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Classification and Analysis of Medical Images

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Abstract: Machine learning has phenomenal applications in the field of medicine. Image processing and analysis, play a vital role in defining certain aspects in medicine that can save critical time in determining the patient's life. The aim of this project is to develop and render a model to classify, visualize and analyse medical images. This classification and analysis pose several applications to a medical professional as it helps save crucial time in the patient's life and enhance and reduce diagnosis time.

KEYWORDS

Machine Learning, Deep Learning, Image Classification, 3D Reconstruction, Volumetric Segmentation, CT scans, X-Rays, Pneumonia

I. INTRODUCTION

Pneumonia is a disease that creates a situation where it is extremely unlikely to detect it at early stages, if it refers to Hospital acquired Pneumonia, then it can be easily diagnosed and treated. But Pneumonia left untreated is known to be fatal as it builds up fluids in the lungs that causes major unrest to a person's breath. Generally, X-Ray and Computed Tomography image is regarded as the gold standard in the non-invasive diagnosis and treatment of pulmonary diseases. However, basing on two dimensional slices, radiologists and surgeons must view hundreds of CT slices in front of the screen, which might sometime be frustrating and exhausting and also time consuming. What's the worst part is they have to visualize a three-Dimensional features and spatial relationship between different structures according to their experience. It is not accurate and varies among different radiologists and surgeons. 3D reconstruction is a powerful medical data visualization technology for physicians and medical researches. 3D reconstruction could manage all the slices of a person in a single screen. In order to decrease the diagnosis time and enhance the level of diagnosis, this project aims at building a detection model, that classifies a chest X-Ray of a person having Pneumonia from a chest X-Ray of a person being normal. The other aspect of this project involves rendering a DICOM image onto a 3-Dimmensional plot to provide enhanced insight to a medical professional therefore increasing their diagnostic efficiency.

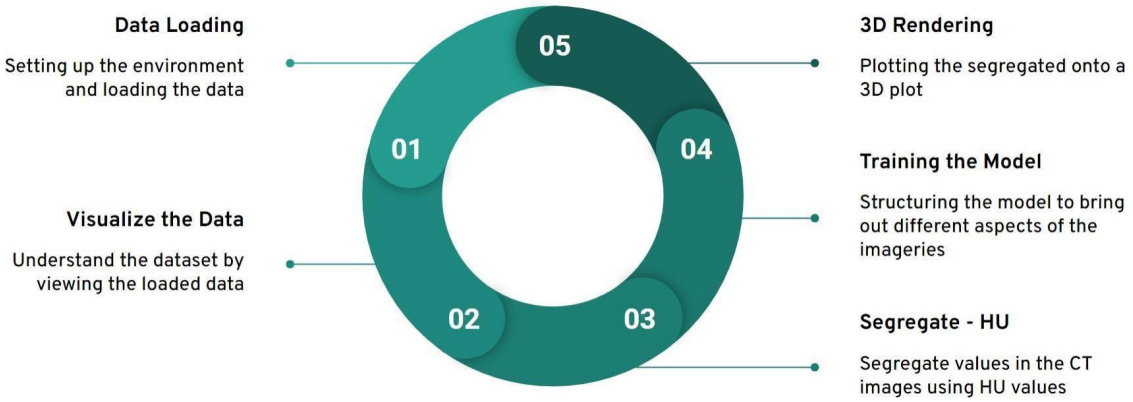
II. LITERATURE REVIEW ON CLASSIFICATION MODELS AND RECONSTRUCTION MODELS

COVID-19 was declared a pandemic caused by a newly discovered virus named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) by the World Health Organization in 2019. RT-PCR is considered the golden standard for COVID-19 detection. Due to the limited RT-PCR resources, early diagnosis of the disease has become a challenge. Radiographic images such as Ultrasound, CT scans, X-rays can be used for the detection of the deathly disease. Developing deep learning models using radiographic images for detecting COVID-19 can assist in countering the outbreak of the virus. The method uses features extracted from pre-trained networks along with Sparse autoencoder for dimensionality reduction and a Feed Forward Neural Network (FFNN) for the detection of COVID-19. Two publicly available chest X-ray image datasets, consisting of 504 COVID-19 images and 542 nonCOVID-19 images, have been combined to train the model. Deep Learning has grown in popularity in recent years, and it now plays a crucial role in Image classification, which involves Medical Imaging. Using Chest CT scans, this study explores the problem statement as possible could contain and avoid a serious COVID-19 outbreak. Current pharmaceutical techniques and diagnostic methods tests such as Reverse Transcription Polymerase Chain Reaction (RT-PCR) and Serology tests are time-consuming, expensive, and require a well-equipped laboratory for analysis, making them restrictive and inaccessible to everyone. Three-dimensional reconstruction of lung and vessel tree has great significance to 3D observation and quantitative analysis for lung diseases. This paper presents non-sheltered 3D models of lung and vessel tree based on supervised semi 3D lung tissues segmentation method. In this, model, the segmentation of the current model is supervised by the result of the previous slice due to the slight changes between the adjacent slice of the lung tissues. Through these mechanisms, lung tissues in all the slices are segmented fast and accurately. The serious problems of left and right lung fusion, caused by partial volume effects, and segmentation of pleural nodules can be settled meanwhile during the semi-3-D process. Belief function theory, a formal framework for uncertainty analysis and multiple evidence fusion, has made significant contributions to medical image segmentations, especially since the development of deep learning.

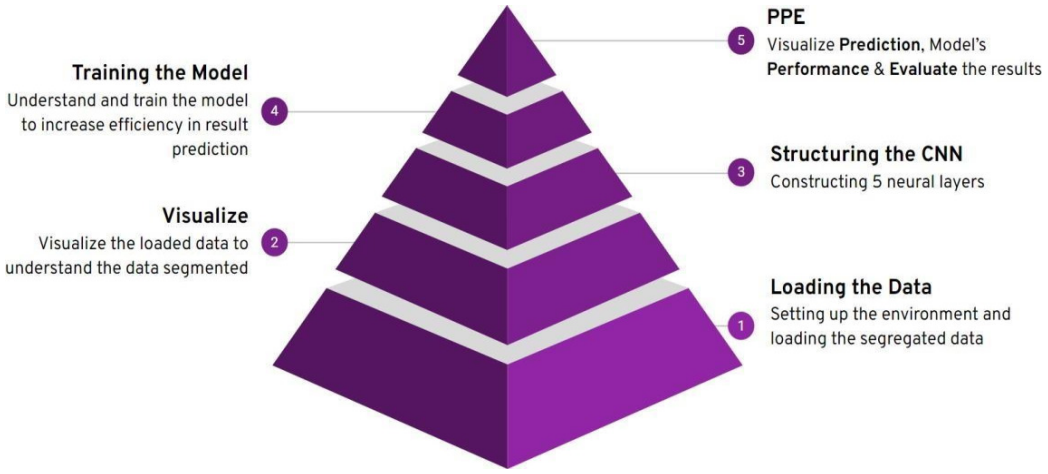
Models are classified based according to the belief function theory. In addition, by discuss the challenges and limitations of present belief function-based medical image segmentation and propose orientations for the future research

III. IMPLEMENTATION OF THE MODEL

The Full working pipeline of the model is as expressed and shown below



1. The first phase consists of loading of the data and setting up the environment.
2. The second phase involves understanding the data by visualizing it.
3. The third phase involves segregating the layers by using Hounsfield units.
4. The fourth phase involves, structuring and training the model.
5. The last phase involves plotting the segregated values onto a 3D plot.



This aspect of the project involves classifying chest CT scans and X-Rays if the patient'sX-Rays contains Pneumonia or not. This is also split into phases as shown below.

1. In this phase, to load the data and set up the environment.
2. In this phase, to visualize the data loaded into the environment to get a betterunderstanding about the dataset.
3. In this phase, to structure the model to with a CNN approach to classify the CTscans and X-Rays.
4. This phase actually deals with structuring and training the model.
5. In this phase, to measure the Prediction, Performance and the Evaluate theprediction to obtain increased accuracy.

IV. GOALS AND DISCUSSIONS

GOALS

The main purpose of Classification and Analysis of Medical scans is to classify, scan, analyze and render the chest X-Rays and CT scans using a Machine Learning Model with a CNN and Binary classification approach. Hospitals with critical care and emergency wards can make use of this to increase their individual professional's efficiency by forgoing essential time required to make diagnosis.

OBJECTIVES

This project works in numerous environments to ensure that the models could run on as many

environments possible. To ensure the reusability of the model, the structure of the model is completed in 3 different environments namely Google Collab notebooks, Kaggle and Jupyter notebooks, all of the three provide different types of runtimes to the system. Making use of different libraries is a vital aspect of this model, as the model has to be efficient enough to produce nearly perfect evaluation scores, and to perform at its maximumefficiency.

V. APPLICATIONS

The basic approach of this project is to speed up the workflow of medical professional, from the patient's prognosis to how to proceed with the diagnosis. This model aims at creating a model without compromising accuracy or any chances of losing data. Also, the medical professional can help get a better insight and efficiency as they can save more time and reduce the diagnostic time with this model, by letting the model diagnose the patient and then looking for probable paths to proceed with the diagnosis.

- Can be used to teach medical professionals.
- Can be used to enhance the doctor's perception of the patient's scans.
- Can be used to increase productivity and efficiency while diagnosing patients.

VI. CONTRIBUTION TO SOCIETY AND ENVIRONMENT

Digital transformation is the new reality of modern world's medical field. Besides industries which use ML models to scale their businesses and efficiency, such as manufacturing, corporate, banking commerce, IT, medical domain has new challenges and it has more importance to address the evolving needs of this domain. This ML pipeline helps medical institutions and professionals, especially for doctors starting out their career in various ways, such as maintain patient's profiles, analyzing the patient's diagnosis and giving out the best possible path for proceeding with the patient's diagnosis. The world is rapidly changing and technology has to meet the expectations of the medical industry. Doctors since ages have been dependent on technology to make better diagnosis, perform and assist them in operations, as well as to increase their efficiency. Some recent implementations have also shown, medical institutions have implemented robots to perform difficult operations.

VII. CONCLUSION

The current knowledge around NFTs and blockchain is quite a niche, at least it is likely in a phase of speculative nature of value production and efforts were put towards filling the gaps of how end-users perceive the notion of value through ownership of NFTs. The stakeholders of the research would be academicians, public and private companies in the blockchain industry seeking to build products around NFTs, students and anyone looking forward to building knowledge from a meta perspective trying to understand the value behind NFTs. The study sheds light on the improvement of the current products and processes enabling blockchain developers to carefully select and build use cases that provide the true value of NFTs.

VIII. FUTURE ENHANCEMENT

After the model is structured and trained, the primary aim is to deploy the model onto a real test world data and allow it to run and observe and finetune the model to yield perfect results. Reusability is another concern, and structure and develop the model in a way that the model can be deployed on a number of different platforms for number of different applications other than CT images and Chest X-Rays.

IX. REFERENCES

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