# A Combined Radio-Histological Approach for Classification of Low Grade Gliomas

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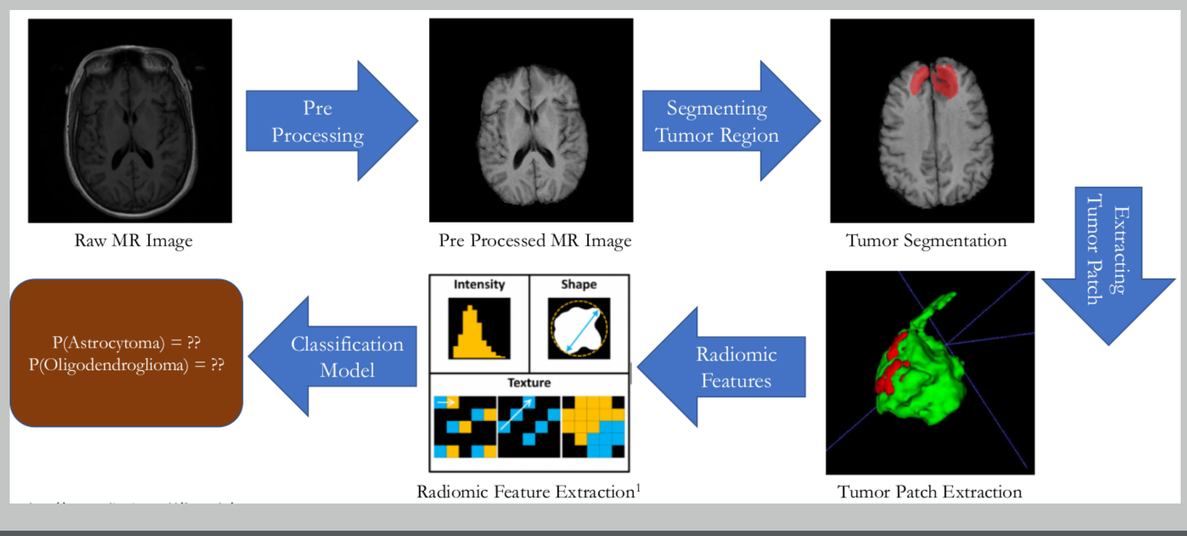
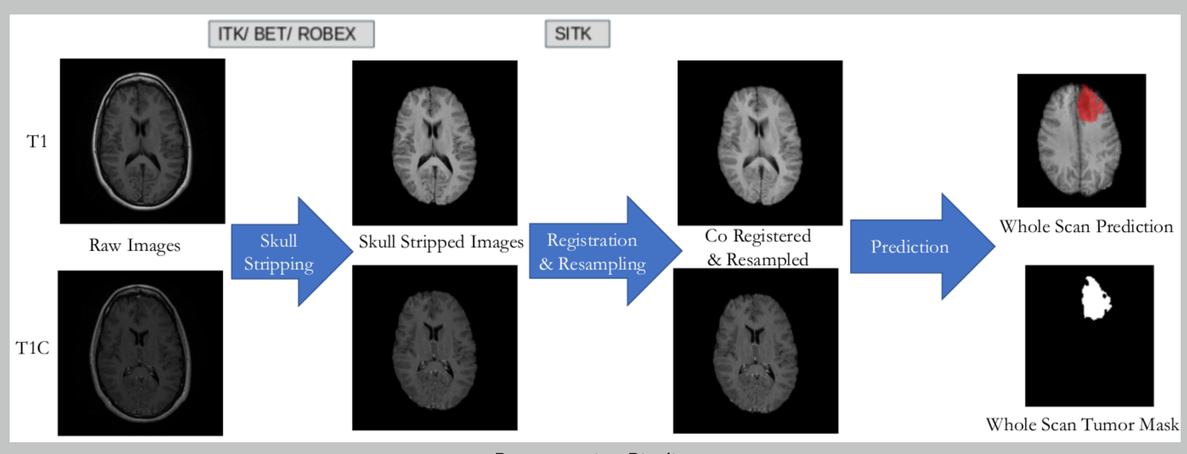
## Introduction

- We demonstrate the utility of deep learning and radiomics features for classification of low grade gliomas (LGG) into astrocytoma(A) and oligodendroglioma(O)
- In this study multi-modal Magnetic Resonance (MR) images and whole-slide H&E stained images of the brain were used
- Segmentation of whole tumor MR images were done using fully convolution neural networks
- From the segmentation maps and T1 MR images high level radiomic features were extracted
- Prominent features extracted from PCA were used to train a logistic regression classifier
- The pre-processing of the whole slide images involved region of interest detection, stain normalization and patch extraction based on Isolation Forest
- The extracted anomaly patches from the H&E images were used to train DenseNet161 to classify O & A

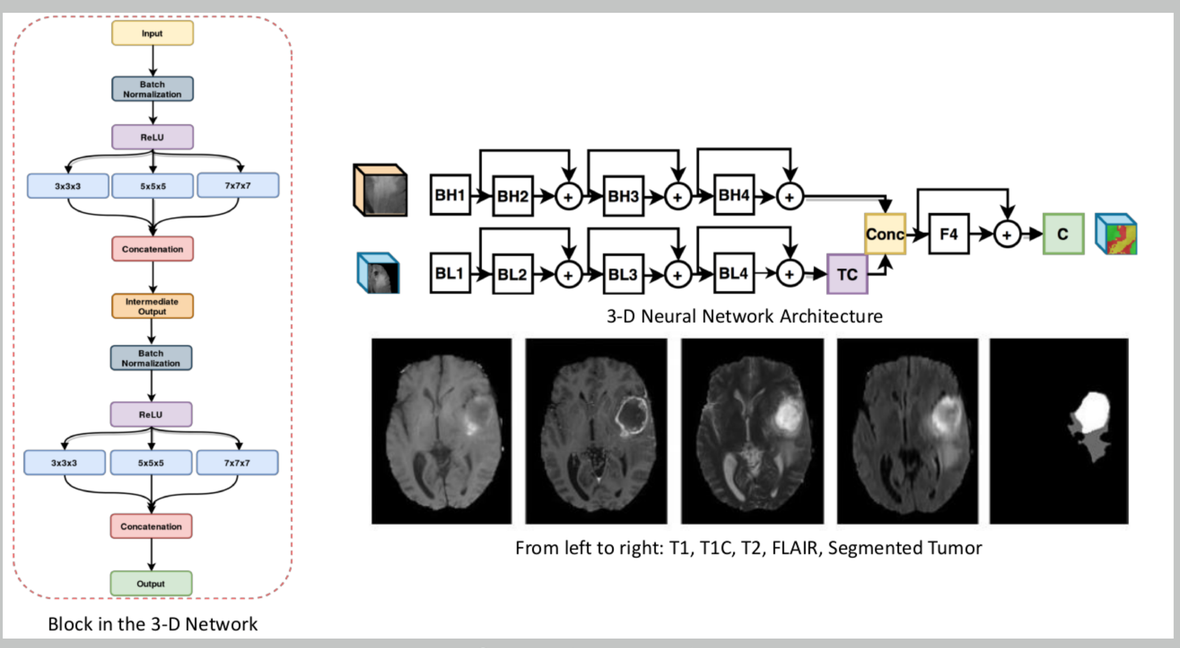
## Radiology Pipeline




## Pre-processing and Segmentation of MRI




Pre-processing Pipeline




Block in the 3-D Network

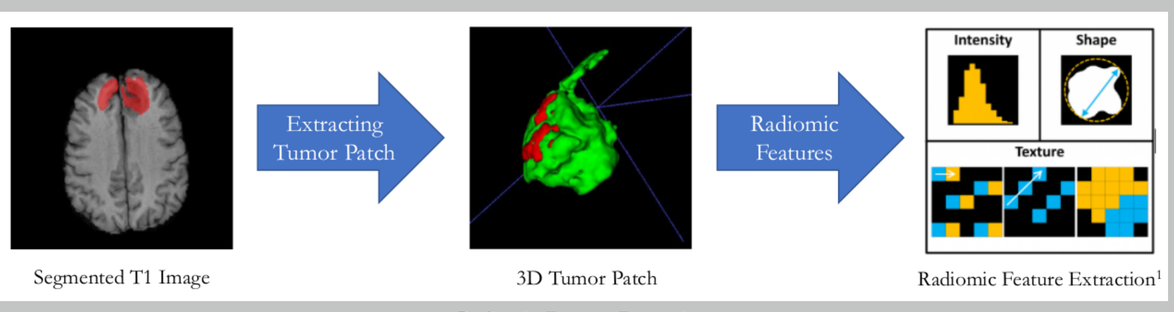
3-D Neural Network Architecture



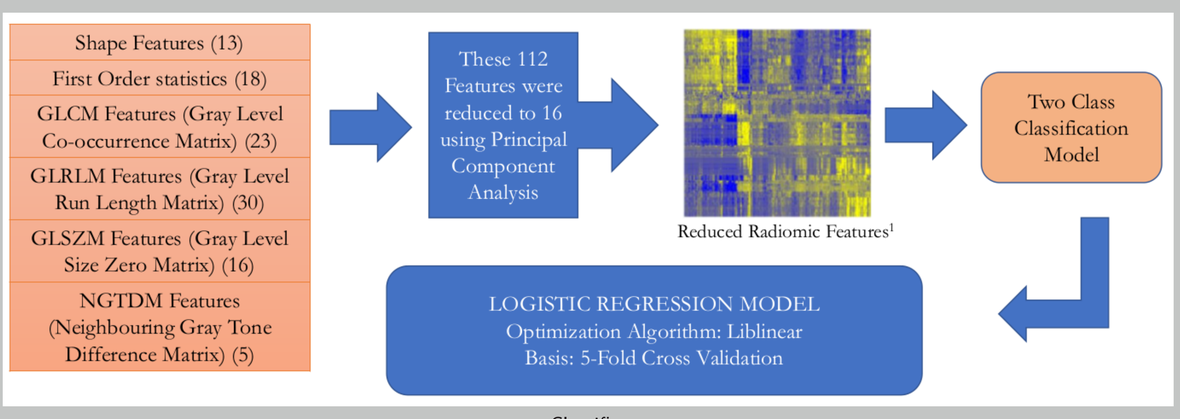
From left to right: T1, T1C, T2, FLAIR, Segmented Tumor

Segmentation Framework

## Radiomic Feature Extraction

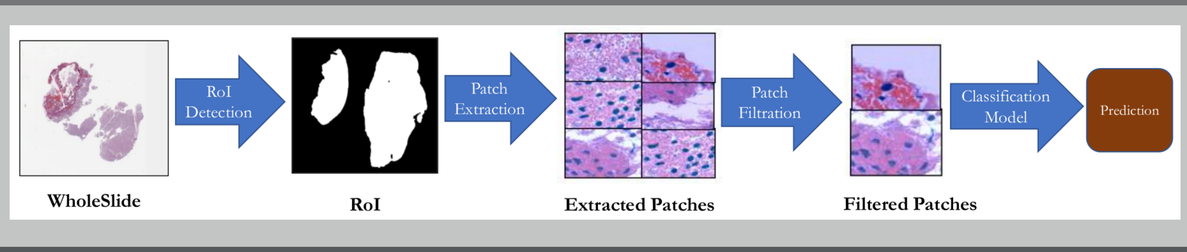



Radiomic Feature Extraction

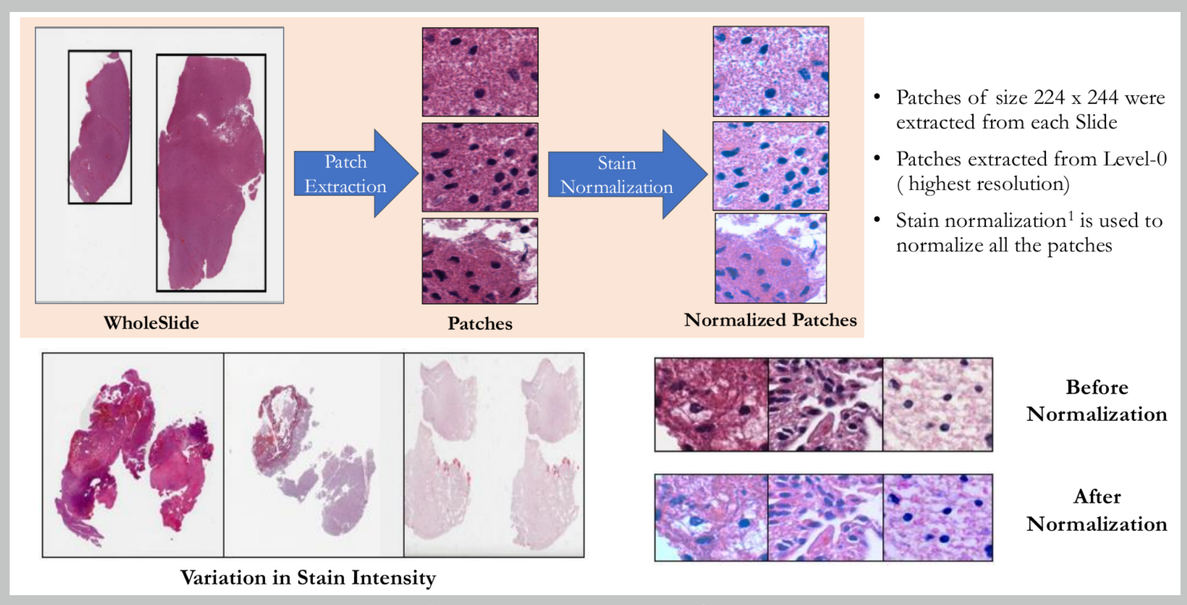



Classifier

## Histology Pipeline

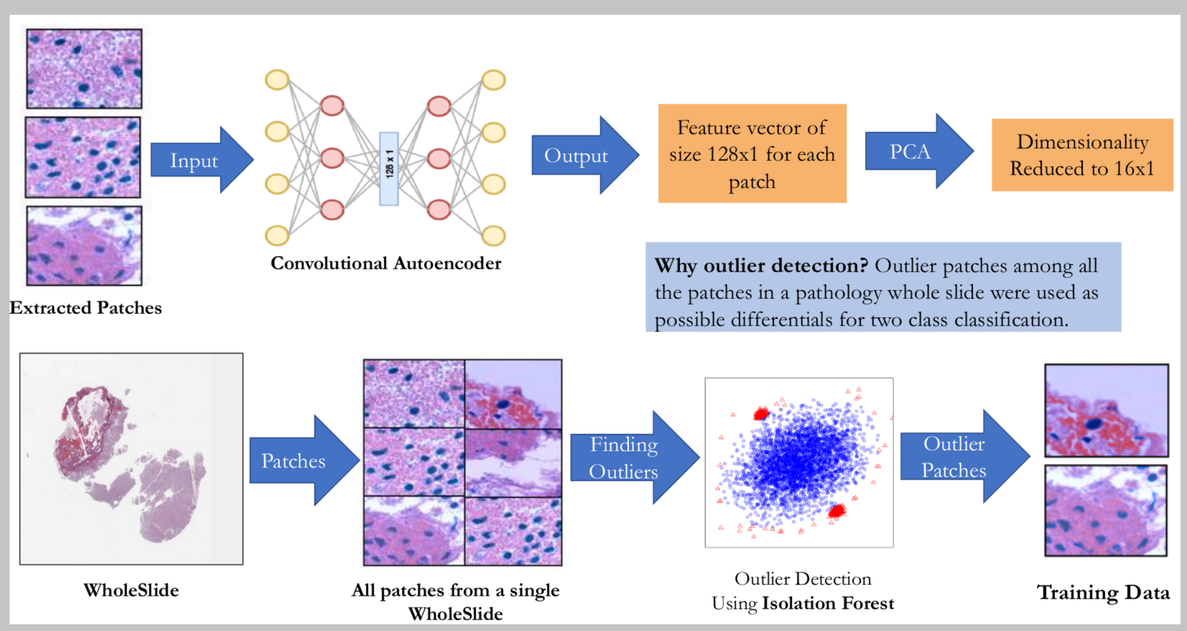



## Pre-processing and Data Generation



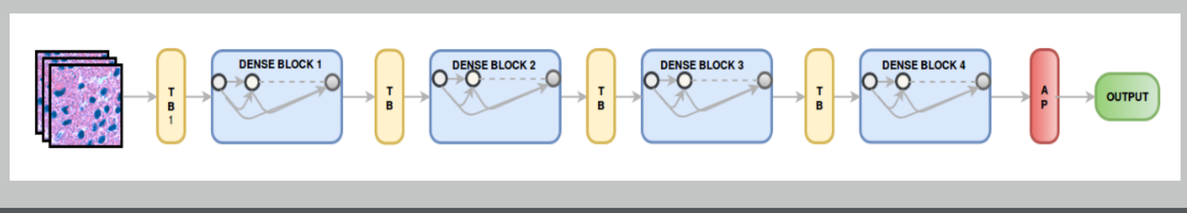

- Patches of size 224 x 244 were extracted from each Slide
- Patches extracted from Level-0 ( highest resolution)
- Stain normalization[1] is used to normalize all the patches

Pre-processing and stain normalization

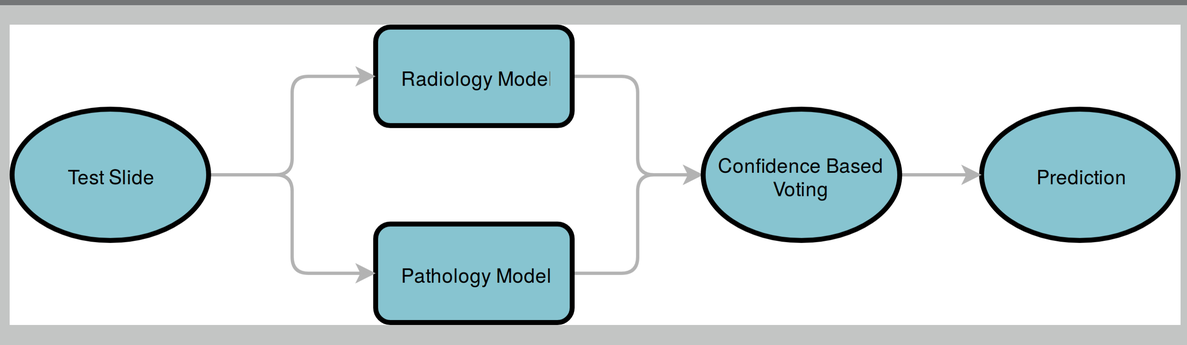



Data Generation

## Histology Classifier




## Combined Models




## Results

On the challenge test dataset (n=20):

- MR model gave an accuracy of 80%
- Histopathology model gave an accuracy of 80%
- MR + Histopathology combined model gave an accuracy of 90%

## References

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