Report on

Anamolies detection in medical images

Submitted to

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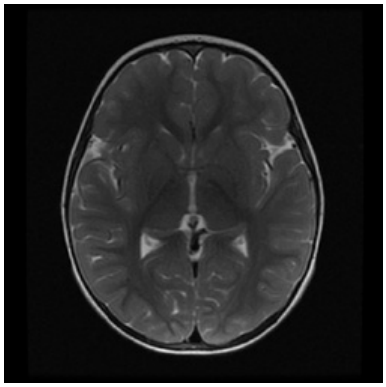
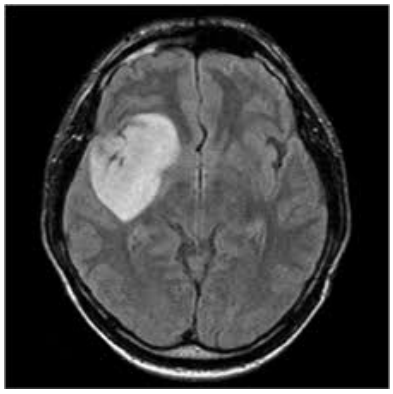
INTRODUCTION

Medical image analysis plays a crucial role in modern healthcare, revolutionizing the way clinicians diagnose and treat various conditions. The integration of advanced imaging technologies, such as magnetic resonance imaging (MRI), computed tomography (CT), and X-ray, has enabled healthcare professionals to obtain detailed visualizations of the human body's internal structures. These serve as crucial diagnostic tools, providing valuable insights into the physiological and pathological aspects of a patient's health.

In this project, we are dealing with detecting tumors in Brain MRI scan. Tumors in brain detected in the scans are anomalies which deviates from the usual scan of the brain. Our model will detect those anomalies that will help to detect the tumors so that it can be treated earlier.



Normal



Tumor

Anomalies and Anomalies Detection significance

Anomalies, also referred to as anomalies or outliers, are observations or data points that deviate significantly from the majority of the dataset or follow a different pattern than the expected norm.
Anomaly detection within medical images holds immense significance as it focuses on identifying irregularities, deviations, or abnormalities in the captured data. Detecting anomalies in medical images is particularly crucial for conditions where subtle deviations can signify the presence of pathology, such as early-stage tumors, vascular abnormalities, or neurological disorders.

There are various approaches and algorithms for anomaly detection, each suitable for different types of data and tasks. Here are some common anomaly detection models:

Isolation Forest:

- Isolation Forest is an ensemble method that builds isolation trees to identify anomalies. It's efficient and works well for high-dimensional data.

Autoencoders:

- Autoencoders are neural network architectures designed for unsupervised learning. They learn to encode input data and reconstruct it, and anomalies are identified based on high reconstruction errors.

CNN:

- Convolutional Neural Networks (CNNs) are often associated with tasks like image classification, they can also be used for anomaly detection, especially when applied to image data

Pre-trained CNN models (e.g., VGG-16, ResNet):

- on large datasets like ImageNet can be fine-tuned for anomaly detection on a specific dataset. The pre-trained models already have learned hierarchical features that can be useful for various computer vision tasks.

REQUIREMENT

Building an Anomaly Detection Model:
Creating a model that can detect anomalies in medical images, such as identifying tumors or lesions that deviate from normal patterns.

Project Planning:

- We will collect the Brain MRI scan dataset from kaggle datasets.
- Will train the model based on the data and then select the model with high accuracy and precision.

Anomaly Detection Model (Visual Geometry Group 16)

Our model excels in brain tumor detection within MRI scans, employing three deep learning models—two simple CNNs with varying layer depths and a VGG 16 model. The dataset categorizes brain MRI scans into 'yes' (tumor present) and 'no' (normal). Comparison of model performances reveals insights into the impact of architecture complexity on anomaly detection accuracy.

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IMPLEMENTATION

- We used simple CNN (convolutional Neural Network), changing the structure of the model by applying various structure of the layers.

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- **Transfer Learning:**
  - Fine-tuning VGG-16 on the dataset, using the pre-trained weights from ImageNet. This allows the model to adapt to the specific characteristics of the data.

- VGG-16 was designed for image classification tasks, specifically for the ImageNet Large Scale Visual Recognition Challenge (ILSVRC) 2014. In this challenge, the task was to classify images into one of 1,000 categories.

- The code for the anomaly detection is available on this Github Repository.

OUTPUT

- The accuracy of the first CNN model achieved is 82.92%

- The accuracy of the second CNN model achieved is 95%.

- The accuracy achieved by using CNN and VGG 16 achieved is 99%

Now this model can detect tumors(anomalies) in an unseen brain MRI with 99% accuracy.

THANK YOU