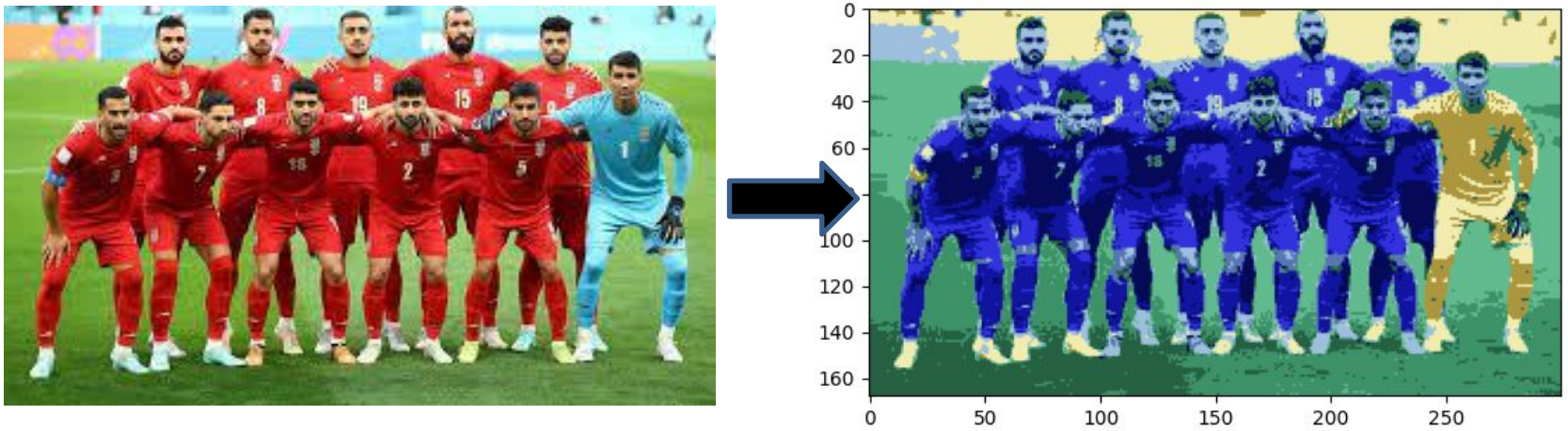
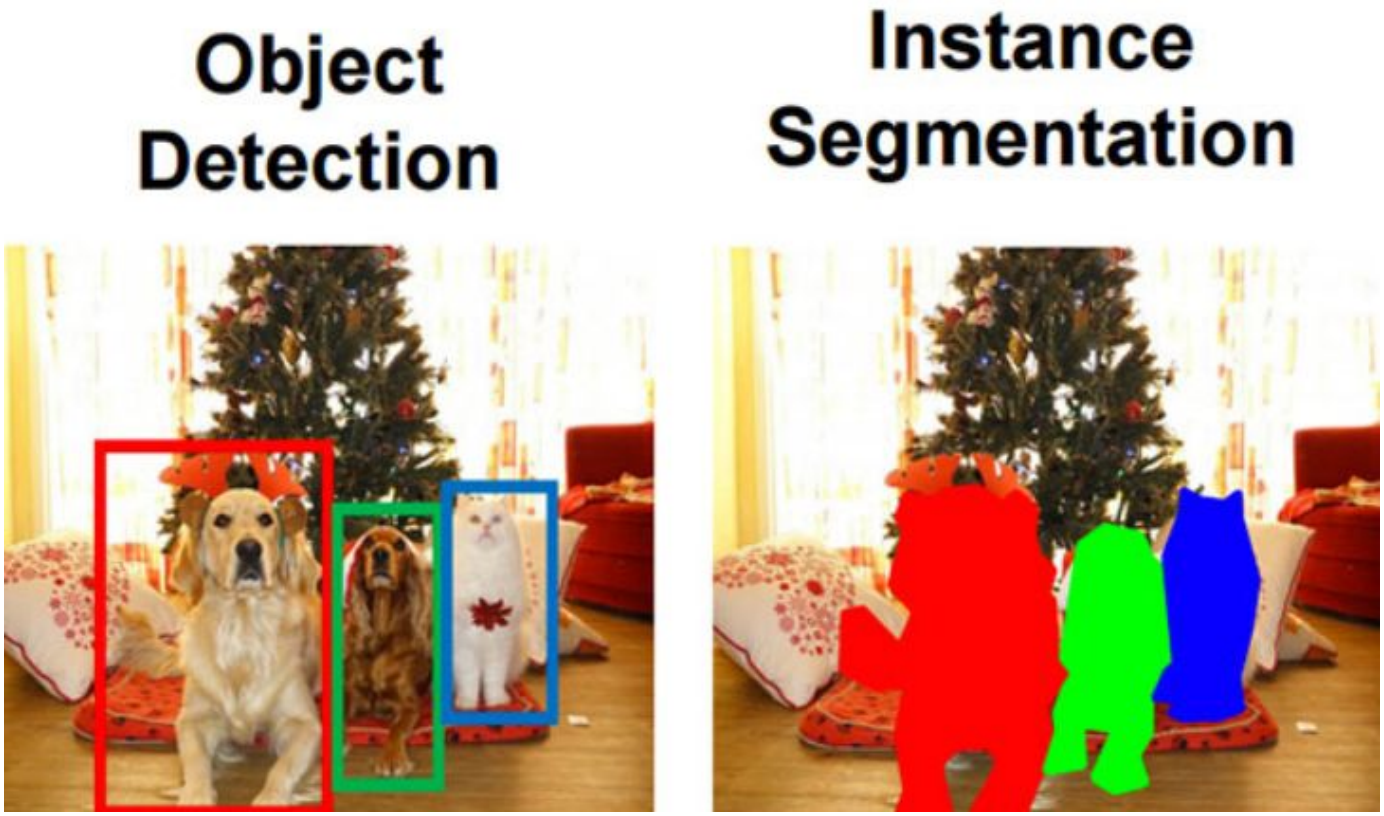
K-MEANS CLUSTERING



Good, not so good

INSTANCE SEGMENTATION CAME TO RESCUE



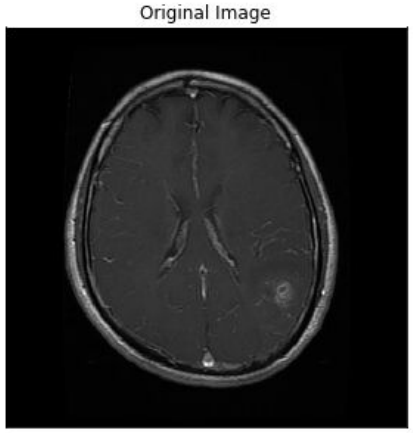
MRCNN OUTPERFORMED K-MEANS

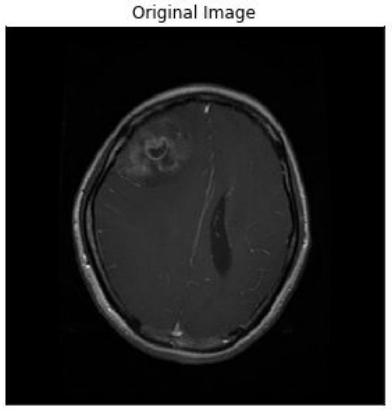
Dataset:

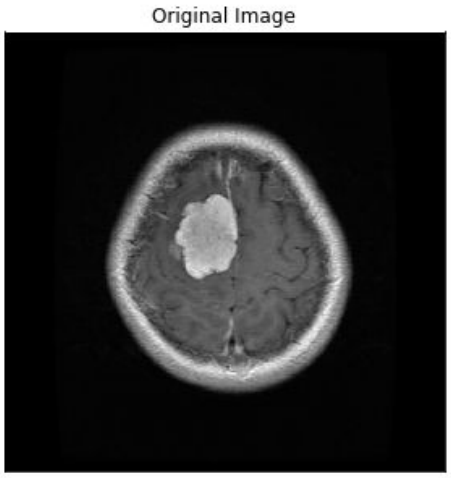
A brain tumor dataset set has been used for the analysis. We have picked it from Github: [Click to open link]

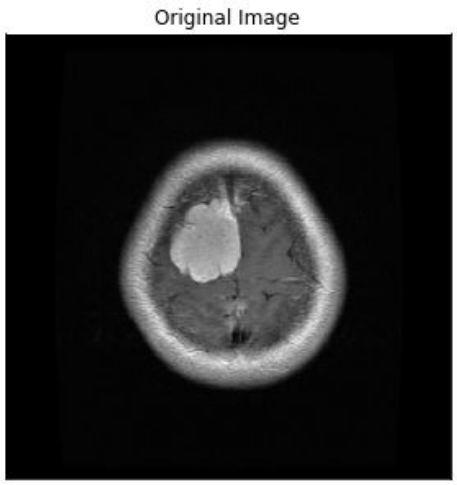
Few examples of the dataset are shown below :

Images without the tumor







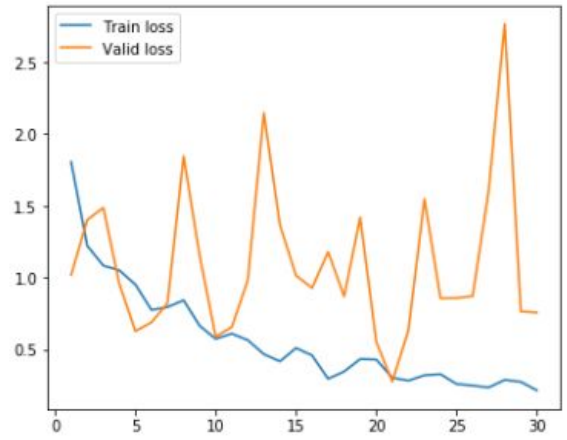


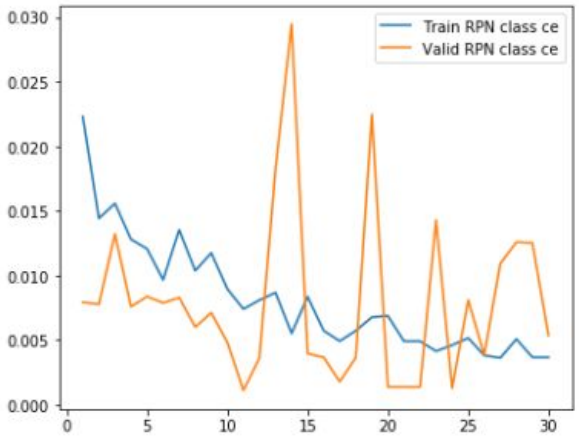
Images with tumor

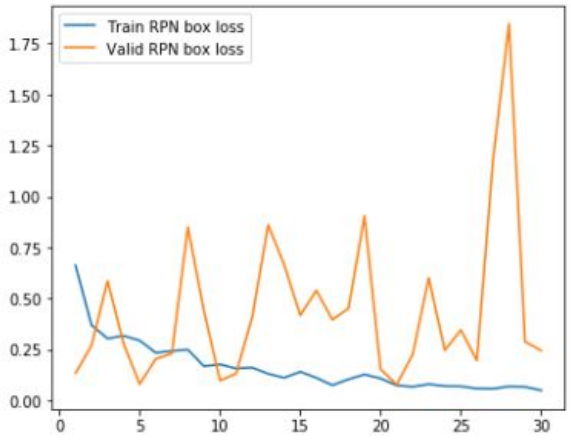
Baseline config for matterport MR-CNN

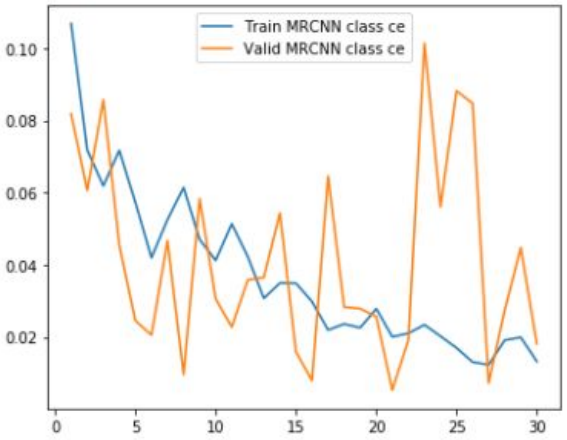
```
Configurations:
BACKBONE                        resnet101
BACKBONE_STRIDES                [4, 8, 16, 32, 64]
BATCH_SIZE                      1
BBOX_STD_DEV                    [0.1 0.1 0.2 0.2]
COMPUTE_BACKBONE_SHAPE          None
DETECTION_MAX_INSTANCES         100
DETECTION_MIN_CONFIDENCE        0.7
DETECTION_NMS_THRESHOLD         0.3
FPN_CLASSIF_FC_LAYERS_SIZE      1024
GPU_COUNT                       1
GRADIENT_CLIP_NORM              5.0
IMAGES_PER_GPU                  1
IMAGE_CHANNEL_COUNT             3
IMAGE_MAX_DIM                   1024
IMAGE_META_SIZE                 14
IMAGE_MIN_DIM                   800
IMAGE_MIN_SCALE                 0
IMAGE_RESIZE_MODE               square
IMAGE_SHAPE                     [1024 1024    3]
LEARNING_MOMENTUM               0.9
LEARNING_RATE                   0.001
LOSS_WEIGHTS                    {'rpn_class_loss': 1.0, 'rpn_bbox_loss': 1.0, 'mrcnn_class_loss': 1.0, 'mrcnn_bbox_loss': 1.0, 'mrcnn_mask_loss': 1.0}
MASK_POOL_SIZE                  14
MASK_SHAPE                      [28, 28]
MAX_GT_INSTANCES                100
MEAN_PIXEL                      [123.7 116.8 103.9]
MINI_MASK_SHAPE                 (56, 56)
NAME                            tumor_detect
NUM_CLASSES                     2
POOL_SIZE                       7
POST_NMS_ROIS_INFERENCE         1000
POST_NMS_ROIS_TRAINING          2000
PRE_NMS_LIMIT                   6000
ROI_POSITIVE_RATIO              0.33
RPN_ANCHOR_RATIOS               [0.5, 1, 2]
RPN_ANCHOR_SCALES               (32, 64, 128, 256, 512)
RPN_ANCHOR_STRIDE               1
RPN_BBOX_STD_DEV                [0.1 0.1 0.2 0.2]
RPN_NMS_THRESHOLD               0.7
RPN_TRAIN_ANCHORS_PER_IMAGE     256
STEPS_PER_EPOCH                 100
TOP_DOWN_PYRAMID_SIZE           256
TRAIN_BN                        False
TRAIN_ROIS_PER_IMAGE            200
USE_MINI_MASK                   True
USE_RPN_ROIS                    True
VALIDATION_STEPS                5
WEIGHT_DECAY                    0.0001
```

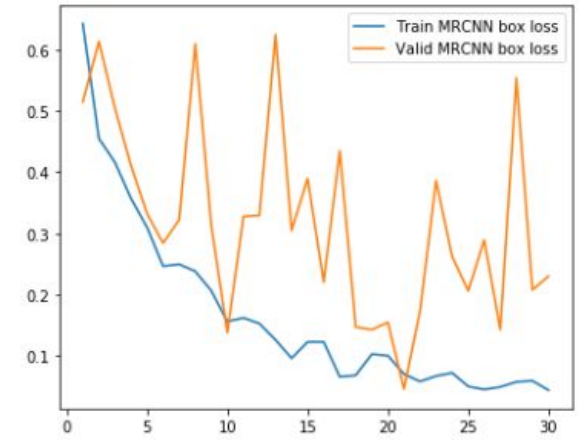
Results: Loss vs Epochs Graph for baseline

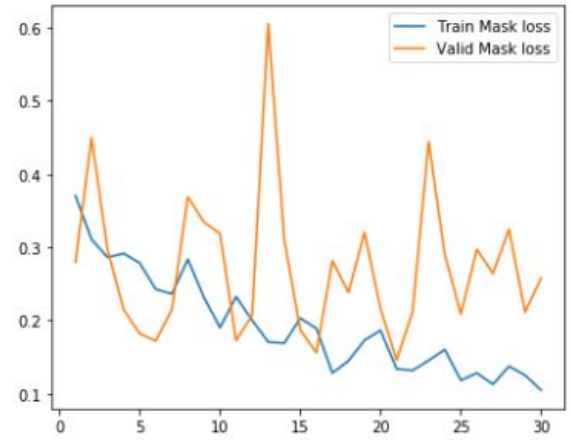




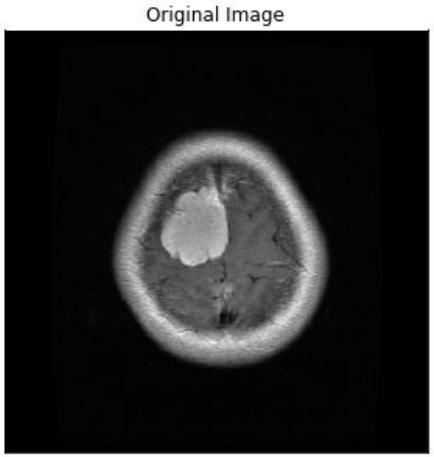


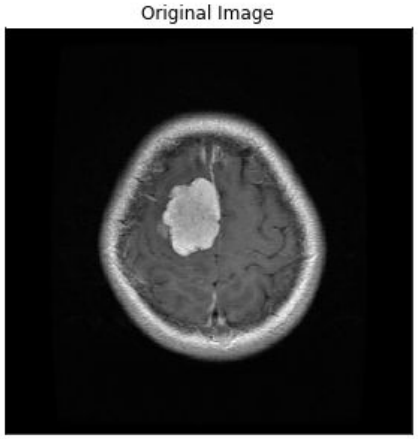


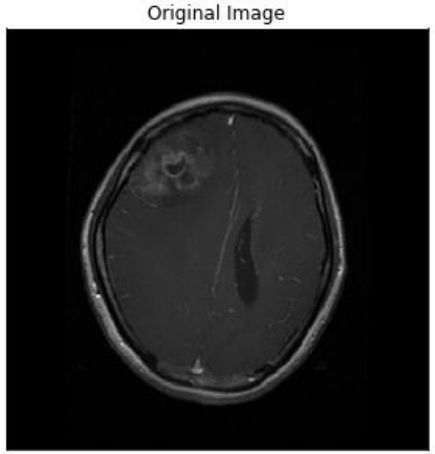




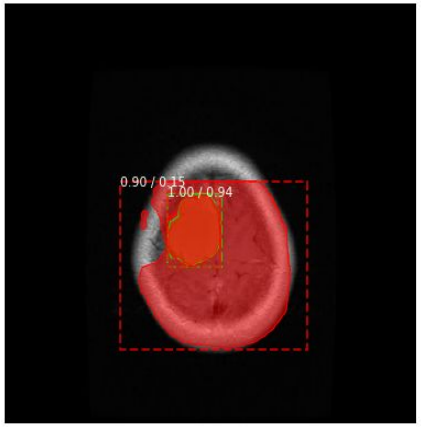
Baseline config for matterport MR-CNN

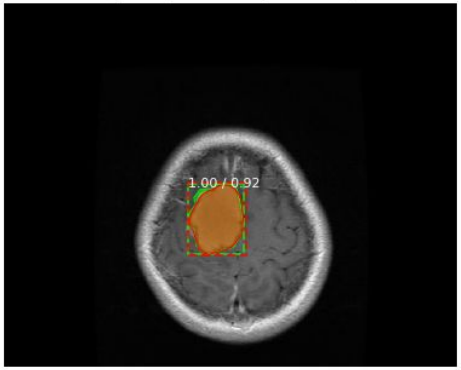


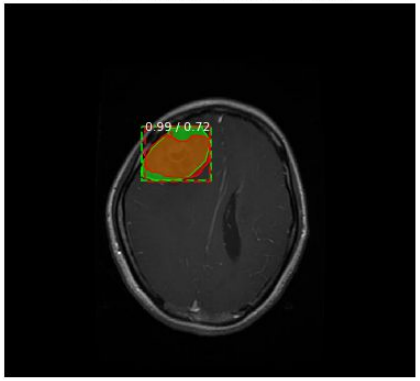




ORIGINAL IMAGE





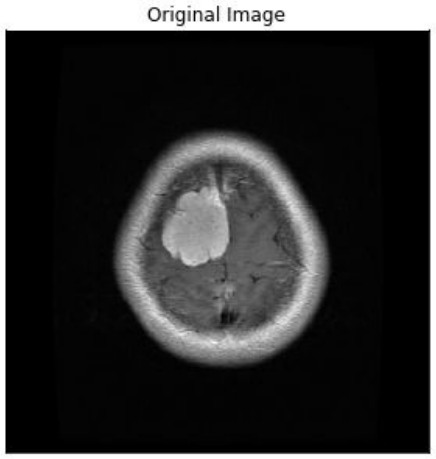


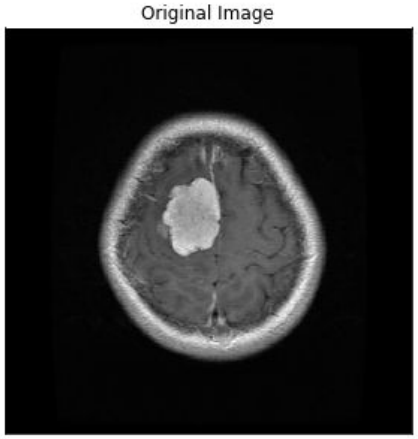
TUMOR PREDICTION CORRESPONDING TO ORIGINAL IMAGE

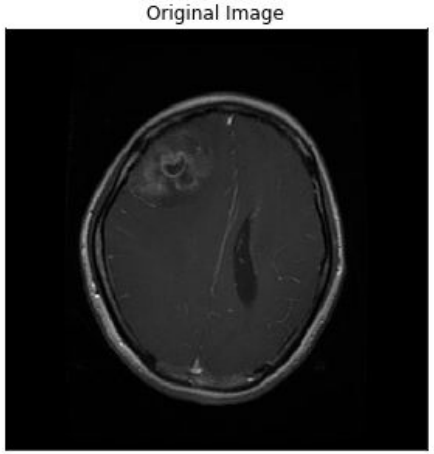
Tuned config for matterport MR-CNN Resnet50

```
Configurations:
BACKBONE                        resnet50
BACKBONE_STRIDES                [4, 8, 16, 32, 64]
BATCH_SIZE                      1
BBOX_STD_DEV                    [0.1 0.1 0.2 0.2]
COMPUTE_BACKBONE_SHAPE          None
DETECTION_MAX_INSTANCES         100
DETECTION_MIN_CONFIDENCE        0.7
DETECTION_NMS_THRESHOLD         0.3
FPN_CLASSIF_FC_LAYERS_SIZE      1024
GPU_COUNT                       1
GRADIENT_CLIP_NORM              5.0
IMAGES_PER_GPU                  1
IMAGE_CHANNEL_COUNT             3
IMAGE_MAX_DIM                   1024
IMAGE_META_SIZE                 14
IMAGE_MIN_DIM                   800
IMAGE_MIN_SCALE                 0
IMAGE_RESIZE_MODE               square
IMAGE_SHAPE                     [1024 1024    3]
LEARNING_MOMENTUM               0.9
LEARNING_RATE                   0.001
LOSS_WEIGHTS                    {'rpn_class_loss': 1.0, 'rpn_bbox_loss': 1.0, 'mrcnn_class_loss': 1.0, 'mrcnn_bbox_loss': 1.0, 'mrcnn_mask_loss': 1.0}
MASK_POOL_SIZE                  14
MASK_SHAPE                      [28, 28]
MAX_GT_INSTANCES                100
MEAN_PIXEL                      [123.7 116.8 103.9]
MINI_MASK_SHAPE                 (56, 56)
NAME                            tumor_detect
NUM_CLASSES                     2
POOL_SIZE                       7
POST_NMS_ROIS_INFERENCE         1000
POST_NMS_ROIS_TRAINING          2000
PRE_NMS_LIMIT                   6000
ROI_POSITIVE_RATIO              0.33
RPN_ANCHOR_RATIOS               [0.5, 1, 2]
RPN_ANCHOR_SCALES               (32, 64, 128, 256, 512)
RPN_ANCHOR_STRIDE               1
RPN_BBOX_STD_DEV                [0.1 0.1 0.2 0.2]
RPN_NMS_THRESHOLD               0.7
RPN_TRAIN_ANCHORS_PER_IMAGE     256
STEPS_PER_EPOCH                 100
TOP_DOWN_PYRAMID_SIZE           256
TRAIN_BN                        False
TRAIN_ROIS_PER_IMAGE            200
USE_MINI_MASK                   True
USE_RPN_ROIS                    True
VALIDATION_STEPS                5
WEIGHT_DECAY                    0.0001
```

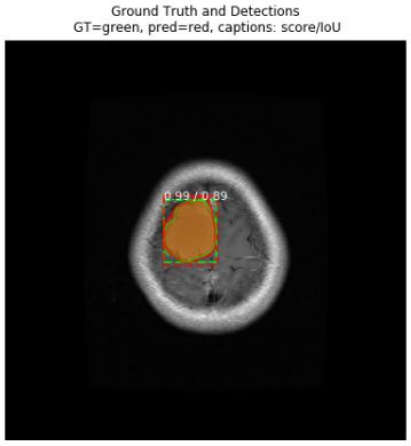
Tuned config for matterport MR-CNN using ResNet-50

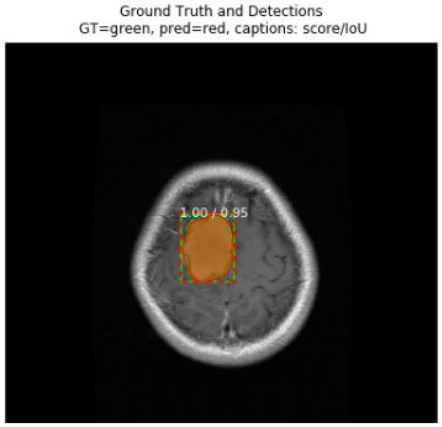


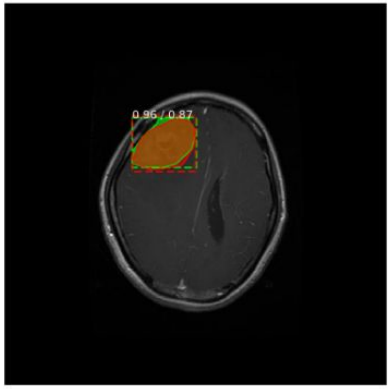




ORIGINAL IMAGE

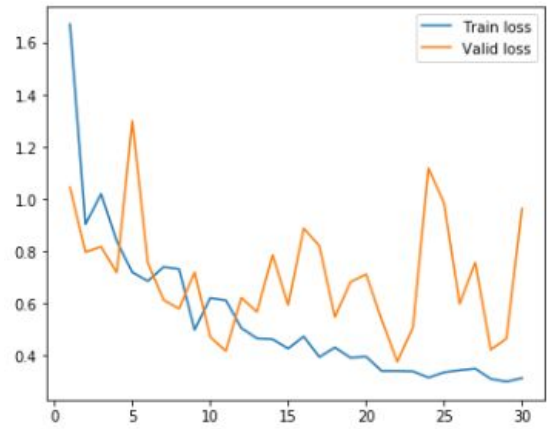


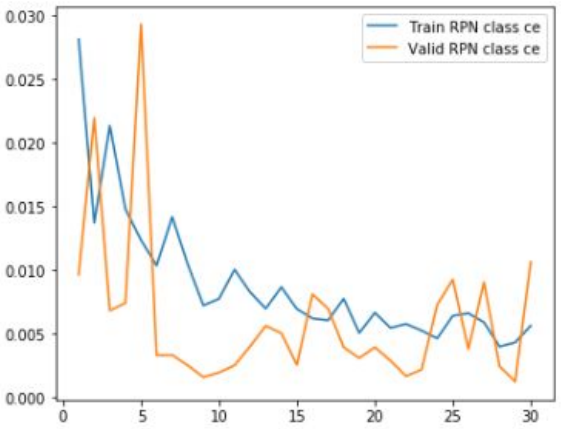


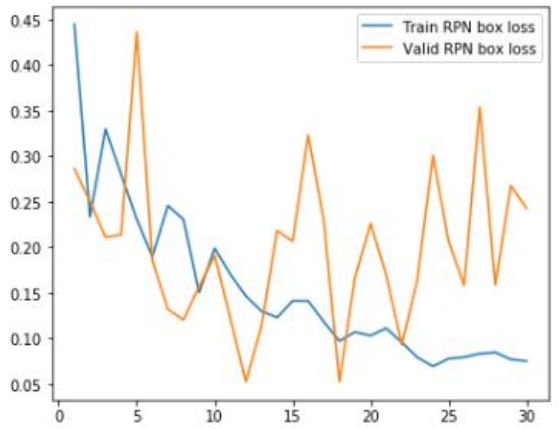


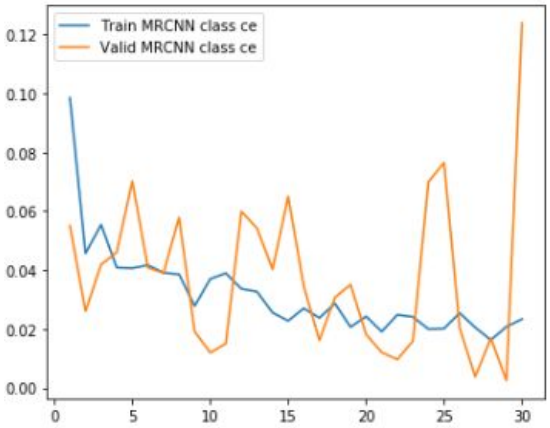
TUMOR PREDICTION CORRESPONDING TO ORIGINAL IMAGE

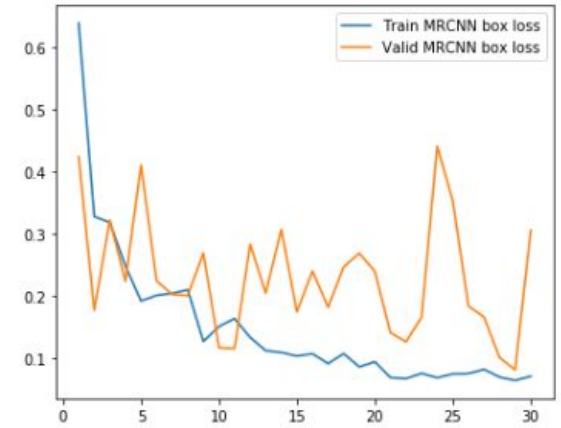
Results: Loss vs Epochs Graph for ResNet-50

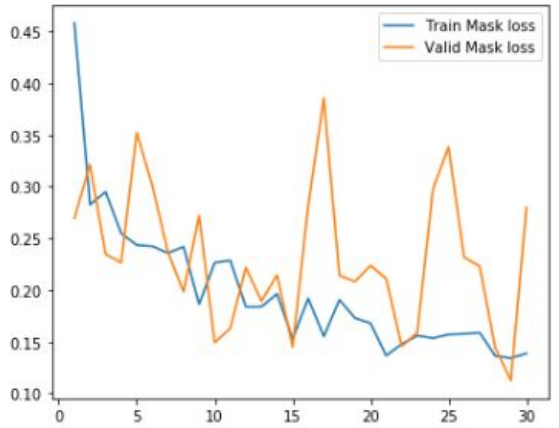




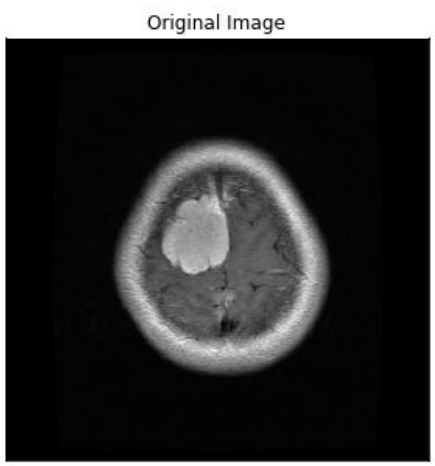


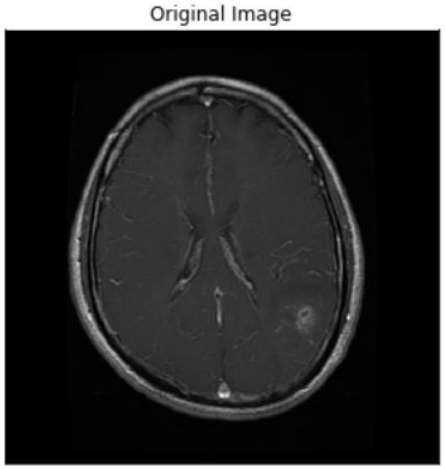


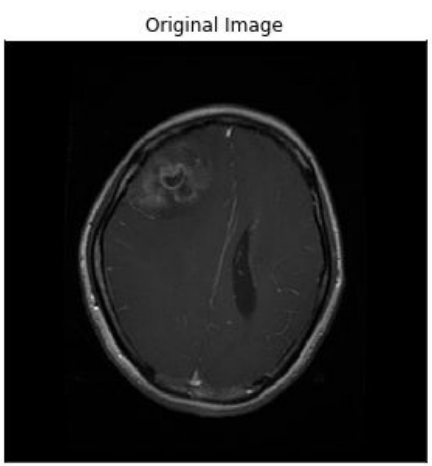




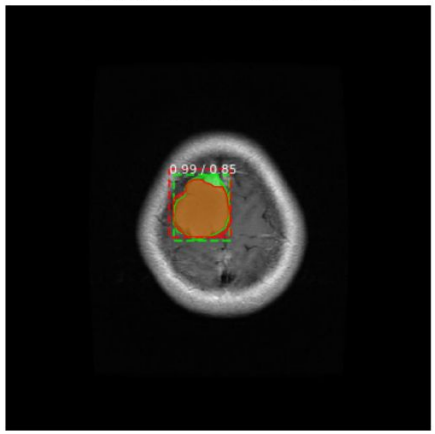
Tuned config for matterport MR-CNN using elu activation function

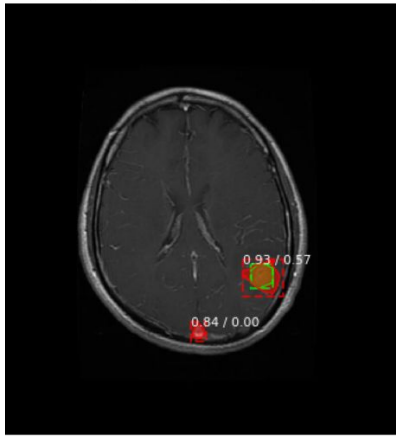


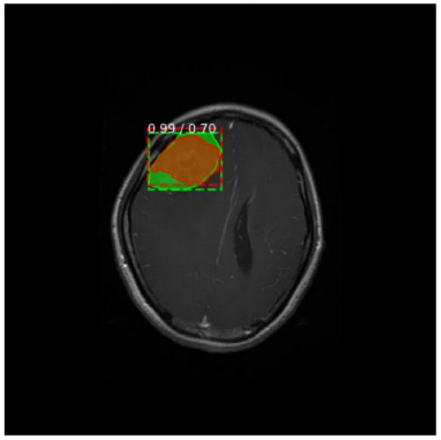




ORIGINAL IMAGE

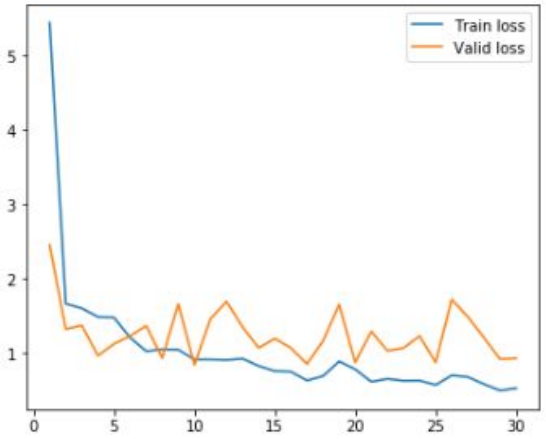


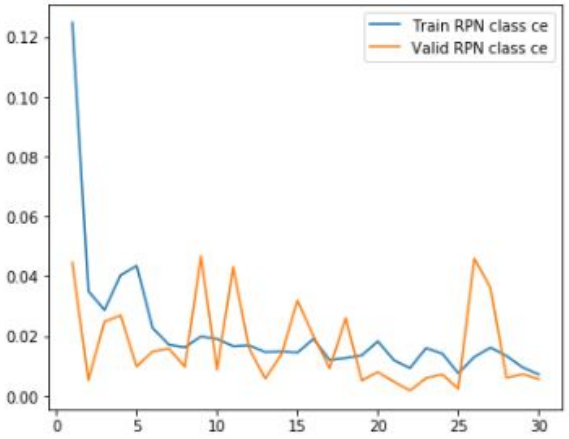


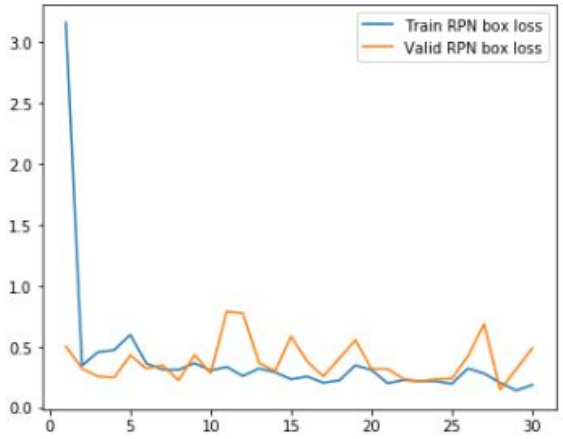


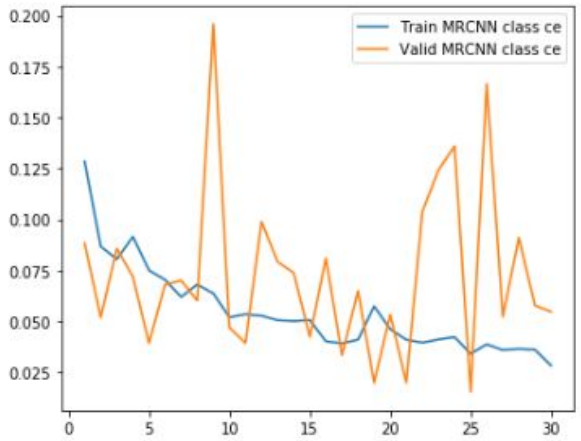
TUMOR PREDICTION CORRESPONDING TO ORIGINAL IMAGE

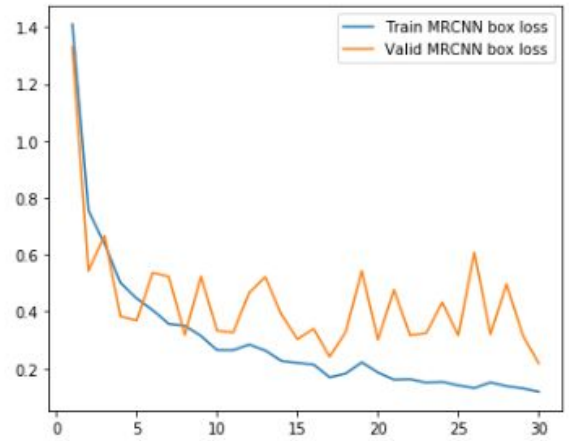
Results: Loss vs Epochs Graph for elu activation

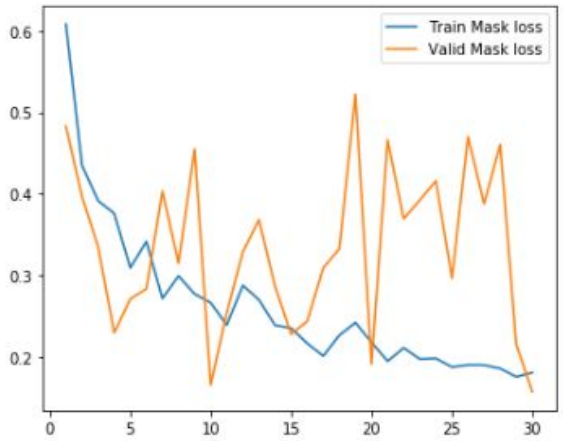










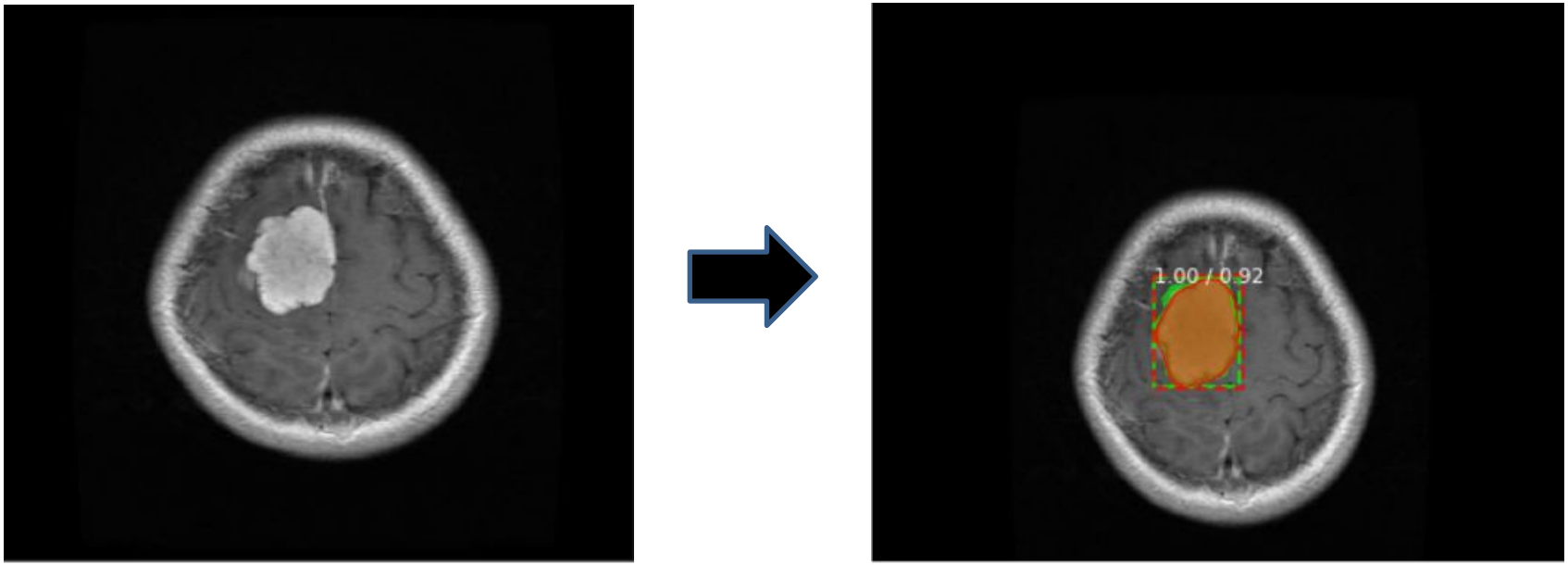


MRCNN experiment on tumor dataset

Parameter tuning for back bone phase of Masked Regions with Convolutional Neural Network

1. Learning Rate - 0.01, 0.005, 0.001 -> 0.01 better
2. Backbone algorithm - resnet101, resnet50 -> resnet50 better
3. Activation layer - relu vs elu -> relu better

RESULT OF MRCNN



Reference:

1. https://github.com/matterport/Mask_RCNN
2. https://www.kaggle.com/code/rastislav/mri-brain-tumor-segmentation-w-mask-r-cnn/notebook