Panoptic Segmentation using DETR

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Metrics on which Model will be Evaluated:

1. **Bounding Box Model**
    a. Loss
    b. mAP
    c. BBox Loss
2. **Segmentation Model**
    a. Loss
    b. mAP

Detailed Workflow:

1. Gather Images
2. Annotate Images
3. Get COCO annotation from Facebook DETR
4. Merge COCO annotation and construction annotation and create final Category Mapping
5. Create Final Dataset
6. Create Mask Images for Panoptic Training
7. Create Bounding Box Annotation JSON for Object Detection Model
8. Create Segmentation Annotation JSON for Panoptic Segmentation Model
9. Split Dataset into Train 80% - Test 20%
10. Build Detection Model
11. Train Detection Model

12. Apply Different Transformations while Training
13. Test Detection Model
14. Regularize or Hyper parameterize Model based on Test Results
15. Visualize Loss and Accuracy
16. Visualize sample Bounding Box Predictions
17. Build Segmentation Model
18. Train Segmentation Model
19. Apply different Transformations while Training
20. Test Segmentation Model
21. Regularize or Hyper parameterize Model based on Test Results
22. Visualize Loss and Accuracy
23. Visualize sample Panoptic Predictions

DATA MODELS:

Data Model for Object Detection:

```
{
        “categories”: [{
        “color”: [R,G,B],
        “isthing”: enum[0, 1],
        “id”: integer,
        “name”: string
    }],

    “images”: [{
        “id”: integer,
        “file_name”: string (image name with extension),
        “width”: integer (image width in pixels),
        “height”: integer (image height in pixels)
    }],

    “annotations”: [{
        “id”: integer,
        “image_id”: integer,
```

“category_id”: integer,
“segmentation”: [float],
“area”: float,
“bbox”: float,
“iscrowd”: enum[0,1]
}]
}

Sample:


```
"categories": [
   {
      "color": [
         220,
         20,
         60
      ],
      "isthing": 0,
      "id": 1,
      "name": "misc"
   },

   {
      "color": [
         255,
         255,
         128
      ],
      "isthing": 0,
      "id": 2,
      "name": "textile"
   }

]
```

```
"images": [
    {
        "id": 6356,
        "file_name": "lime_6356.jpg",
        "width": 1920,
        "height": 1080
    },

    {
        "id": 7718,
        "file_name": "distribution_transformer_7718.jpg",
        "width": 3024,
        "height": 4032
    },

    {
        "id": 9040,
        "file_name": "skid_steer_loader_9040.jpg",
        "width": 440,
        "height": 293
    }

]
```

```
"annotations": [
    {
        "id": 20669,
        "image_id": 6356,
        "category_id": 41,
        "segmentation": [
            [
                358.66,
                772.31,
                849.03,
                1132.05,
                875.98,
                898.79,
                337.93,
                360.73,
                811.71,
                358.66,
                770.24
            ]
        ],
        "area": 232553.0,
        "bbox": [
            337.93,
            591.92,
            1341.51,
            389.81
        ],
        "iscrowd": 0,
        "attributes": {
            "occluded": false
        }
    }
]
```

Data Model for Panoptic Segmentation:

```
{
        "annotation": [{
                "image_id" : int,
                "file_name" :str,
                "segments_info" : ["segment_info"],
        }]

        "segment_info" :[{
                "id"  : int,
                "area" : int,
                "category_id": int,
                "bbox" :[x, y,  width, height]
            "iscrowd" : 0  1
        }]


        "categories": [{
                "id": int,
                "name":str,
                "supercategory": str,
                "isthing" : 0 or 1,
                "color" :[R, G, B]
        ]}
}
```

Sample:


```
"categories": [
    {
        "color": [
            220,
            20,
            60
        ],
        "isthing": 0,
        "id": 1,
        "name": "misc"
    },

    {
        "color": [
            255,
            255,
            128
        ],
        "isthing": 0,
        "id": 2,
        "name": "textile"
    }

]
```

```
"annotations": [
  {
    "segments_info": [
      {
        "segment_id": 0,
        "category_id": 1,
        "bbox": [
          0.0,
          0.0,
          225.0,
          225.0
        ],
        "area": 35508,
        "iscrowd": 0,
        "isthing": 0,
        "id": 3937500
      },
      {
        "segment_id": 1,
        "category_id": 38,
        "bbox": [
          9.28,
          24.93,
          206.38,
          174.39
        ],
        "area": 14461.0,
        "iscrowd": 0,
        "isthing": 1,
        "id": 25799
      },
    ],
    "file_name": "hydra_crane_5.png",
    "image_id": 5
  }
]
```

```
"images": [
    {
        "id": 5,
        "file_name": "hydra_crane_5.jpg",
        "width": 225,
        "height": 225
    },
    {
        "id": 6,
        "file_name": "hydra_crane_6.jpg",
        "width": 500,
        "height": 500
    }
]
```

Features Supported:

1. Take an image as an input & output the panoptic segmentation for construction materail & COCO classes
2. Generate a bounding box object detection for a given image
3. Check the confidence % of the model for all the predictions

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