



IMPROVING CLASSIFICATION OF PNEUMONIA IN CHEST X-RAY IMAGES

With the rise of COVID-19, medical facilities were operating beyond peak capacity. Capgemini has developed a Deep Learning based classification system that can distinguish between pneumonia and non-pneumonia cases as well as between viral (including COVID-19) and bacterial cases in seconds. The aim of the project is to support the diagnosis of pneumonia and thus reduce the overall workload of medical staff. This MVP was presented on the AIforGood 2020 Summit organized by ITU.

With the help of X-rays, the authors envision a potential to support developing countries in their task of classifying pneumonia, e.g. caused by COVID-19. Thus reducing the workload of medical staff. The technology of X-rays is a widespread and therefore feasible solution for diagnosing infectious viruses. By implementing an algorithm that provides a high identification rate of pneumonia, patients could receive treatment at an earlier stage.

Overview

Industry: Healthcare

Client Challenges:

- Limited access to sophisticated radiology limits diagnostic options.
- Limited time for diagnosis due to overworked medical staff.
- In urgent situations, the human eye may often miss out some cases that could prove fatal to the patient.

Results:

- Generation of masks using the U-net architecture, highlighting the area of interest in an X-ray.
- The procedure proved to be beneficial in classifying pneumonia.
- Improvement in classification of pneumonia and bacterial/viral.
- The solution is relevant to other medical fields for classification.

Our approach:

Our approach consists of three main stages: Pre-processing the images with generation of so called "masks", deciding if the image indicates that patient has pneumonia or not and finally, for those images classified as pneumonia, deciding whether the pneumonia is of bacterial or viral nature. By applying the mask on the X-ray we produced a cut out which was stacked on the existing X-ray RGB image in an 4th layer.

Key Features:

The approach of segmenting the lungs supports the AI system in focusing on pathological features of an X-ray. Key results of our research were that the algorithm led to an improved classification of X-ray in the distinction between pneumonia and non-pneumonia cases and between bacterial and viral pneumonia.

The results in segmenting lung from CXR images can be seen in the following images.



Our Value Add

The benefit of this project is that by generating lung masks the accuracy is increased. In particular, this led to a reduction in the number of false negatives, which is very important in a medical context. The enhanced classification, along with lung segmentation, can be used to support pneumonia diagnosis.



Normal



Covid-19 infected

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