

Chapter 11

Automatic Classification of Diseases From X-Ray Images Using Xception Deep Convolution Neural Networks

Venkatesan R.

SASTRA University (Deemed), India

Umamaheswari P.

SASTRA University (Deemed), India

ABSTRACT

The growth of artificial intelligence (AI) and deep learning in recent years has been played vital role scientific and research related field. The influence of AI can be seen and felt in many fields today. One of the most important applications of AI is in the field of medicine. Across the globe, many radiological societies are exploring medical image analysis (MIA) with the application of AI techniques. The inclusion and deployment of AI in medical imaging have changed the way of interpretation and diagnosis drastically. This experiment was aimed to classify multiple diseases from the X-ray images using Xception deep convolutional neural networks (XDCNN). The chest X-ray images were trained in the Xception network. The system classified 18 diseases based on ground truths and the accuracy rate was calculated.

1 INTRODUCTION

Medical image services, such as radiography, endoscopy, computed tomography (CT), mammography images (MG), ultrasound images, magnetic resonance imaging (MRI), Nuclear medicine imaging, Positron Emission Tomography (PET), and pathological tests, have seen a dramatic increase in demand in the health-care system. Furthermore, due to a scarcity of radiologists, analysing medical images can be a difficult and time-consuming task. Artificial Intelligence (AI) (Fan et al, 2020) has been on the rise for several years now. This is as an effort to mimic human intelligence levels has surpassed its expectations

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in many ways. Nowadays, it has excelled the expectations that were laid on it during its inception. The Machine Learning (ML) programs have made several computations possible in trans-disciplinary mode, which is not achieved in conventional programming. Some of the thrust areas of AI are listed below for reference in table 1. An important application of Artificial Intelligence and Machine Learning (ML) comes in the field of Medical Image Analysis (MIA). MIA is an important utility in modern medicine, which aids the physicians in the diagnosis process by providing valuable predictions on the

medical image samples such as X-rays, MRI scans and CT scans. The inclusion of AI & ML techniques in the field of MIA has led to increased efficiency in medical diagnosis and treatment by harnessing the power of computers in making intelligent decisions regarding the ailments.

Table 1. Streams of Artificial Intelligence

STREAM	APPLICATIONS
Machine Learning(ML)	Making computers learn with minimal or no human intervention
Neural Networking(NN)	Artificial networks that emulate the working of a human brain
Robotics	An interdisciplinary stream that focuses on building robots for industrial and domestic purposes
Natural Language Processing (NLP)	Focuses on understanding human language, either speech or text

The gradual inclusion of Artificial Intelligence and Machine Learning in MIA is indispensable today, given the huge computational power computers possess now. The concept of MIA has travelled a long way since its inception. With recent advancements in computer technologies over the years, Medical Imaging has gone through various stages of evolution to become what it is today. Computers, being more powerful than humans in performing operations involving bulk data, can be very helpful in predicting the diseases using X-rays. The type of X-rays that this system focuses on is chest X-rays, which are taken around the region of thorax between the neck and the diaphragm.

Medical Image Analysis [MIA] (Wang et al, 2020) is an important utility in modern medical sciences. The inclusion of AI & ML techniques in the field of MIA has become indispensable today. This inter-disciplinary research led to increased efficiency in medical diagnosis (Mondal et al, 2019). This experiment revolves around interpreting chest X-ray images and classifying them to different disease labels based on the X-ray. This involves a massive amount of training that has to be done in order to get the system familiar about the chest X-rays and their nature. The completed system will be very helpful in predicting the diseases from the chest X-ray images with minimal or no human intervention. We do know that a digital X-ray image is a vital diagnostic tool. This experiment focused on interpreting chest X-ray images to find diseases from the computation point of view.

This approach is being followed by many researches across the globe in terms of computer vision and deep learning perspectives. This trend attracted as to work on this area and to classify the diseases as per given labels. We used Google Colab to build this system. The Xception (Chollet 2017) a deep convolutional neural network (DCNN) architecture developed by Google researchers, involves depth-wise separable convolutions. This system classified 18 different disease labels with higher accuracy. A massive amount of training was done to get the system familiar with the input images and the parameters. Xception is an extension of the inception Architecture that replaces the standard Inception modules with

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