1. Installation

Update to Tensorflow 2.5

```
# Update CUDA for TF 2.5
!wget https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2004/x86_64/libcudnn8_8.1.0.77-1+cuda11.2_amd64.deb
!dpkg -i libcudnn8_8.1.0.77-1+cuda11.2_amd64.deb
# Check if package has been installed
!ls -l /usr/lib/x86_64-linux-gnu/libcudnn.so.*
# Upgrade Tensorflow
!pip install --upgrade tensorflow==2.5.0
```

```
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.8/dist-packages (from requests<3,>=2.21.0->tensorboard~=2
Requirement already satisfied: urllib3<1.27,>=1.21.1 in /usr/local/lib/python3.8/dist-packages (from requests<3,>=2.21.0->tensorboard
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.8/dist-packages (from importlib-metadata>=4.4->markdown>=2.6.8->te
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in /usr/local/lib/python3.8/dist-packages (from pyasn1-modules>=0.2.1->google-aut
Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.8/dist-packages (from requests-oauthlib>=0.7.0->google-auth-
Building wheels for collected packages: termcolor, wrapt
  Building wheel for termcolor (setup.py) ... done
  Created wheel for termcolor: filename=termcolor-1.1.0-py3-none-any.whl size=4849 sha256=761e4915029b91de233ece74e7af9db4ece74f36068
  Stored in directory: /root/.cache/pip/wheels/a0/16/9c/5473df82468f958445479c59e784896fa24f4a5fc024b0f501
  Building wheel for wrapt (setup.py) ... done
  Created wheel for wrapt: filename=wrapt-1.12.1-cp38-cp38-linux_x86_64.whl size=78559 sha256=1873aa3ed37dd678e41da13e402f144bf7972fe
  Stored in directory: /root/.cache/pip/wheels/5f/fd/9e/b6cf5890494cb8ef0b5eaff72e5d55a70fb56316007d6dfe73
Successfully built termcolor wrapt
Installing collected packages: wrapt, typing-extensions, termcolor, tensorflow-estimator, keras-nightly, numpy, grpcio, absl-py, tens
  Attempting uninstall: wrapt
    Found existing installation: wrapt 1.14.1
    Uninstalling wrapt-1.14.1:
      Successfully uninstalled wrapt-1.14.1
  Attempting uninstall: typing-extensions
    Found existing installation: typing_extensions 4.4.0
    Uninstalling typing_extensions-4.4.0:
      Successfully uninstalled typing_extensions-4.4.0
  Attempting uninstall: termcolor
    Found existing installation: termcolor 2.2.0
    Uninstalling termcolor-2.2.0:
      Successfully uninstalled termcolor-2.2.0
  Attempting uninstall: tensorflow-estimator
    Found existing installation: tensorflow-estimator 2.9.0
    Uninstalling tensorflow-estimator-2.9.0:
      Successfully uninstalled tensorflow-estimator-2.9.0
  Attempting uninstall: numpy
    Found existing installation: numpy 1.21.6
    Uninstalling numpy-1.21.6:
      Successfully uninstalled numpy-1.21.6
  Attempting uninstall: grpcio
    Found existing installation: grpcio 1.51.1
    Uninstalling grpcio-1.51.1:
      Successfully uninstalled grpcio-1.51.1
  Attempting uninstall: absl-py
    Found existing installation: absl-py 1.3.0
    Uninstalling absl-py-1.3.0:
      Successfully uninstalled absl-py-1.3.0
  Attempting uninstall: tensorflow
    Found existing installation: tensorflow 2.9.2
    Uninstalling tensorflow-2.9.2:
      Successfully uninstalled tensorflow-2.9.2
ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is the sour
xarray 2022.12.0 requires numpy>=1.20, but you have numpy 1.19.5 which is incompatible.
xarray-einstats 0.4.0 requires numpy>=1.20, but you have numpy 1.19.5 which is incompatible.
pydantic 1.10.4 requires typing-extensions>=4.2.0, but you have typing-extensions 3.7.4.3 which is incompatible.
jaxlib 0.3.25+cuda11.cudnn805 requires numpy>=1.20, but you have numpy 1.19.5 which is incompatible.
jax 0.3.25 requires numpy>=1.20, but you have numpy 1.19.5 which is incompatible.
grpcio-status 1.48.2 requires grpcio>=1.48.2, but you have grpcio 1.34.1 which is incompatible.
google-cloud-bigquery 3.4.1 requires grpcio<2.0dev,>=1.47.0, but you have grpcio 1.34.1 which is incompatible.
cupy-cuda11x 11.0.0 requires numpy<1.26,>=1.20, but you have numpy 1.19.5 which is incompatible.
cmdstanpy 1.0.8 requires numpy>=1.21, but you have numpy 1.19.5 which is incompatible.
Successfully installed absl-py-0.15.0 grpcio-1.34.1 keras-nightly-2.5.0.dev2021032900 numpy-1.19.5 tensorflow-2.5.0 tensorflow-estima
```

Install Mask R-CNN

```
!wget https://pysource.com/extra_files/maskrcnn_colab_demo_commit_17.zip
!unzip maskrcnn_colab_demo_commit_17.zip
import sys
sys.path.append("/content/maskrcnn_colab/mrcnn_demo")
```

```
from m_rcnn import *
%matplotlib inline
```

```
--2023-01-29 08:02:30--  https://pysource.com/extra_files/maskrcnn_colab_demo_commit_17.zip
Resolving pysource.com (pysource.com)... 104.21.67.193, 172.67.180.33, 2606:4700:3036::ac43:b421, ...
Connecting to pysource.com (pysource.com)|104.21.67.193|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 59340 (58K) [application/zip]
Saving to: ‘maskrcnn_colab_demo_commit_17.zip’

maskrcnn_colab_demo 100%[===================>]  57.95K  --.-KB/s    in 0.009s

2023-01-29 08:02:31 (6.37 MB/s) - ‘maskrcnn_colab_demo_commit_17.zip’ saved [59340/59340]

Archive:  maskrcnn_colab_demo_commit_17.zip
   creating: maskrcnn_colab/
   creating: maskrcnn_colab/mrcnn_demo/
  inflating: maskrcnn_colab/mrcnn_demo/config.py
  inflating: maskrcnn_colab/mrcnn_demo/model.py
  inflating: maskrcnn_colab/mrcnn_demo/m_rcnn.py
  inflating: maskrcnn_colab/mrcnn_demo/parallel_model.py
  inflating: maskrcnn_colab/mrcnn_demo/utils.py
  inflating: maskrcnn_colab/mrcnn_demo/visualize.py
VERS 0.4 - updated 04/08/2022
/content/maskrcnn_colab/mrcnn_demo/model.py:2378: SyntaxWarning: "is" with a literal. Did you mean "=="?
  if os.name is 'nt':
Downloading pretrained model to /content/maskrcnn_colab/mask_rcnn_coco.h5 ...
... done downloading pretrained model!
```

```
!nvidia-smi
```

```
Sun Jan 29 08:03:03 2023
+-----------------------------------------------------------------------------+
| NVIDIA-SMI 510.47.03    Driver Version: 510.47.03    CUDA Version: 11.6     |
|-------------------------------+----------------------+----------------------+
| GPU  Name        Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap|         Memory-Usage | GPU-Util  Compute M. |
|                               |                      |               MIG M. |
|===============================+======================+======================|
|   0  Tesla T4            Off  | 00000000:00:04.0 Off |                    0 |
| N/A   50C    P0    26W /  70W |      0MiB / 15360MiB |      0%      Default |
|                               |                      |                  N/A |
+-------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------+
| Processes:                                                                  |
|  GPU   GI   CI        PID   Type   Process name                  GPU Memory |
|        ID   ID                                                   Usage      |
|=============================================================================|
|  No running processes found                                                 |
+-----------------------------------------------------------------------------+
```

2. Image Dataset

Load your annotated dataset

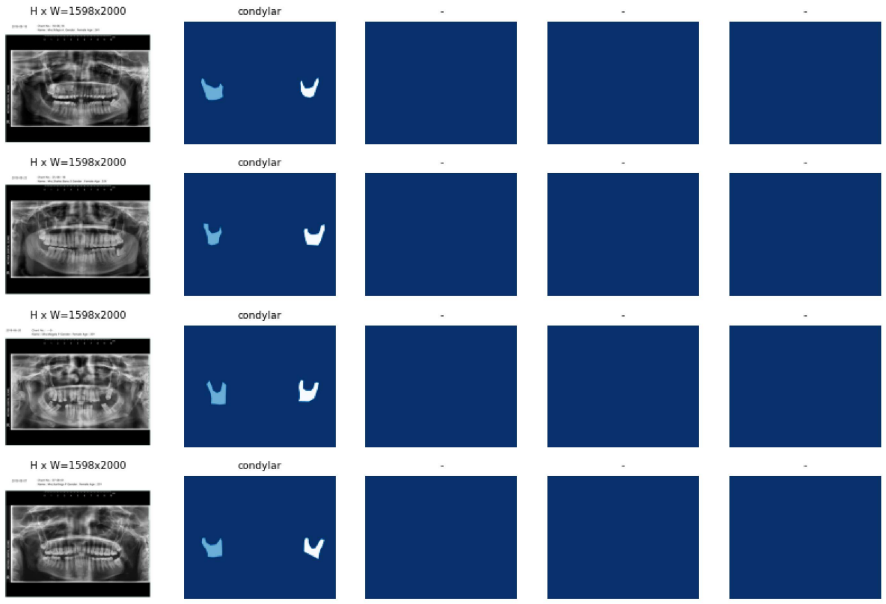
```
# Extract Images
images_path = "dataset.zip"
annotations_path = "annotations (2).json"

extract_images(os.path.join("/content/",images_path), "/content/dataset")
```

```
Extracted: 42 images
```

```
dataset_train = load_image_dataset(os.path.join("/content/", annotations_path), "/content/dataset", "train")
dataset_val = load_image_dataset(os.path.join("/content/", annotations_path), "/content/dataset", "val")
class_number = dataset_train.count_classes()
print('Train: %d' % len(dataset_train.image_ids))
print('Validation: %d' % len(dataset_val.image_ids))
print("Classes: {}".format(class_number))
```

```
Annotation json path:  /content/annotations (2).json
Annotation json path:  /content/annotations (2).json
Train: 38
Validation: 4
Classes: 1
```

```
# Load image samples
display_image_samples(dataset_train)
```



3. Training

Train Mask RCNN on your custom Dataset.

```
# Load Configuration
config = CustomConfig(class_number)
# config.display()
model = load_training_model(config)
```

```
/content/maskrcnn_colab/mask_rcnn_coco.h5
```

```
# Start Training
# This operation might take a long time.
train_head(model, dataset_train, dataset_train, config)
```

```
Starting at epoch 0. LR=0.001

Checkpoint Path: /content/maskrcnn_colab/logs/object20230129T0812/mask_rcnn_object_{epoch:04d}.h5
Selecting layers to train
fpn_c5p5               (Conv2D)
fpn_c4p4               (Conv2D)
fpn_c3p3               (Conv2D)
fpn_c2p2               (Conv2D)
fpn_p5                 (Conv2D)
fpn_p2                 (Conv2D)
fpn_p3                 (Conv2D)
fpn_p4                 (Conv2D)
rpn_model              (Functional)
mrcnn_mask_conv1       (TimeDistributed)
mrcnn_mask_bn1         (TimeDistributed)
mrcnn_class_conv1      (TimeDistributed)
mrcnn_class_bn1        (TimeDistributed)
mrcnn_mask_conv2       (TimeDistributed)
mrcnn_mask_bn2         (TimeDistributed)
mrcnn_class_conv2      (TimeDistributed)
mrcnn_class_bn2        (TimeDistributed)
mrcnn_mask_conv3       (TimeDistributed)
mrcnn_mask_bn3         (TimeDistributed)
mrcnn_bbox_fc          (TimeDistributed)
mrcnn_mask_conv4       (TimeDistributed)
mrcnn_mask_bn4         (TimeDistributed)
mrcnn_mask_deconv      (TimeDistributed)
mrcnn_class_logits     (TimeDistributed)
```

```
mrcnn_mask             (TimeDistributed)
Epoch 1/5
500/500 [==============================] - 566s 1s/step - batch: 249.5000 - size: 4.0000 - loss: 0.3592 - val_loss: 0.1255
Epoch 2/5
500/500 [==============================] - 454s 907ms/step - batch: 249.5000 - size: 4.0000 - loss: 0.1004 - val_loss: 0.0773
Epoch 3/5
500/500 [==============================] - 454s 907ms/step - batch: 249.5000 - size: 4.0000 - loss: 0.0725 - val_loss: 0.0714
Epoch 4/5
500/500 [==============================] - 453s 906ms/step - batch: 249.5000 - size: 4.0000 - loss: 0.0569 - val_loss: 0.0525
Epoch 5/5
500/500 [==============================] - 453s 906ms/step - batch: 249.5000 - size: 4.0000 - loss: 0.0540 - val_loss: 0.0482
```

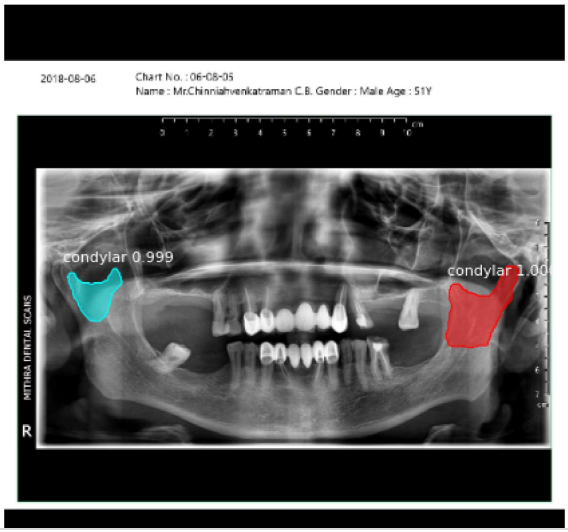
4. Detection (test your model on a random image)

```
# Load Test Model
# The latest trained model will be loaded
test_model, inference_config = load_test_model(class_number)
```

```
WARNING:tensorflow:From /usr/local/lib/python3.8/dist-packages/tensorflow/python/util/deprecation.py:602: calling map_fn_v2 (from tenso
Instructions for updating:
Use fn_output_signature instead
Loading weights from  /content/maskrcnn_colab/logs/object20230129T0812/mask_rcnn_object_0005.h5
Re-starting from epoch 5
```

```
# Test on a random image
test_random_image(test_model, dataset_val, inference_config)
```

```
original_image           shape: (512, 512, 3)         min:    0.00000  max:  255.00000  uint8
Trained model result
Processing 1 images
image                    shape: (512, 512, 3)         min:    0.00000  max:  255.00000  uint8
molded_images            shape: (1, 512, 512, 3)      min: -123.70000  max:  151.10000  float64
image_metas              shape: (1, 14)               min:    0.00000  max:  512.00000  int64
anchors                  shape: (1, 65472, 4)         min:   -0.70849  max:    1.58325  float32
Annotation
```



✓ 5s completed at 2:29 PM