CRITERIA

MEETS SPECIFICATIONS

Domain Background

Student briefly details background information of the domain from which the project is proposed. Historical information relevant to the project should be included. It should be clear how or why a problem in the domain can or should be solved. Related academic research should be appropriately cited. A discussion of the student's personal motivation for investigating a particular problem in the domain is encouraged but not required.

Modern medical imaging technologies (CT, X-ray, MRI…) are substantial for a reliable diagnosis. Those technologies with different medical test and measurement generate a very complex and high dimensional space for diagnosis. As a biomedical engineer, I am interested on data based clinical diagnosis. However, the complexity (number of features) and the huge volume of the data make it difficult for humans to use it efficiently. Deep learning models can be a supporting tool for the physician to consolidate their decisions. [1] As an example, clearly demonstrate how deep learning can improve diagnosis accuracy in different pathological fields. Deep learning as an artificial intelligence tool can perform a task that is based on big number of features that overcome the human abilities to build their decisions. As data complexity augment, deep learning will present the only possibility to build diagnosis hypotheses.

Problem Statement

Student clearly describes the problem that is to be solved. The problem is well defined and has at least one relevant potential solution. Additionally, the problem is quantifiable, measurable, and replicable.

Pneumonia diagnosis is based on different parameters (review of the medical history perform blood tests; require chest X-ray and pulse oximetry or chest computed tomography CT scan). However, for emergency cases medical history and blood test are generally not available. Rapid intervention also is expected for bacterial type of pneumonia. The aim of this project is thus to build a classifier that can decide if a patient has a pneumonia by providing ONLY its chest X-ray (as it is a fast information to be acquired). This will enable the medical doctor to meet fast decisions in emergency cases and alleviate the

diagnosis process by enhancing or diminishing the physician to conduct farther medical tests to support their initial diagnosis

Datasets and Inputs

The dataset(s) and/or input(s) to be used in the project are thoroughly described. Information such as how the dataset or input is (was) obtained, and the characteristics of the dataset or input, should be included. It should be clear how the dataset(s) or input(s) will be used in the project and whether their use is appropriate given the context of the problem.

The provided data of this project is 3 folders (train, validation and test) of chest_xray images. Each folder contain 2 subfolders named: NORMAL and PNEUMONIA. The class of each data point (image) is deduced from its location. Images has different sizes. Some are rgb and others are gray level images.

We acquired this data set from this following Kaggel source: https://www.kaggle.com/paultimothymooney/chest-xray-pneumonia

This data set will be an input to learn a deep learning model (after preprocessing) to perform a classification task and decide whether the subject image present a Pneumonia patient or a healthy person.

Solution Statement

Student clearly describes a solution to the problem. The solution is applicable to the project domain and appropriate for the dataset(s) or input(s) given. Additionally, the solution is quantifiable, measurable, and replicable.

The solution of this classification problem is deep learning model composed of the convolutional neural network CNN stacked to fully connected layers. The architecture of the model will be provided in the final report.

Benchmark Model

A benchmark model is provided that relates to the domain, problem statement, and intended solution. Ideally, the student's benchmark model provides context for existing methods or known information in the domain and problem given, which can then be objectively compared to the student's solution. The benchmark model is clearly defined and measurable.

[2] Used pre-trained inception V3 model [3] they claimed 94% validation accuracy.

Evaluation Metrics

Student proposes at least one evaluation metric that can be used to quantify the performance of both the benchmark model and the solution model presented. The evaluation metric(s) proposed are appropriate given the context of the data, the problem statement, and the intended solution.

As a classification problem, we will use accuracy precision and recall as metrics to measure performance of the model.

Let TP, TN, FP and FN be true negative, true negative, false positive and false negative respectively we recall that:

Precision = TP/(TP+FP)

Recall = TP/(TP+FN)

Project Design

Student summarizes a theoretical workflow for approaching a solution given the problem. Discussion is made as to what strategies may be employed, what analysis of the data might be required, or which algorithms will be considered. The workflow and discussion provided align with the qualities of the project. Small visualizations, pseudocode, or diagrams are encouraged but not required.

We will choose a substitute for the inception V3 model, which is the VGG 16 model [4]. We will apply transfer learning (to overcome the small amount of available data) technique for the shallow layers of the model and keep training process for the deeper layers. We will also try to overcome the data class imbalance by some data augmentation techniques that fit to the context.

Presentation

Proposal follows a well-organized structure and would be readily understood by its intended audience. Each section is written in a clear, concise and specific

manner. Few grammatical and spelling mistakes are present. All resources used and referenced are properly cited.

Ok.

References

[1] Litjens, G., Sánchez, C., Timofeeva, N. *et al.* "Deep learning as a tool for increased accuracy and efficiency of histopathological diagnosis. " *Sci Rep* 6**,** 26286 (2016)

[2] Kermany, Daniel S., et al. "Identifying medical diagnoses and treatable diseases by image-based deep learning." *Cell* 172.5 (2018): 1122-1131.

[3] Szegedy, Christian, et al. "Rethinking the inception architecture for computer vision." *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2016.

[4] Simonyan, Karen, and Andrew Zisserman. "Very deep convolutional networks for large-scale image recognition." *arXiv preprint arXiv:1409.1556* (2014).