Project-2 Proposal

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Problem statement

This is a problem statement in which we are going to identify a tumour using CT scan data or PET scan data, in combination with identifying the tumour's location with dark or light markings that provide details on its size. As a result of this information, the following could be interpreted:

- A cancer grade is determined by its size (i.e., if a patient is regularly screened as per doctor's instruction then with the help of size detection, one could determine the cancer grade directly).
- Additionally, we could identify a cancer stage up to some extent based on the quality of the scan and the information it contains.

Literature Review around problem statement

CT scans – Or “Computed Tomography” scans – uses X-rays to create an image of a desired body part (Whichever it may be). Generally, a X-ray is aimed at the patient and quickly rotated through them to get an idea of what the structure of the cross-section of the patient is. The signals thus produced are passed through a computer for processing, which puts it together and returns an image. These images are taken until desired number of slices of a patient is imaged, and successive images can even be put together by another program to make a 3D reconstruction of the patient’s insides, as seen by the CT scan. The images produced by CT scans are very similar to x-rays, as in they are stopped by dense tissues (Like bones) and pass through soft tissues (varies and depends on tissues). The images produced by CT scans can be used to detect any large abnormal masses, such as clots or tumors. A CT scan may use contrast (inject a substance to get higher contrast in targeted tissue) or even radiopharmaceuticals (such as FDG, although this does require a PET-CT scan, which requires a PET scan along with a CT scan to correlate increased glucose consumption) to detect possible tumors.This is typically meant for early detection of cancer, as well as monitoring tumors after detection. It can indicate metastasis (spread of cancer to other parts of the body) as well, if present. However, a CT scan is typically not considered to be enough proof for presence of cancer. Typically, a biopsy needs to be done, and the tissue sample needs to be sent to a histopathologist for further classification of the cancer. The image produced by a CT scan is produced by a radiologist, and a report is sent back to the primary physician.An MRI scan – or “Magnetic Resonance Imaging” scan – uses magnetic fields and radio pulses to create an image of a desired body part. Magnetic fields align the hydrogen ions within the body, and the radio pulses cause said molecules to produce signals. These signals are processed by a computer to create a cross sectional image of the body part. It produces two types of images, T1-weighted and T2-weighted. T1 returns fatty tissues as bright, T2 returns fatty and water-based tissues. Water based tissues alone can be found by comparing with T1. Bright part indicates presence of those tissues. MRIs end up creating images of soft tissues within the body, which doctors can use to judge whether there is an abnormality or not. MRIs of the brain can reveal brain tumors (not all of which are malignant)

Using MRI and CT scan images, work has been done using deep learning - In nature they published an article of a model that outperformed human doctors in classifying CT scans of lung cancer. Using MRI scans of brain tumor, they got high accuracy using CNNs and autoencoders.

Data Description

Data will be primarily from cancer imaging archives or Figshare, such as MRI or CT scans of the tumor alongside information about the patient's scanning visit. An image of a healthy scan could be taken from another database, such as the NIH. Currently, these data are unlabeled, but we are going to label and train them. Additionally, we will use some of the data that is available in other public databases as well.

Bibliography:

- Artificial intelligence is improving the detection of lung cancer (nature.com)
- MRI-based brain tumor detection using convolutional deep learning methods and chosen machine learning techniques - PubMed (nih.gov)
- https://www.cancerimagingarchive.net/
- Pancreatic Cancer Detection on CT Scans with Deep Learning: A Nationwide Population-based Study - PubMed (nih.gov)
- Deep Learning for Lung Cancer Detection on Screening CT Scans: Results of a Large-Scale Public Competition and an Observer Study with 11 Radiologists | Radiology: Artificial Intelligence (rsna.org)
- A DEEP LEARNING APPROACH FOR CANCER DETECTION AND RELEVANT GENE IDENTIFICATION - PubMed (nih.gov)