DEEP LEARNING- BASED BIOMEDICAL IMAGING CLASSIFIER

HISTOPATHOLOGICAL IMAGE DIAGNOSIS FOR BREAST CANCER SUBTYPES

INTRODUCTION

- Machine learning (ML) and deep learning (DL) tools are widely used with growing success across different applications in health care industry to improve decision-making. Businesses that have access to huge volumes of high-quality data are increasingly turning to ML/DL to perform tasks where humans can not take decisions. Recently, ML/DL approaches have been widely benefited in various fields such as predicting patient's risk, imaging classification or automated imaging diagnosis, designing patient-specific therapies, automating processes, understanding customer behavior including drug treatment and planning.
- Histopathological imaging-based diagnosis is a time-consuming process and limited availability of pathologists and radiologists including laborious task and expensive (including human errors as well as subjective clinician's decisions). Hence, ML model that could classify tumor subtype and predict the stage of clinical diagnosis would be particularly valuable. Few ML/DL based approaches are developed for automated clinical diagnosis in order to classify and predict the disease stage.

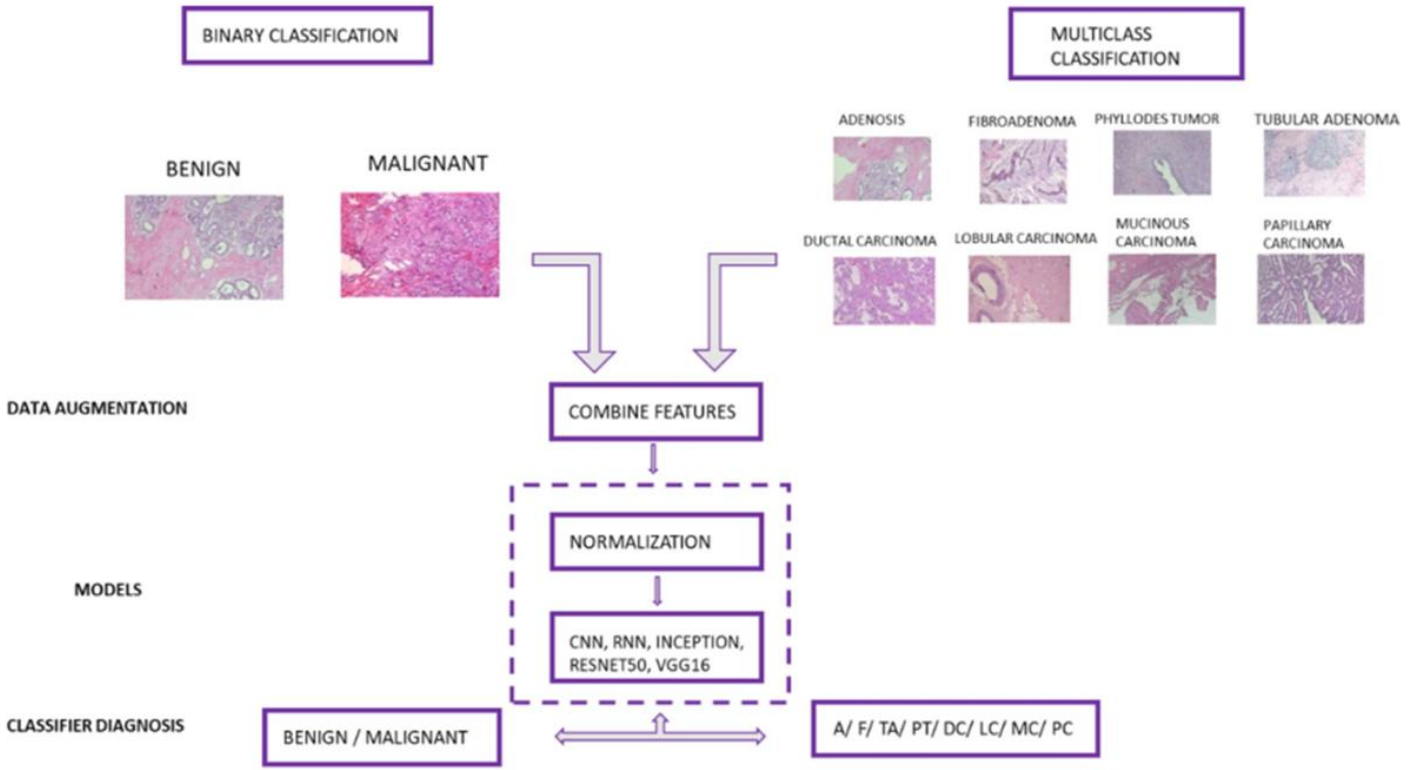
PROBLEM STATEMENT

- Current approaches for the automated imaging classification as well as the prediction of disease stage or grading clinical diagnosis is a challenging task. Grading of cancer histopathology slides requires more pathologists and expert clinicians as well as it is time consuming to look manually into whole-slide images. Hence, an automated classification of histopathological breast cancer sub-type is useful for clinical diagnosis and therapeutic responses. Recent deep learning methods for medical image analysis suggest the utility of automated radiological imaging classification for relating disease characteristics or diagnosis and patient stratification.

CHALLENGES

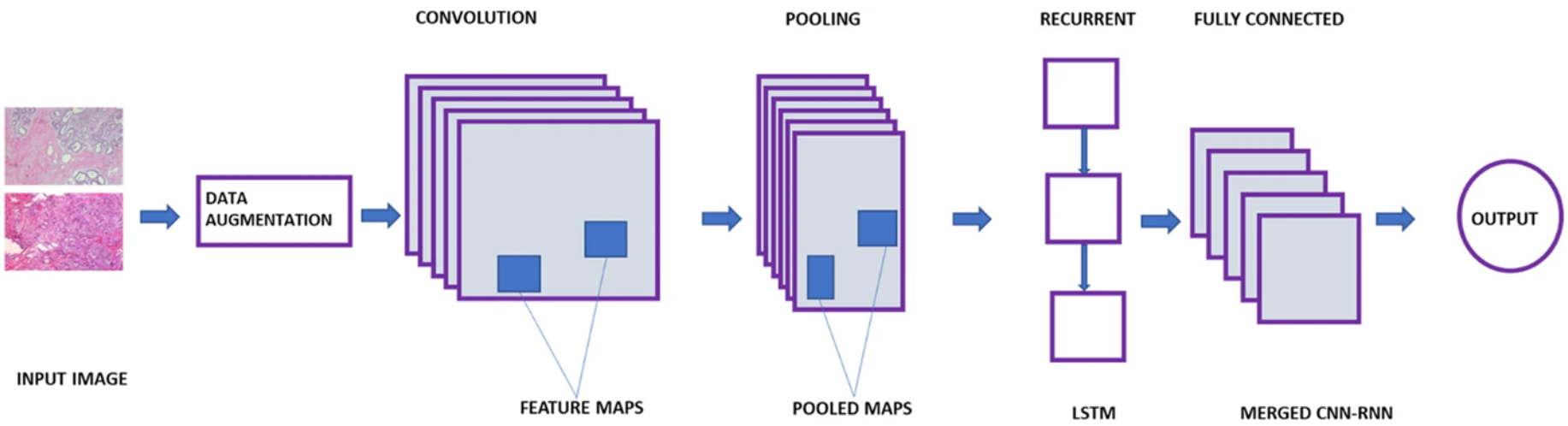
- Manual visualization of whole slide images is a cumbersome task.
- Laborious and time consuming.
- Handling human errors and decision making.
- Limited pathological training data and imaging datasets.
- Different imaging resolutions/magnification factor and scanners
- Individual patient level data is not publicly accessible.

OUR APPROACH



OUR APPROACH AND RESULTS

- CNN-LSTM RNN Model Architecture



RESULTS

Performance Measures for Binary Classification Model

Magnification	Training: testing samples	Accuracy (%)	Precision	Recall
40×	1428:567	99.03	0.99	0.99
100×	1278:803	99.75	1.00	0.99
200×	1185:828	99.64	0.99	1.00
400×	1353:467	98.07	0.98	0.97

Performance Measures for Multi-class Classification Model

Magnification	Training: testing samples	Accuracy (%)	Precision	Recall	Top K-categorical accuracy
40×	1428:567	96.3	0.97	0.95	1.00
100×	1278:803	92.6	0.92	0.93	0.9987
200×	1185:828	88.04	0.87	0.88	0.9963
400×	1353:467	92.51	0.92	0.93	1.00

IMPACT

- ML/DL classification of breast cancer subtype as benign or malignant for histopathology imaging.
- This will be beneficial for patients and clinicians for diagnosis and treatment planning in less time and huge cost reduction with minimal risk in decision making.
- One primary reason as to why the proposed pipeline is potential and useful – automated analysis of histopathological imaging based clinical diagnosis to predict the clinical subtype and stage benign or malignant. Also, further use the model to predict on future test images to be benign or malignant.

WHY 3BIGS?

- 3BIGS imaging pipeline enable our customers to predict the clinical subtype as well as predict the cancer stage as benign or malignant for a specific histopathological imaging using deep learning model. By assiduous reduction of the inherent noise in the heterogeneous magnification factors, 3BIGS imaging pipeline has alleviated the challenges of utilization of data augmentation for imbalanced data samples across different breast cancer subtypes. Automated feature extraction and reduce the redundant or inherent noise using feature reduction techniques to improve the accuracy in the outcome of the diagnosis. We also have high-end servers at our end which can additionally reduce the time required for these analyses.

- 3BIGS solution offers an affluent scheme of ML/DL algorithms and other imaging tools to enable the hospitals or clinical research centers, clinicians (pathologists, radiologists and medical patrons) to give better inference and faster insights from histopathological imaging data. Vantage 3BIGS imaging expertness in designing a better automated diagnosis as well as data analysis techniques to predict the cancer subtype as well as stage such as benign or malignant. Meliorate your R&D efforts today and use our tested and validated models or build models of your own with much ease using our ML/DL trained imaging data.