CSE 674 ADVANCED MACHINE LEARNING PROJECT PROPOSAL
Detection of COVID-19 from CT images using Deep Convolutional Neural Network Design

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1. PROJECT STATEMENT AND PROJECT DESCRIPTION

Project Statement : 'Proposing a Deep Convolutional Neural Network Design for detection of COVID-19 from chest CT images via a machine driven design exploration approach.We have planned to use the COVIDx-CT, a benchmark CT image dataset derived from CT imaging data collected by the China National Center for Bioinformation comprising 104,009 images across 1,489 patient cases'.

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), continues to have a significant impact on patients and healthcare systems worldwide. For the timely isolation and treatment of patients infected with this novel disease, it is imperative to have fast and effective screening tools to pinpoint their infection. RT-PCR is the primary means of screening for Covid-19. As an alternating screening tool , Chest computed tomography (CT) imaging has been proposed. During the early stages of Covid-19 pandemic, CT images were used extensively. Visual examination of CT images is a time-consuming manual operation for radiologists, especially when patient traffic is high or in big studies.

In this project , we will introduce a deep convolutional neural network that will detect Covid-19 cases from chest CT images via a machine driven design exploration approach. To investigate the decision-making behavior of our model, we will perform an explainability-driven performance validation and analysis of its predictions. This will allow us to explore the critical visual factors associated with COVID-19 infection and ensure that our model's decisions are based on relevant CT image features.

2. AVAILABLE MODELS/ RELATED WORKS

The similarities and variations of our planned models with connected work on the theoretic account below are analyzed.

(1) Yifan Peng et.al [1] in this journal started by extracting images, tags, and related image descriptions from PMC-OA articles. The paper focuses on using deep learning models, where it further identifies the individual figures as CT, CXR, or any other kinds of scientific data and figures with their kinds and pertinent descriptions from the manuscript are included in their final database. It is basically to differentiate COVID19 from influenza on single CT images. But it is difficult to label large scale imaging data specifically in the public domain and some of the figures are compound so the data needs to be divided if it is complex.

(2) Qingsen Yan et.al [2] in this paper used a novel deep neural network for the segmentation of the COVID infected areas along with CT images.They have used a specific block called called Feature Variation block where it is used to solve the problem of differentiating COVID19 from other diseases and inorder to test the robustness 10 cases from Germany were used. But here, the main problem is that the features have a lot of redundant information and the COVID19 infection characteristics are diverse and are similar to the existing medical imaging segmentation methods.

3. DATASET

COVIDx CT, an open access benchmark dataset currently comprises 104,009 CT slices from 1,489 patients. This dataset will be used to train and validate our models for COVID-19 detection from CT images. This CT imaging data is derived from CT imaging data collected by the CNCB . The CNCB data is composed of chest CT examinations from different hospital cohorts across China as part of the China Consortium of Chest CT Image Investigation.

4. PROPOSED SYSTEM

The network proposed is a machine-driven design exploration strategy that could exhibit high architectural diversity by the use of heterogeneous composition of conventional spatial convolution layers, pointwise convolutional layers, and depthwise convolution layers in a way that strikes a balance between accuracy and architectural and computational complexity . Furthermore, we have planned on using the machine-driven design exploration strategy that could make use of unstrided and strided projection-replication-projection-expansion design patterns, which we denote as PRPE and PRPE-S for unstrided and strided patterns, respectively. Also the output of the network design will be included with a softmax layer corresponding to the following prediction into three categories: (i) no infection (normal), (ii) non-COVID-19 pneumonia (iii) COVID-19 viral pneumonia.

5. MILESTONE

The first milestone would be to achieve the proposed architecture of our project. The second milestone would be to optimize our model in order to achieve a good accuracy.

6. REFERENCES

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2. Qingsen Yan , Bo Wang, Dong Gong , Chuan Luo, Wei Zhao, Jianhu Shen, Jingyang Ai, Qinfeng Shi, Yanning Zhang , Shuo Jin, Liang Zhang, and Zheng You, “COVID-19 Chest CT Image Segmentation Network by Multi-Scale Fusion and Enhancement Operations (2021)”.

3.Qingyun Ren; Bingyin Zhou; Liang Tian; Wei Guo, “Detection of COVID-19 With CT Images Using Hybrid Complex Shearlet Scattering Networks(2021)”.

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