TERM

PROJECT ON

SOFTWARE ENGINEERING

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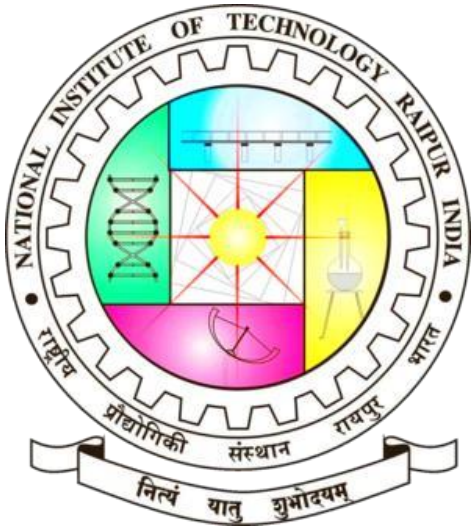
In partial fulfillment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE & ENGINEERING



NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
G.E Road Raipur, Chhattisgarh, India APRIL,2021

USING ARTIFICIAL INTELLIGENCE TO DETECT BRAIN TUMOURS AND ITS LOCATION

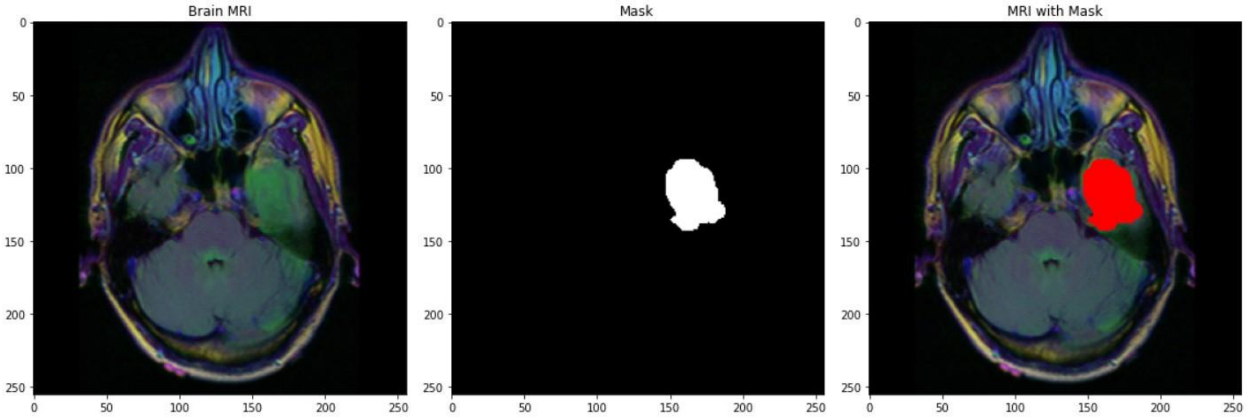
Artificial Intelligence is being used in many Health Care areas such as –

1. Disease Diagnosis with Medical Imaging.
2. Surgical Robots
3. Maximizing Hospital Efficiency

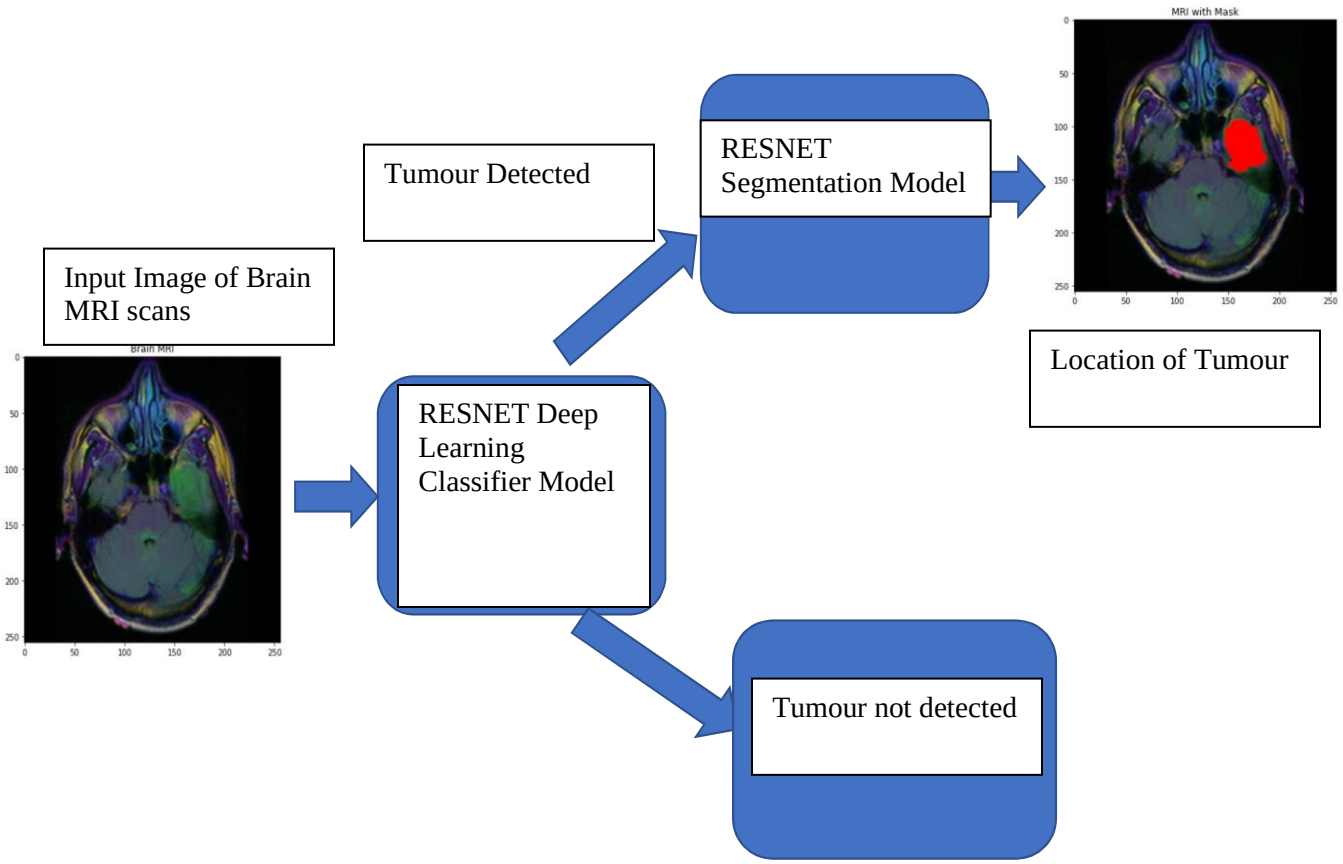
AI healthcare Market is about to reach $45.5 billion in 2026 from $4.5 billon today. Deep learning has been proven to be superior in detecting diseases from CT scans, MRI scan and X Ray scans, significantly increases the accuracy and speed.

In This term Project, we are going to use MRI scans samples of Brain and train the computer using many deep neural networks to detect Brain tumors with greater accuracy than 95%.

Our aim here is to detect whether the sample is suffering from brain tumors with the location of brain tumors.

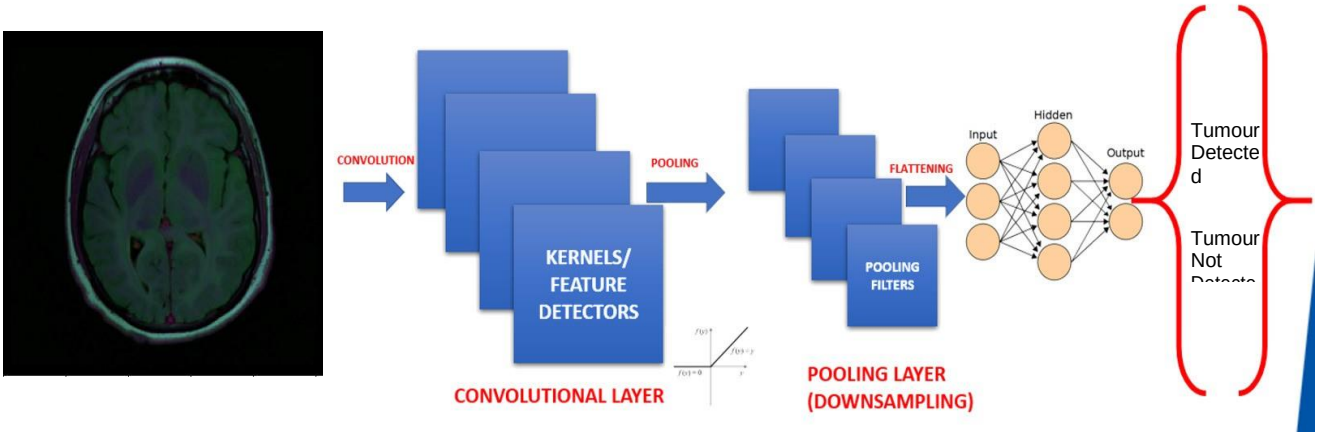


Here is the model of the AI we are going to work on –



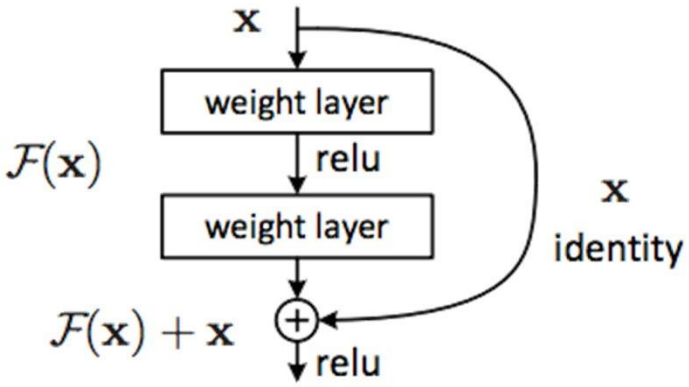
- The First Layer of CNN use to extract high level general Features.
- The last couple of layers are used to perform classification (on a specific task).
- Local respective fields scan the image first searching for simple shapes such as edges/lines
- These edges are then picked up by the subsequent layer to

form more complex features.



NOW REVIEW OF RESNET RESIDUAL NETWORK –

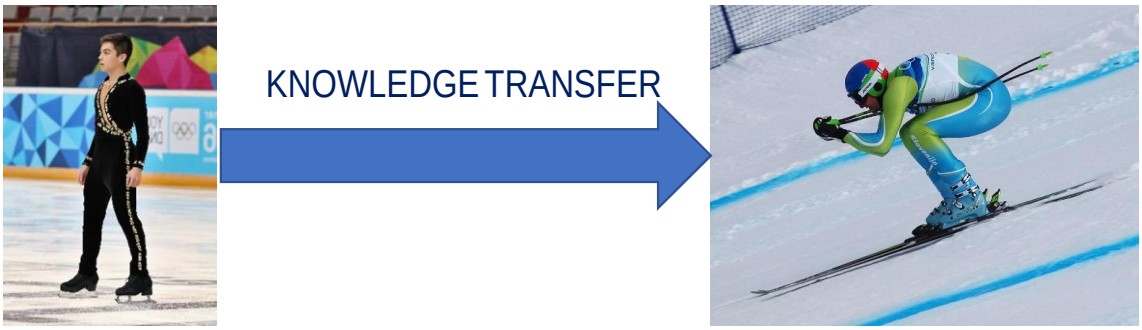
- As CNNs grow deeper, vanishing gradient tend to occur which negatively impact network performance.
- Vanishing gradient problem occurs when the gradient is back- propagated to earlier layers which results in a very small gradient.
- Residual Neural Network includes "skip connection" feature which enables them to train 152 layers without the issue of diminishing gradient.
- Resnet works by adding "identity mappings" on top of the CNN.
- ImageNet contains 11 million images and 11000 categories.
- ImageNet is used to train RESNET deep network.



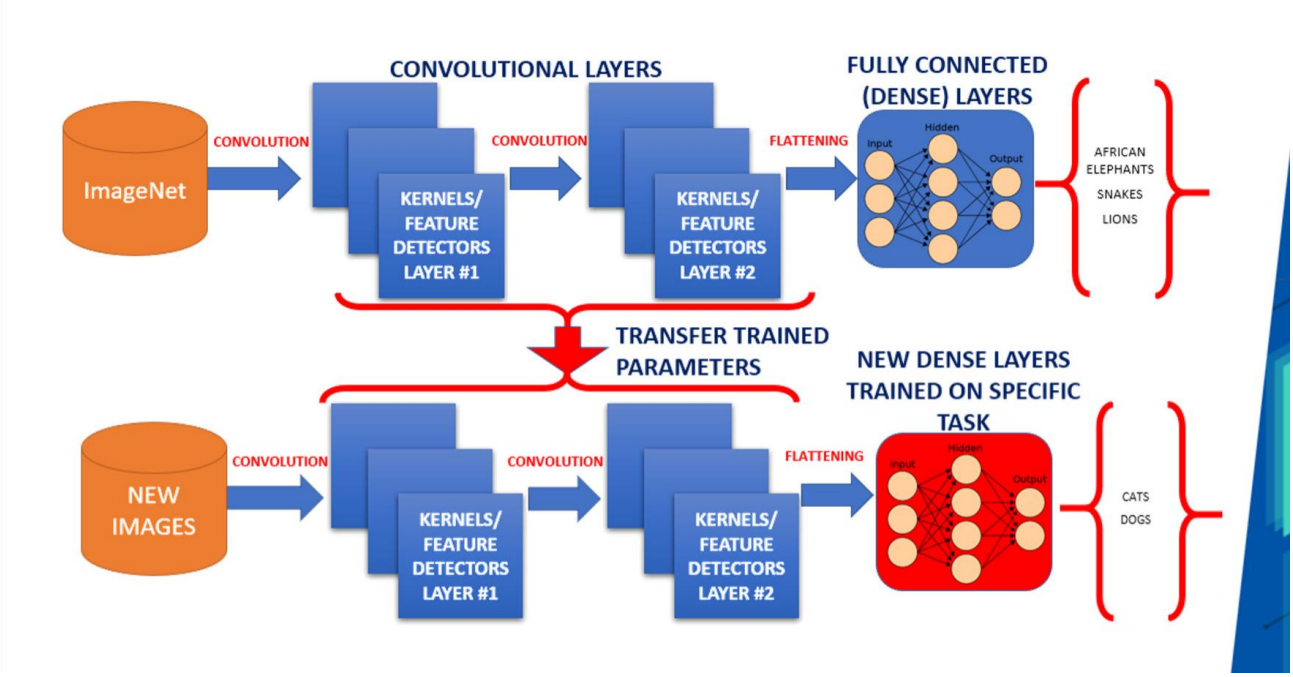
TRANSFER LEARNING –

- Transfer learning is a machine learning technique in which network thathas beentrainedto perform a specific taskis being reused(repurposed)as a starting point for another similar task.

- Transfer learning is widely used since starting from a pre-trained models can dramatically reduce the computational time requirediftrainingisperformed fromscratch.



NOW HERE IS OUR CONVOLUTIONAL AND FULLY CONNECTED LAYERS



- Strategy #1Steps:

  Freeze the trained CNN network wights from the first layer.

  Only train the newly added dense layers (with randomly initialized Weight).

- Strategy #2Steps:

  InitializetheCNNnetworkwiththepre-trainedweights

  Retrain the entire CNN network while setting the learning

  Rate to be very small this is critical to ensure that we do not aggressively changed the

  Trained weight.

- Transfer Learning Advantages are -

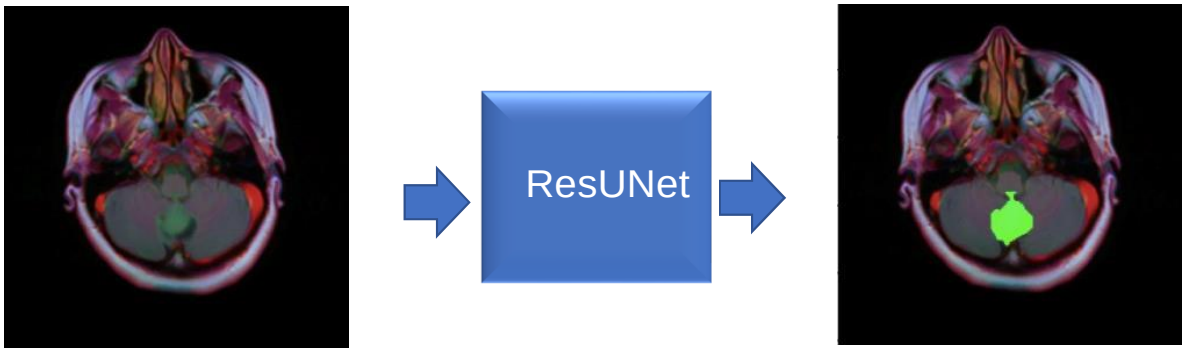
  Providesfasttrainingprogress,youdon'thavetostart

  from scratch using randomly initialized weights

  we can train small set of data to get results

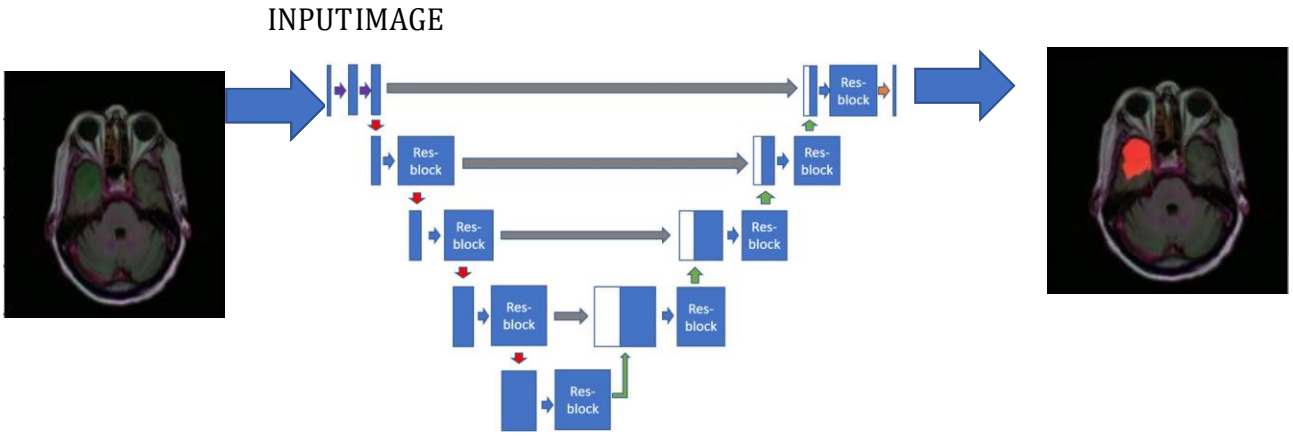
WHAT IS IMAGE SEGMENTATION -

- The goal of the image segmentation is to extract information from images at the pixel-level.
- Image segmentation can be used to localization which offers tremendous value in many applications such as medical imaging and self-driving car etc.
- Modern image segmentation techniques are based on deep learning approach which makes use of common architectures such as CNN, FCNs (Fully Convolution Networks) and Deep
- We will use the ResUNet architecture for our project.



ResUNet

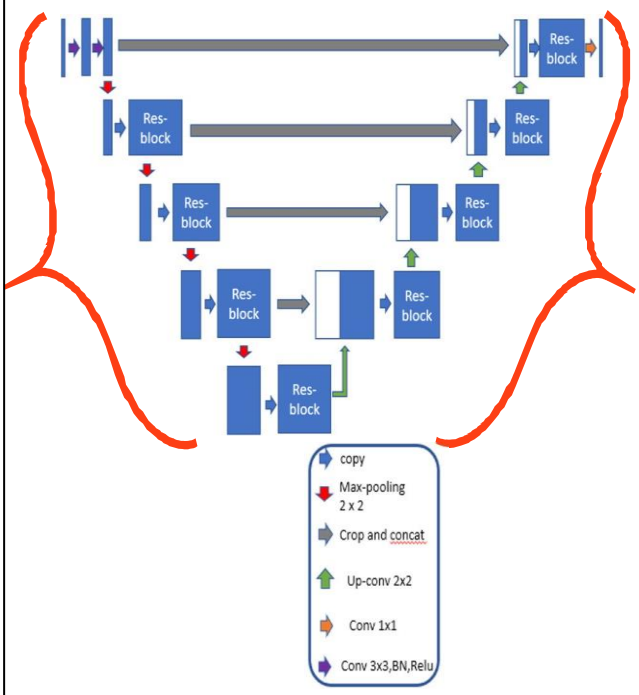
- ResUNet architecture combine UNet backbone architecture with residual blocks overcomethevanishinggradientsproblemspresentindeeparchitectures. UNet architecture is fully based on convolutional network that works in a way that it performs well on segmentation tasks.
- ResUNet consists of three parts:
  - (1) Encoder or contracting path
  - (2) Bottleneck
  - (3) Decoder or expansive path



ResUNet Architecture –

ENCODER –

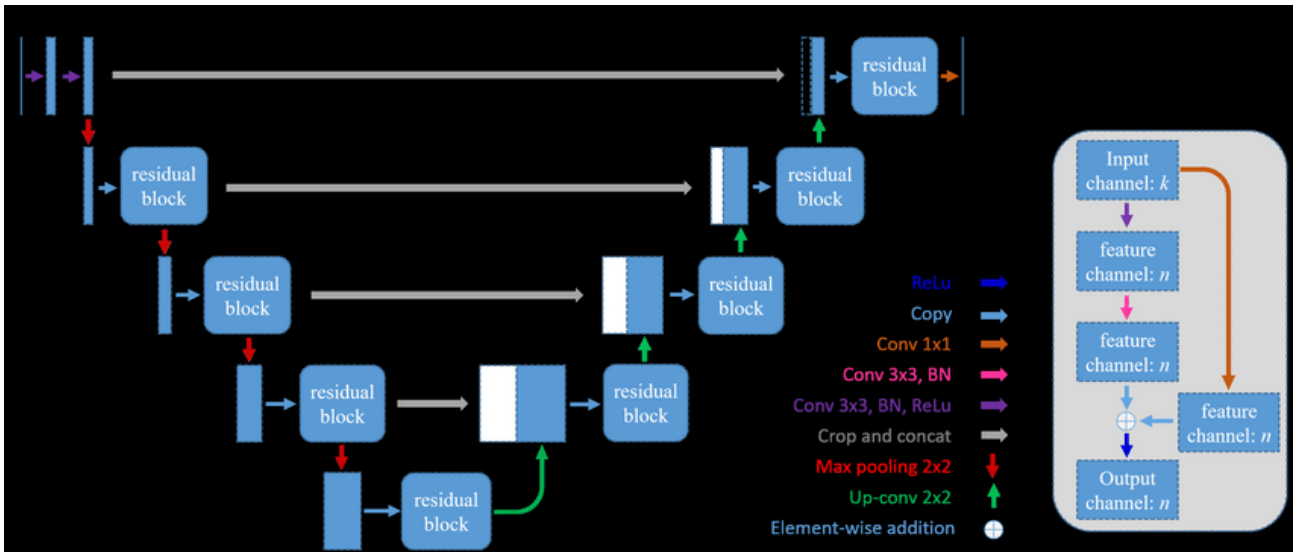
- The contraction path consists of several contraction block each takes an input that passes through res-blocks followed by 2*2 max pooling. Feature maps after each block doubles which helps the model learn complex features easily.



DECODER –

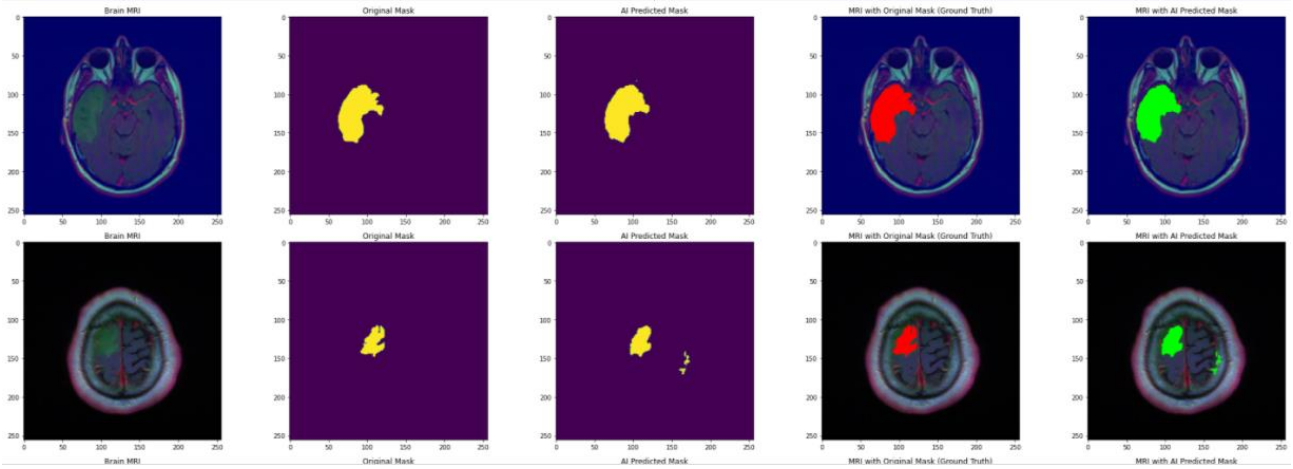
- This helps to ensure that features learned while contracting are used while reconstructin g the image.
- Finally in the last layer of expansion path, the output from the res-blocks is passed through 1x1 convolution layer to produce the desired output with the same size as the input.

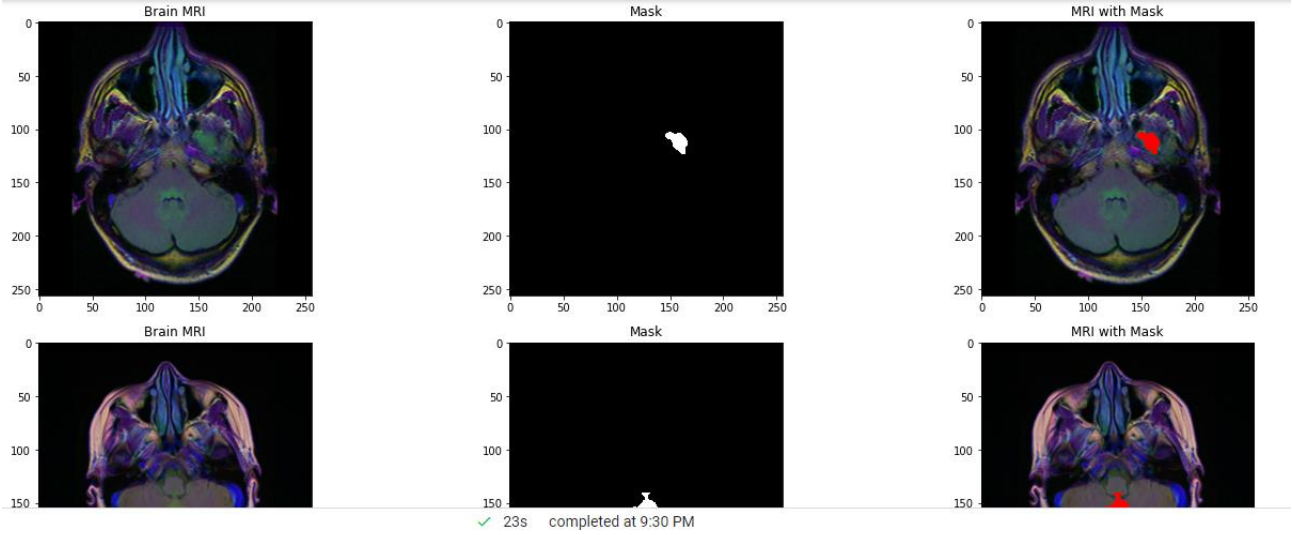
BASIC ARCHITECTURE OF RESUNET



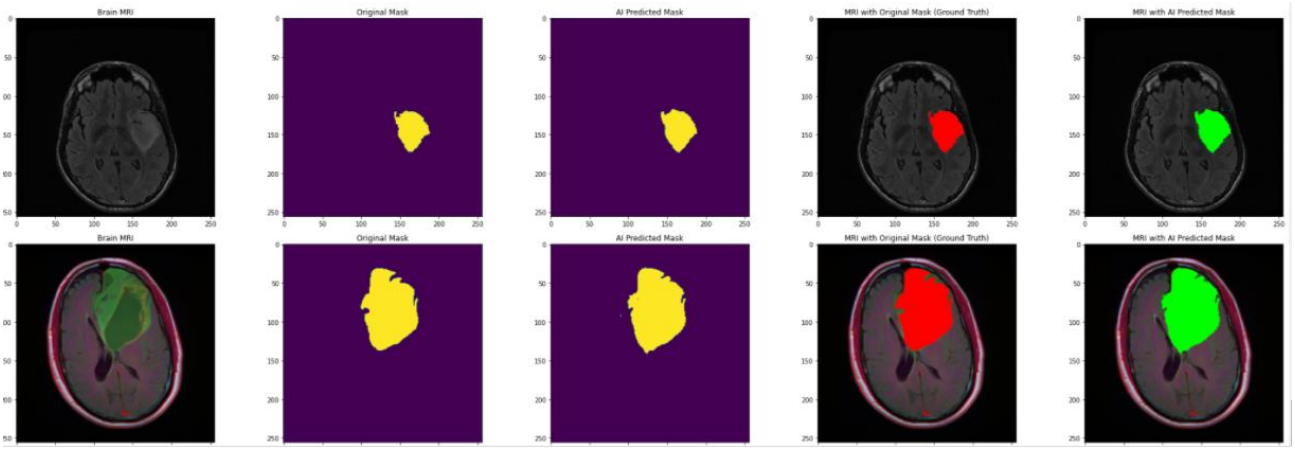
CONCLUSION –

We were able to localize and detect the tumors in brain MRI scans with great efficiency. We can use this technique to get the result fast and accurate. The accuracy was equivalent to Doctors. Here is the Input Images and Comparison of the result between the doctor and AI.





Comparison –


Brain MRI
Original Mask
AI Predicted Mask
MRI with Original Mask (Ground Truth)
MRI with AI Predicted Mask
Brain MRI
Original Mask
AI Predicted Mask
MRI with Original Mask (Ground Truth)
MRI with AI Predicted Mask

THANK YOU