Chest X-ray Classification

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Abstract

Medical Sciences has progressed much in day to day, chest radiology requires timely reporting, fast detection of various diseases. Automating this is a crucial step in radiology. In this paper we have developed a CNN for classifying chest X-ray images into 15 different categories. The dataset comprised of TFR records which had over 112120 compressed chest X-rays present in them.

The performance of our developed model along with the highlighting of gradients shows that automation has a lot to offer to improve the quality of our medical infrastructure and patient care overall, in general

Introduction

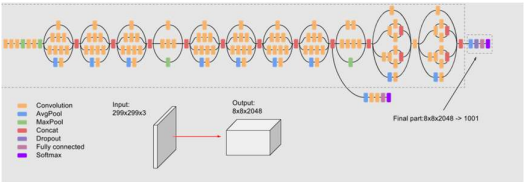
Cardiothoracic and pulmonary abnormalities are one of the leading causes of morbidity, mortality, and health service use worldwide. American Lung Association says that, lung cancer is the number one cancer killer in the United States, with more than 33 million Americans have a chronic lung disease. The chest radiograph (chest X-ray) is the most commonly requested radiological examination owing to its effectiveness in the characterization and detection of cardiothoracic and pulmonary abnormalities. It is also widely used in lung cancer prevention and screening. Due to the heavy workload of doctors and radiologists timely, the reporting and examination of chest X-ray takes a lot of time and , this in some cases can mean deadly consequences for the patient, in this sense an automated model , which is able to classify various chest ray images into a broad range of categories is indeed , going to be a useful resource , as it can help our medical professionals make an informed decision more quickly. The time saved by our medical professionals an now be spent on images or a set of images (X-rays) which the model, doesn't perform well on, these images can now be used to further increase the performance of the model

Deep learning which is commonly known as DL, is a new and emerging subfield of Machine learning. These algorithms take their inspiration from the workings of the human brain. Deep learning nowadays is the leading method used to create Artificially intelligent machines which are capable of replicating human intelligence. Deep learning models are used in Computer vision, Natural language processing and many other complicated applications such as automated driving etc.

Deep learning models such as CNNs have proven to be an extremely important tool to perform computer vision, due to the information age bought by internet has led to the emergence of large-scale datasets. CNNs take processed images as input and perform a series operation to learn rich information about the image, in order to bridge the gap between high-level representation and low-level features.

Proposed Work – Algorithm

The proposed algorithm makes use of the InceotionV3 Deep learning model, with some added layers to it. InceptionV3 is a CNN whose architecture comes from the inception family. The TFRRecords are first loaded and decoded accordingly. The dataset is later split into validation and training images , the teraining images are used to train the model meanwhile the validation images are used to test the models accuracy. The neural network model (CNN) is built and trained on the training set after training the model we make use of Integrated gradients to further understand the X-ray image



Experimental Setup - Dataset;

The data set is available on Kaggle and comprises of nearly 256 serialized records which comprise of nearly 112120 images. The dataset is available from the following link - https://www.kaggle.com/nickuzmenkov/nih-chest-xrays-tfrecords

Software - Hardware Needed;

Software requirements – The code requires a python version >= 3.8 to run smoothly with all the pre requisite libraries mentioned in the requirements.txt file installed beforehand

Hardware Requirements –Minimum of 8 gb ram , along with 20GB storage space. Should have a good processor (at least greater than or equivalent to Inte i5) along with a GPU for support

ML/DL Model

The proposed algorithm makes use of the InceotionV3 Deep learning model, with some added layers to it.InceptionV3 is a convolution neural network architecture from the inception family. Apart from the layers already present in the inceptionV3 model , some layers have been added , which comprise of a 512 units Dense layer followed by a BatchNormalizer, followed by 128 units Dense Layer ,followed by another BatchNormalizer followed by 32 units Dense layer which is followed by the last Dense output layer of 15 units.

Summary/ Conclusion

In our modern world , technology is present everywhere from video games to performing surgeries in real life . Technology has made our lives easier. The model has achieved the following metrics after the training with a loss of 0.1946 , AUC score: 0.7301 and a binary accuracy of 0.9307.The above metrics suggest that the model is performing a decent job in classifying medical X-ray images , and helping doctors in identifying the underlying illness present by analysing the chest X rays

Reference Papers

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