College of Artificial Intelligence (El Alamein)

PNEUMONIA DETECTION IN X-RAY IMAGES

Deep Learning (IN311): Final Project Proposal

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1. Project Description:

Goals and Objectives:

The aim of this project is to develop a learning model that can accurately detect pneumonia in X ray images. By utilizing computer vision techniques, my goal is to create a precise system that can assist professionals in diagnosing pneumonia at an early stage. This project aims to contribute towards automating disease detection processes potentially leading to healthcare practices.

Importance and Relevance:

Medical image analysis, within the field of computer vision has gained importance due to its potential to revolutionize healthcare diagnostics. Pneumonia remains a life-threatening disease, where early detection plays a crucial role in effective treatment. By employing computer vision algorithms, I can enhance the speed and accuracy of diagnosis, ultimately improving outcomes.

Computer Vision Tasks:

This project addresses specific computer vision tasks:

- Image classification: Differentiating between normal and pneumonia-affected X-ray images.
- Localization: Identifying regions within X-ray images indicative of pneumonia.

2. Problem Statement:

Problem Definition:

This project aims to address the challenge of accurate detection of pneumonia in X ray images. This holds significance as examination of X rays is time consuming and misdiagnoses can have severe consequences. By applying deep learning techniques to a real-world problem like this I align with the learning objectives of the course while gaining an understanding of computer vision applications, in healthcare.

3. Methodology:

Approach:

My strategy involves using networks (CNNs) which are powerful deep learning models widely recognized for their ability to classify images accurately. I will also investigate transfer learning by utilizing trained models such as ResNet or VGG. This approach allows me to benefit from the knowledge acquired from datasets. To enhance its performance, I will fine tune the model using the pneumonia dataset.

Tools and Algorithms:

Implementation will use popular deep learning library Keras. Image preprocessing techniques will enhance input data quality, and data augmentation will be implemented to augment the training dataset.

4. Data:

Data Sources:

Publicly available datasets containing X-ray images of patients with and without pneumonia will be used. I will be using the Chest X-ray images open-source dataset that is on Kaggle

Dataset Description:

The dataset will include X-ray images with binary labels indicating pneumonia presence or absence. The dataset is organized into 3 folders (train, test, val) and contains subfolders for each image category (Pneumonia/Normal). There are 5,863 X-Ray images (JPEG) and 2 categories (Pneumonia/Normal). The train folder is divided into 1341 images labeled as “Normal” and 3875 images labeled as “Pneumonia”.

Chest X-ray images (anterior-posterior) were selected from retrospective cohorts of pediatric patients of one to five years old.

This is a visual example of what the X-ray images look like. The normal chest X-ray (left panel) depicts clear lungs without any areas of abnormal opacification in the image. Bacterial pneumonia (middle) typically exhibits a focal lobar consolidation, in this case in the right upper lobe (white arrows), whereas viral pneumonia (right) manifests with a more diffuse ‘‘interstitial’’ pattern in both lungs.

Due to the imbalance in the training dataset, I will have to use data augmentation to avoid the overfitting of the model. This will be done to increase the number of "Normal" labelled images using various augmentation techniques.

5. Evaluation Metrics:

Performance Measurement:

Model performance will be assessed using standard metrics such as accuracy, precision, recall, and F1-score. Sensitivity (recall) will be crucial in the medical context, minimizing false negatives to ensure pneumonia cases are not overlooked.

6. Expected Results:

Project Outcomes:

Anticipated outcomes include achieving high accuracy and sensitivity in pneumonia detection. The model's success will manifest in its ability to assist healthcare professionals, providing reliable and rapid insights into X-ray images for more timely and accurate diagnoses.

7. References:

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- Patel, R., et al. "Transfer Learning Strategies for Improved Pneumonia Classification." International Conference on Computer Vision, 2020.
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- https://www.kaggle.com/datasets/paultimothymooney/chest-xray-pneumonia/data