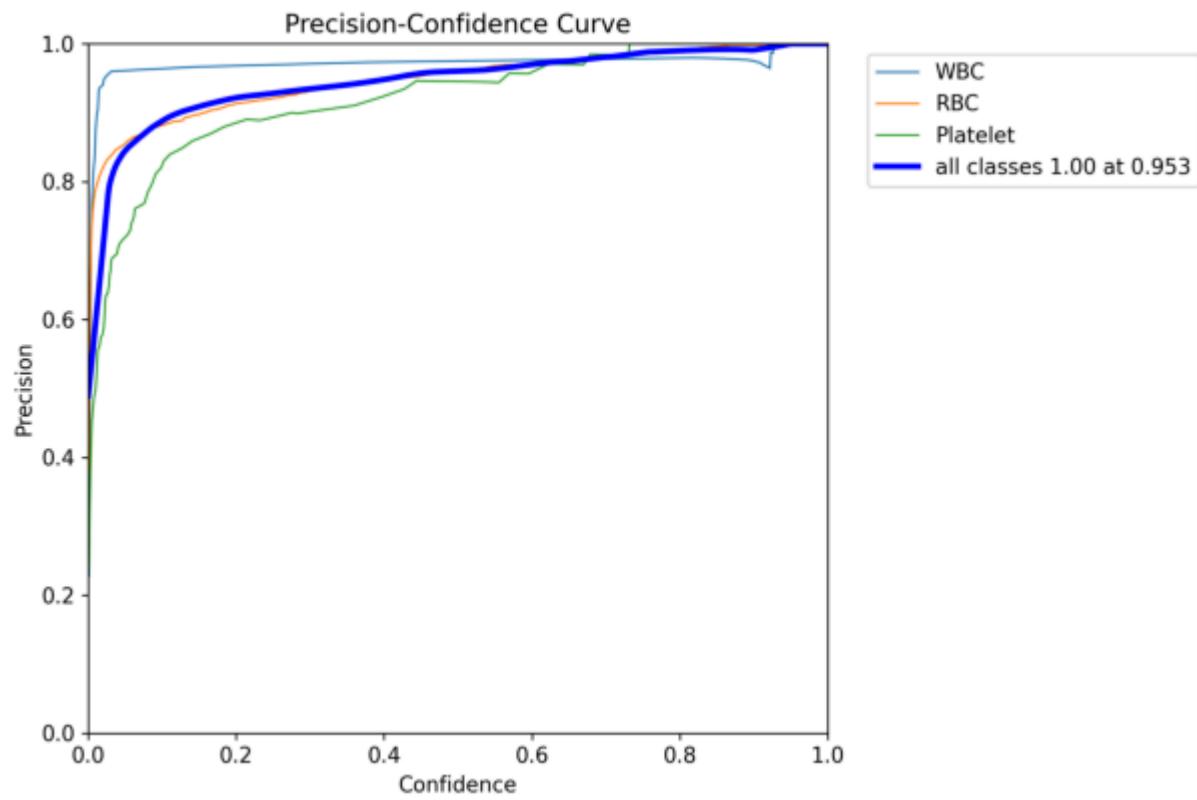
confusion_matrix_normalized.png



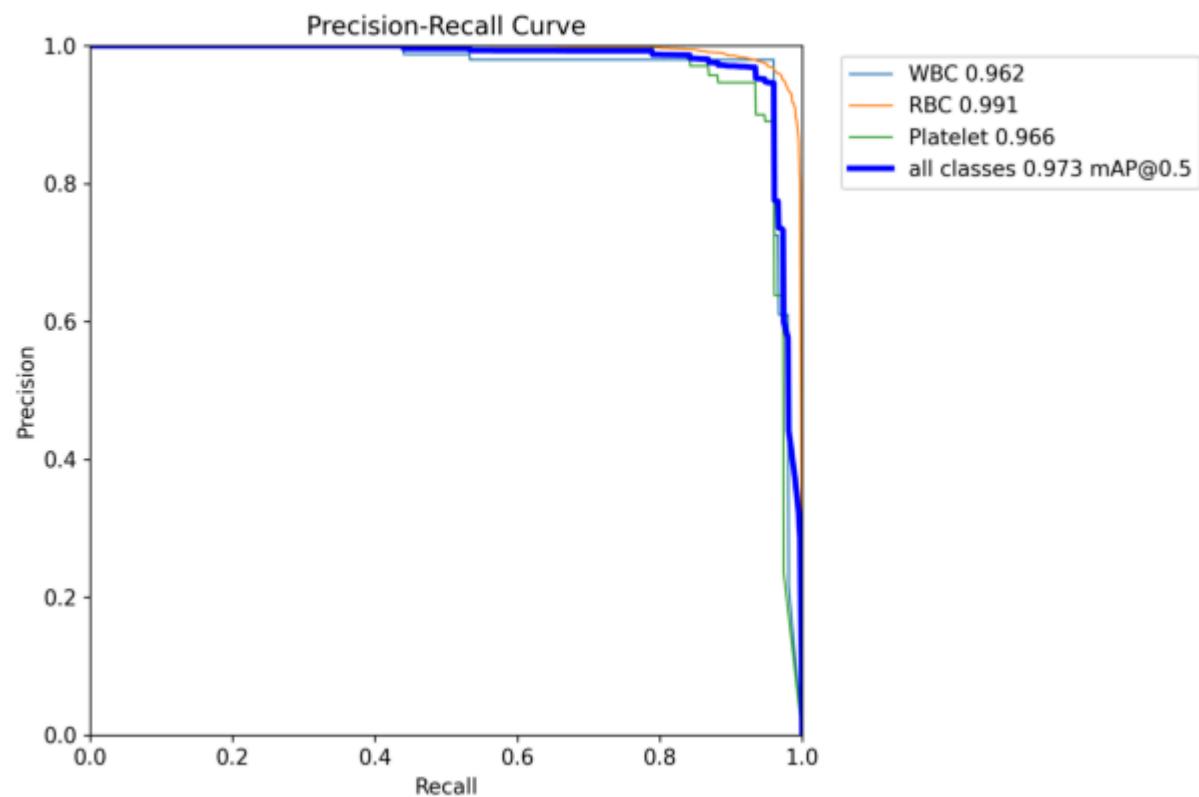
F1_curve.png



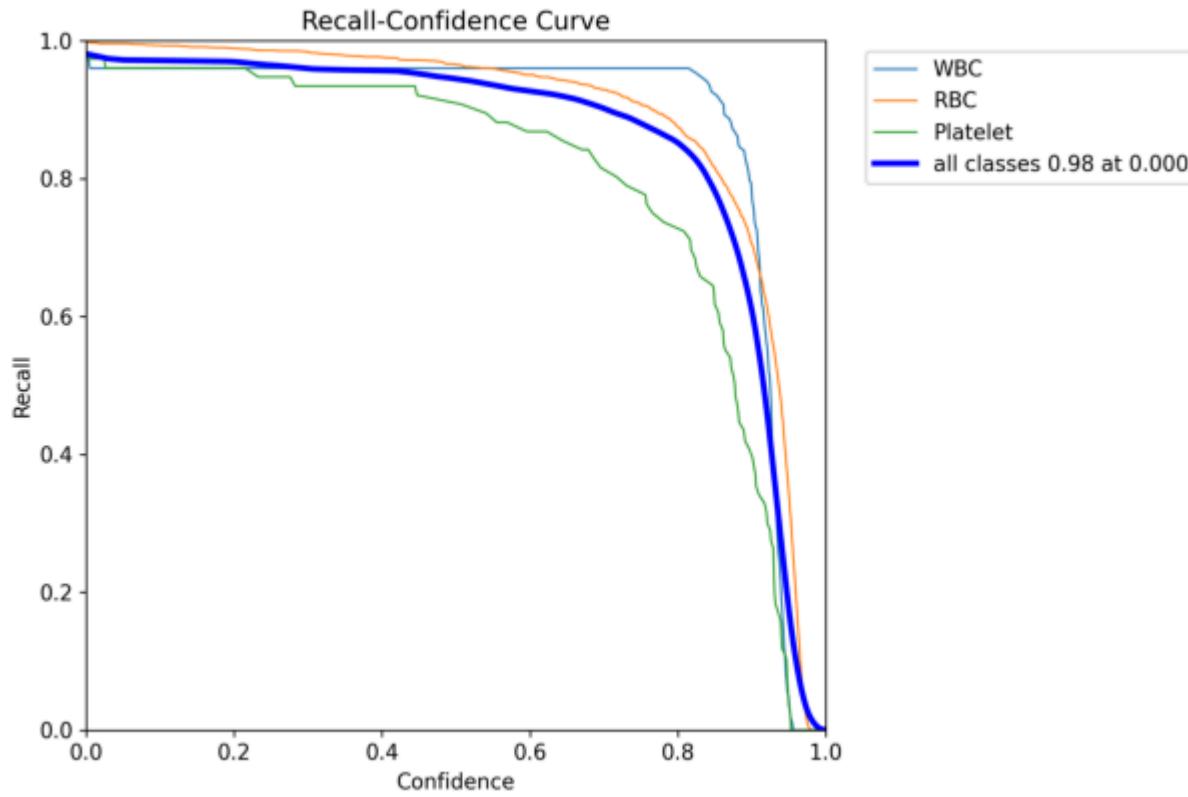
P_curve.png



PR_curve.png



R_curve.png



Compare the results of early training with the results of late training:

Notes: For training, the epoch is 50, and the batch size is 16. We have 1008 training data, so train_batch0.jpg refers to the first batch result of the first epoch, and the train_batch2520.jpg refers to the first batch result of the 40th epoch. By comparing the previous and later training images, it can be seen that the model is indeed more and more accurate in training, and the loss is getting smaller.

```
In [ ]: import matplotlib.pyplot as plt
import os
import pandas as pd
from tabulate import tabulate

image_paths = [
    "runs/detect/train/train_batch0.jpg",
    "runs/detect/train/train_batch2520.jpg"
]

for img_path in image_paths:
```

```
if os.path.exists(img_path):
    img = plt.imread(img_path)
    plt.figure(figsize=(10, 8))
    plt.imshow(img)
    plt.axis('off')
    plt.title(os.path.basename(img_path))
    plt.show()
else:
    print(f"file not found: {img_path}")

# Read results.csv and print info of epoch1 and epoch40
csv_path = "runs/detect/train/results.csv"
df = pd.read_csv(csv_path)

epoch_1 = df[df["epoch"] == 1]
epoch_40 = df[df["epoch"] == 40]

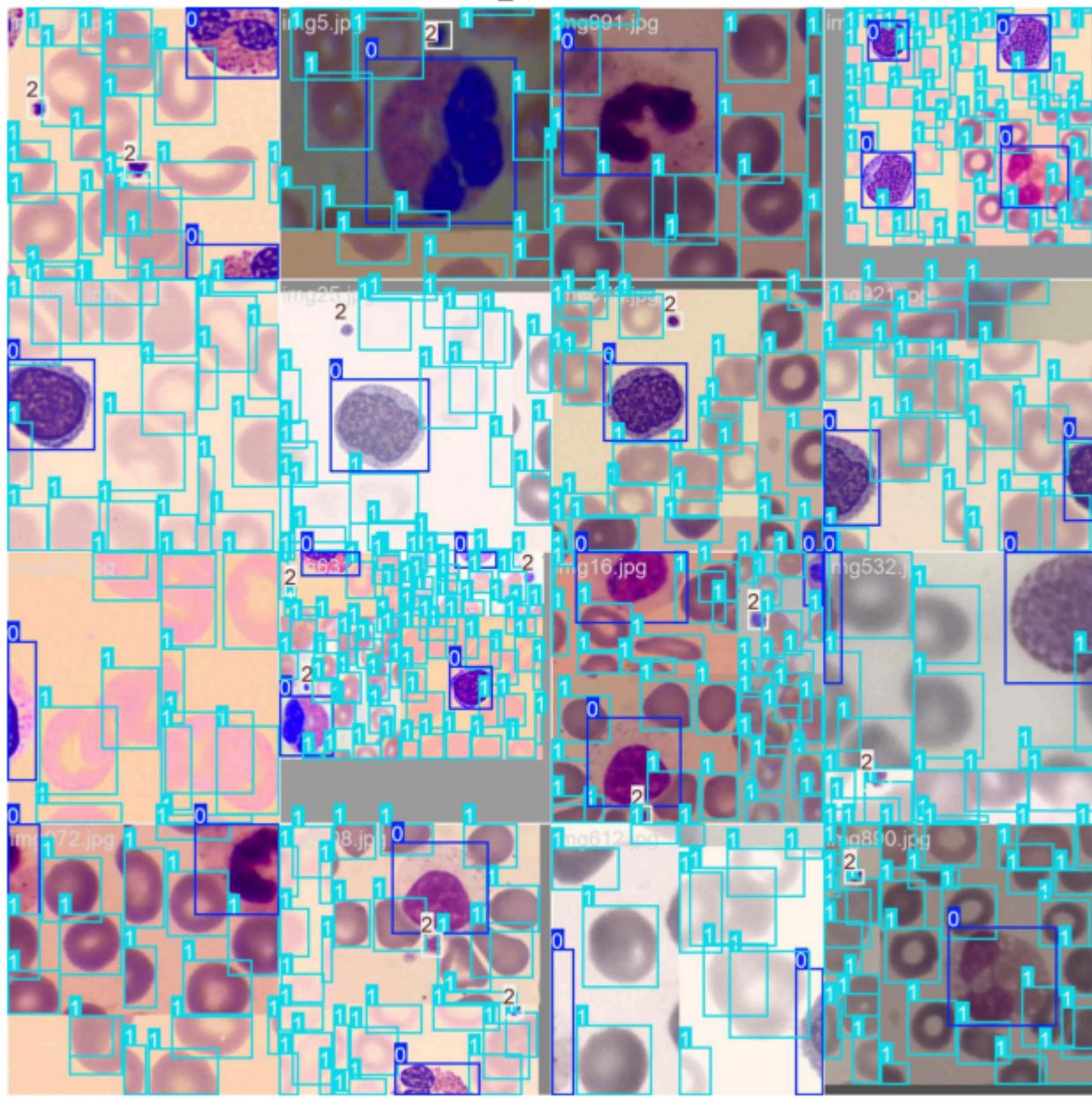
columns = ["epoch", "time", "train/box_loss", "train/cls_loss", "train/dfl_loss",
           "metrics/precision(B)", "metrics/recall(B)", "metrics/mAP50(B)", "metrics/mAP50-95(B)",
           "val/box_loss", "val/cls_loss", "val/dfl_loss"]

epoch_1_data = epoch_1[columns].values.tolist()
epoch_40_data = epoch_40[columns].values.tolist()

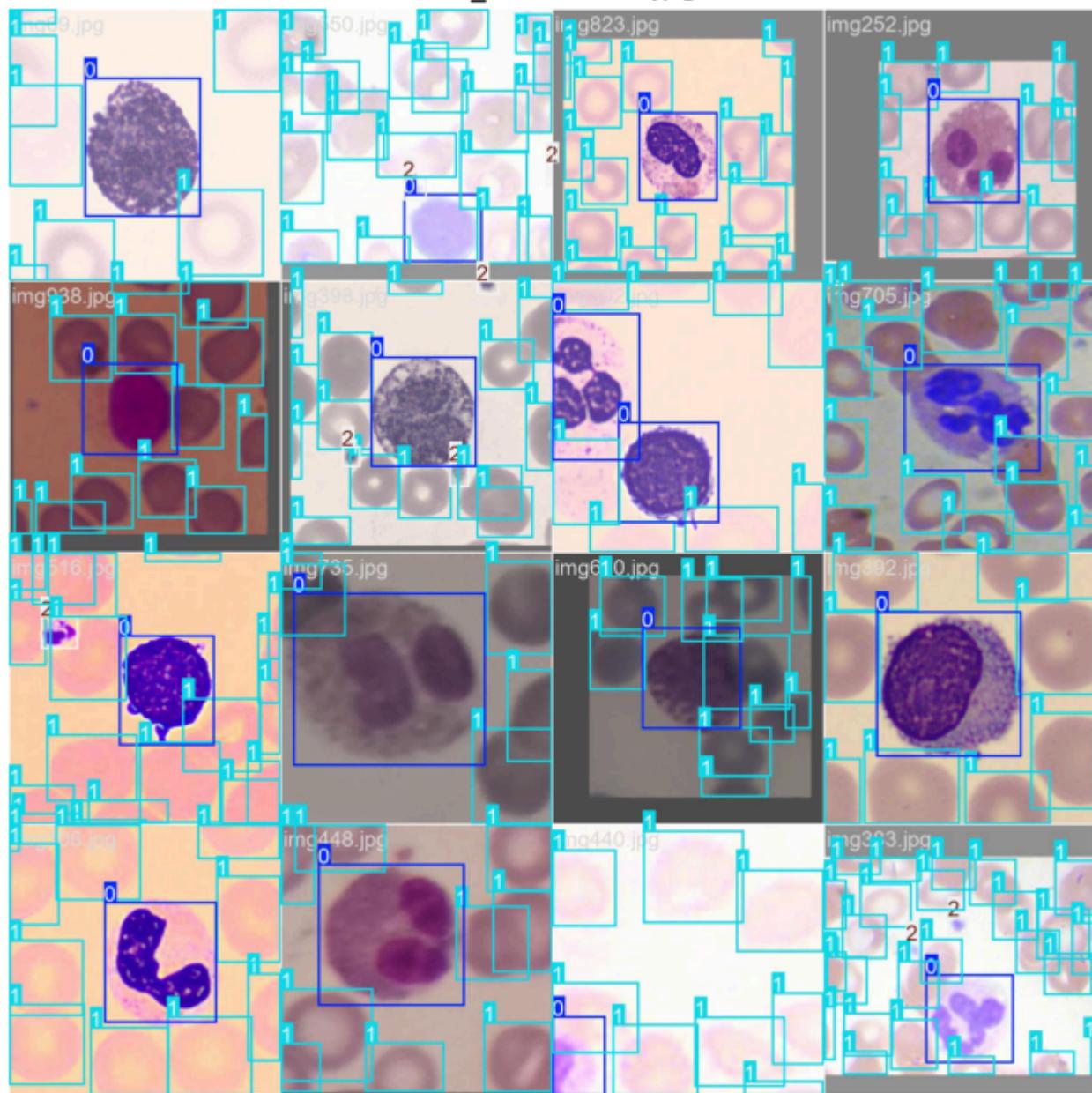
print("Epoch 1 Training Info:")
print(tabulate(epoch_1_data, headers=columns, tablefmt="grid"))

print("\nEpoch 40 Training Info:")
print(tabulate(epoch_40_data, headers=columns, tablefmt="grid"))
```

train_batch0.jpg



train_batch2520.jpg



Epoch 1 Training Info:

| epoch | time | train/box_loss | train/cls_loss | train/dfl_loss | metrics/precision(B) | metrics/recall(B) |
|------------------|---------------------|----------------|----------------|----------------|----------------------|-------------------|
| metrics/mAP50(B) | metrics/mAP50-95(B) | val/box_loss | val/cls_loss | val/dfl_loss | | |
| 1 | 350.015 | 0.9837 | 1.76613 | 1.2285 | 0.96238 | 0.59588 |
| 0.64446 | 0.50454 | 0.77807 | 0.90254 | 1.03918 | | |

Epoch 40 Training Info:

| epoch | time | train/box_loss | train/cls_loss | train/dfl_loss | metrics/precision(B) | metrics/recall(B) |
|------------------|---------------------|----------------|----------------|----------------|----------------------|-------------------|
| metrics/mAP50(B) | metrics/mAP50-95(B) | val/box_loss | val/cls_loss | val/dfl_loss | | |
| 40 | 18528.4 | 0.54384 | 0.33237 | 0.96006 | 0.95407 | 0.95664 |
| 0.9781 | 0.84125 | 0.50963 | 0.3083 | 0.97022 | | |