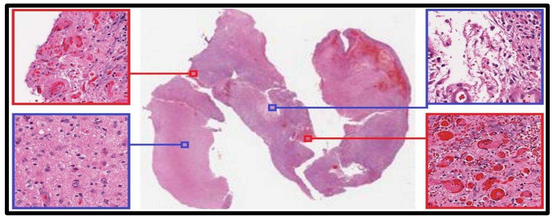
INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY
HYDERABAD
R&D SHOWCASE 2021
Technology, Social Impact

Deep Learning in Histopathology Whole Slide Images

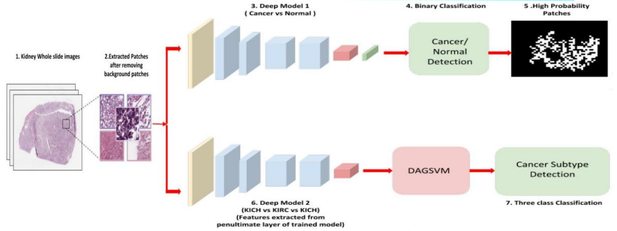
Introduction

Histopathological images contain morphological markers of disease progression that have diagnostic and predictive values. However, complex morphological information remains unutilized in unaided approach to histopathology.
Due to computational issues of processing such gigapixel images, we tile these images to get high resolution patches and train the CNNs using these patches for CV tasks such as classification, detection etc.



Patch extraction for processing gigapixel WSI as inputs to CNN

Past works

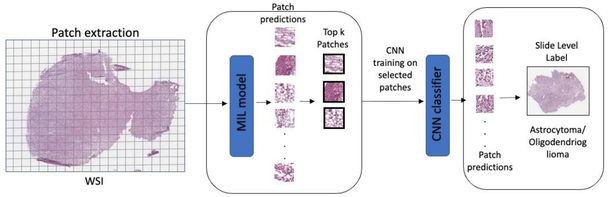


Demonstrate how deep learning framework can be used for an automatic classification of Renal Cell Carcinoma (RCC) subtypes and obtain features for survival prediction

Brain Tumor Subtype Classification

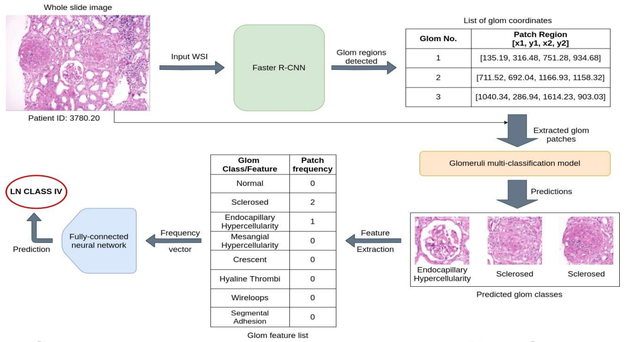
Problem: Classification of low grade brain tumor from Histopathology images into its subtypes Astrocytoma and Oligodendroglioma.
Method :

- **Patch Selection:** Extraction of patches from Whole Slide Images(WSI) and discarding the background patches.
- **MIL approach:** Consistent elimination of non discriminative patches from each slide.
- Training CNN classifier on the final selected cancerous patches and predict slide level label from the patch-based predictions.

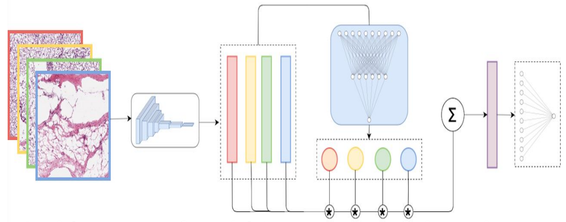


Detecting Lupus Nephritis stages using glomeruli features

Problem : Detection of Glomeruli from kidney histopathology images and classification into 6 stages of Lupus Nephritis (LN).
Lupus Nephritis (LN) : It is a commonly occurring disease affecting the Glomeruli region which are a functional unit of Kidney. The International Society of Nephrology proposed 6 stages of LN based on the features found in the glomeruli affected in LN patients.



Cancer detection using MIL+CNN

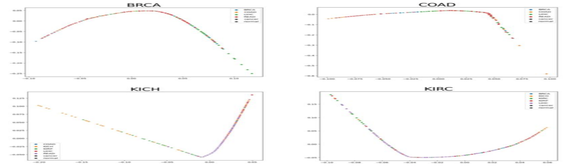


Architecture of Multi-Instance model used

Problem: Whole slide images are typically in Gigapixel scale making it computationally infeasible to directly train an image classifier
Method: We use attention-based weighting to obtain the representative feature of a WSI and train a classifier on these features

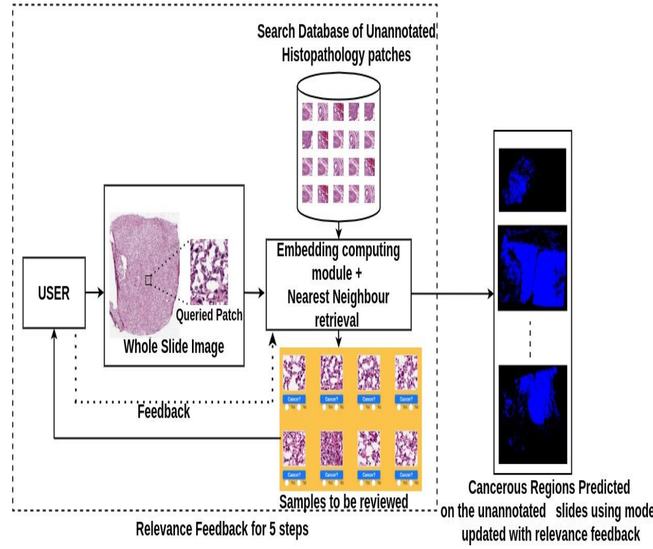
Benchmarking CNNs on TCGA

We train Patch-CNNs for 9 subtypes and perform inference of each model on all other subtypes.



T-SNE plots showing cross-organ inference

Interactive Learning using CBIR



Problem: Annotating and searching in WSI's for anamolous or tumourous regions that exist in small proportions of the WSI is a rigorous task and the work load would scale up if there are several such WSI's
Method: We propose a relevance feedback framework for an interactive patch based image retrieval and extend the proposed workflow towards annotating unannotatedwhole slide images

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