Deep Learning Based Medical Image Super Resolution and Disease Detection

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INTRODUCTION

- Medical imaging is an integral part of the diagnostic process. From ultrasounds to MRIs to CT scans, radiologists need and use medical imaging to properly diagnose and treat diseases. Doctors also use medical imaging technologies to determine whether a particular therapy has been effective in patients.
- We are living in a data driven lead generation, and with the advent of AI/ML, scientists and researchers are using these technologies to extract relevant information from large amounts of data and generate actionable insights that could be applied to many applications. One such application is in field of diagnosis.

PROBLEM STATEMENT

- Super-resolution shows promising results over the normal medical image. We want to know how super-resolution affects a medical image which has abnormality? Does super-resolution affect the abnormality region when applied over a low-resolution image? If it does affect, then up to what extent? Can we improve upon it?
- Is it possible to create a generalised model that, when given an image can tell whether the image has an abnormality or not? We are trying to answer a single class classification problem at present. Why single class? Because if the model classifies the image as abnormal, we don’t know which abnormality model is talking about.

LITERATURE REVIEW

- Deep Learning
  - Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans: learn by example
  - Models are trained by using a large set of labeled data and neural network architectures that contain many layers.
- Super-Resolution
  - Super Resolution is the process of recovering a High Resolution (HR) image from a given Low Resolution (LR) image.

LITERATURE REVIEW

- Image Segmentation
  - Image segmentation is the process of partitioning an image into multiple segments.
  - Image segmentation is typically used to locate objects and boundaries in images.
- Image Classification
  - assigning pixels in the image to categories or classes of interest

LITERATURE REVIEW

- PREVIOUS WORK
  - Interpolation Techniques
  - Dynamic Range Enhancement of MRI Images (Retinex theory).
  - Denoising, Learning-Based Example Database and Patch Super-Resolution Method.
  - Brain tumour classification using deep CNN features via transfer learning.
    - GoogleNet
    - ResNet34
  - Deep learning-based Enhanced Tumour Segmentation Approach for MRI Brain Images

MOTIVATION

- High resolution is of importance in medical imaging for diagnosis. Many applications require zooming of a specific area of interest. However, high-resolution images are not always available because setup for high-resolution imaging proves expensive and also it may not always be feasible due to the inherent limitations of the sensor and noise.
- Image segmentation and image classification are two leading pillars of image processing. Due to the different human anatomy and high variability, medical image segmentation or labelling is a major challenge.

WORK PROGRESS

- Medical Image Segmentation.
- Medical Image Classification.
- Check for available datasets [X-Ray Chest, MRI - Brain, CT- Brain] to support the work.
- Autoencoders.
- Study U-Net Architecture and how U-Net can be used as Autoencoders. We are using U-Net because it can be used to tackle both the problems, super-resolution as well as for classification problems.

FUTURE WORK

- Gather sufficient dataset [X-Ray Chest, MRI - Brain, CT- Brain] to train the model. If not available, look we will go for data augmentation techniques.
- Once, the desired dataset is available, then train the model over medical images, and test it over the cropped image which contains only the segment containing abnormality.
- Analyse existing super-resolution techniques on medical images with abnormality and validate whether the abnormality segment in the image is affected or not.

THANK YOU