Project Title: A Diagnostic Decision Support System which Can Predict Diagnostic Markers: Robust Deep Learning Based Method of Predicting Diagnostic Markers and Diagnosing Disease Automatically

Project Description:

In recent years, with the gradual awakening of global health awareness, human beings have shown an urgent need for further development of medical level. Artificial intelligence (AI) has great potential to promote the further development of medical diagnostic technology because of its excellent performance in the field of data processing beyond human experts. Despite it has excellent performance in the field of automatic diagnosis using medical images, the interpretability and text-based medical data analyzability of AI still face great challenges.

In order to solve the problems above, on the global scale, researchers have gradually integrated deep learning technology with medical diagnosis. Edward Choi and his colleagues used recurrent neural network to process electronic health records (EHR) for diagnosing heart failure onset. Laila Rasmy et al. used recurrent neural networks to predict the risk of heart failure based on a large number of mixed EHR data. Sasank Chilamkurthy et al. used natural language processing model to recognize non-contrast head CT scan to identify various head diseases, such as intracranial haemorrhages and cranial fractures et al. Kang Zhang et al. used transfer learning algorithm and Google's Inception-V3 model to rapidly diagnose many kinds of diseases of eye and children pulmonary diseases. Michael A. Schwemmer et al. used deep neural network decoding framework to classify intracortical recording, and then controlled the motor to help patients complete corresponding actions, according to the classification results. Although deep learning technology has shown a strong competitive advantage in the field of automatic diagnosis using medical images, it still faces many major challenges, such as processing medical text information. In the actual clinical diagnosis processing, in addition to the diseases that can be diagnosed by medical images, there are many diseases that need to be diagnosed by medical text data, such as hyperlipidemia, diabetes, etc.

In order to achieve the purpose of automatically diagnosing diseases using text-based medical data, long-short time memory (LSTM) neural network was proposed. LSTM mentioned above rely on memory cells to learn long-range dependence information. As we know, each human physiological parameter is not independent, they are interrelated, and this relationship is difficult to be found by simple coding or logistic regression algorithm. Therefore, we need a deep learning model that can learn the relationship better of far apart data to complete the task of processing text-based medical data. Simply, the LSTM neural network takes the original text-based medical data as input, and then use many special neurons to extract the joint features automatically from the original data, and finally use the classification function to classify the samples automatically to achieve the purpose of automatic diagnosis of diseases. This architecture make it possible to process medical text data which have complex internal relationships, deep learning technology has been widely used in various fields.

What will be made available to the student:

- Interns with work closely with a PhD student on the architecture of the LSTM-deep learning;
- One manuscript to use as a reference;
- Data available from Qatar Biobank.

Duties/Activities:

1. Get familiar with deep learning and LSTM;
2. Implement it on biobank data;
3. Calculate several accuracy of the algorithm.

Required Skills: fluent in programming either in Matlab, or Python or R

Preferred Intern Academic Level: None

Learning Opportunities: Student will have the opportunity to learn about bioinformatics, computational biology, Health informatics, machine learning, writing a paper to publish, etc.

Expected Team Size: *it is preferable to have team projects*

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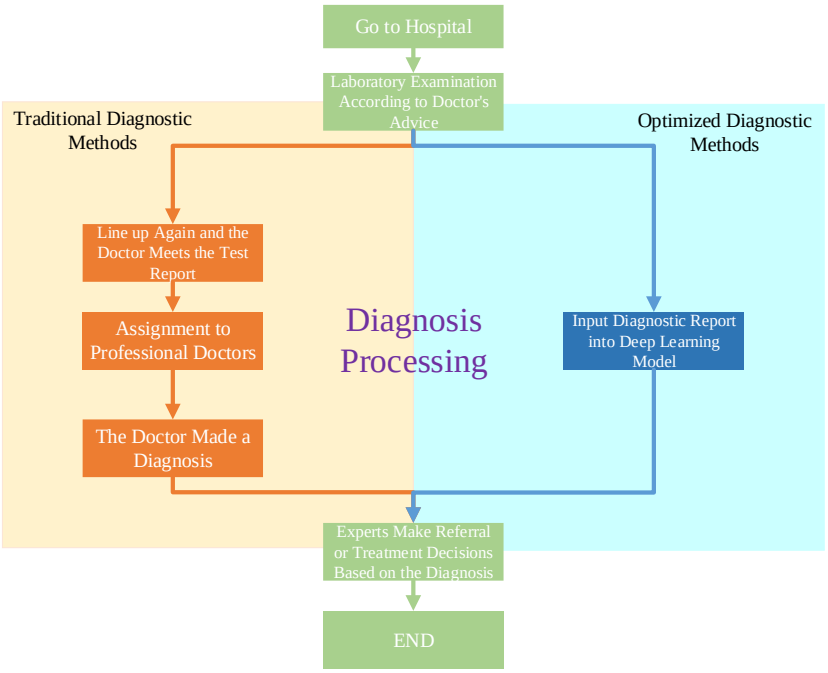

Figure 1. Traditional diagnostic process and optimized diagnostic process