HEMATOLOGIC DISEASES DETECTION USING IMAGE PROCESSING

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ABSTRACT

For several diseases, blood analysis is an important indicator; it includes many parameters that are an indication of particular blood diseases. Patterns that contribute to precisely identifying the disease should be identified in order to predict the disease according to blood analysis. The area responsible for developing models for predicting the performance based on previous data is machine learning. Deep learning algorithms' accuracy is dependent on the quality of data obtained for the learning process. Expert physicians from widely reputable sources compile and validate the data collection. Several classical machine learning algorithms are being studied and positive results have been obtained. Most blood tests do not require strict conditions, such as fasting 8 to 12 hours before the test or avoidance of certain forms of medicinal products. Various parameters in the blood van are calculated by measuring the fluid, Malaria remains a major public health concern around the world, despite the fact that it is both preventable and treatable. Malaria is typically diagnosed by an expert microbiologist after examining a microscopic blood smear sample. Malaria is easily treatable if diagnosed early and followed up with proper medical treatment. Computer-aided diagnosis is becoming more popular because it can be used as a primary screening test in the absence of an expert microbiologist.

Deep learning is an artificial intelligence technique that trains a machine to mimic the thought process of the human brain. The goal of this paper is to create a deep convolutional neural network that can predict malaria parasite infection from thin blood smear samples. The use of artificial intelligence in auxiliary disease diagnosis has recently become a research hotspot. The traditional method of diagnosing diabetes circulatory complications, diabetic peripheral neuropathy, hyperlipidemia, diabetes mellitus peripheral angiopathy, and the comprehensive diseases is to differentiate inspection report by professional doctor. Its implementation of a clinical decision support algorithm for medical text data faces difficulties in terms of confidence and accuracy. Methods: We proposed an expanding learning system to detect diseases in our medical text data, which covers a wide range of human physiological parameters such as hematologic parameters, urine parameters, and biochemical detection.

KEYWORDS – *blood disease, pre-processing, classifier algorithm, feature extraction, Convolutional neural network (CNN)etc*

INTRODUCTION

Blood has many secrets that affect human life. This change could be detected by the values of parameters inside blood analysis tests. Blood tests are widespread because of that; most physicians may recommend blood tests to predict the health level of the patient's body. Applying modern technological tools for helping physicians to improve the accuracy of disease diagnosing, become one of the hot topics of research, especially deep learning and artificial intelligence algorithms. The main objective of this research is using machine learning techniques for detecting blood diseases according to the blood tests values, several techniques are performed for finding the most suitable algorithm that maximizes the prediction accuracy. Blood is drawn from a person's vein using a needle or, in some cases, a finger prick during a blood test. Blood is analysed using a Hematology analyzer or by manually counting blood cells.

The manual method takes a long time and is prone to errors. It takes skilled experts to do the counting, and it can still be highly inaccurate. Although accurate and fast, the haematology analyzer is very expensive and cannot be afforded by every clinic/practitioner. Along with a blood report, the doctor will consider the patient's symptoms, medical history, vital signs such as blood pressure, breathing, pulse, temperature, and results from other tests and procedures. Various image processing techniques have been used as an alternative to the manual method in the past and have yielded positive results.

OBJECTIVE:

The main objective of this thesis is to use machine learning techniques to detect blood diseases according to the values of the blood tests; many techniques are carried out to find the most effective algorithm that maximises the accuracy of prediction. The main objective of this research is using machine learning techniques for detecting blood diseases according to the blood tests values, several techniques are performed for finding the most suitable algorithm that maximizes the prediction accuracy

Proposed work:

Papers used preprocessing techniques such as colour conversion, image segmentation, edge detection, and feature extraction along with a decision tree to identify dengue by classifying phagocytes and lymphocytes to identify dengue by classifying phagocytes and lymphocytes. The CNN algorithm was used to classify leukocytes and aid in disease identification. During feature extraction, various morphological factors such as perimeter, roundness of the cell, area, and so on are taken into account, which aids in classification. The WBCs were classified into five types using Multiclass SVM. WBCs were detected and classified using range filtering and the Level Set algorithm, respectively. Using grayscaling and otsu's method, the region of interest (ROI) was extracted during preprocessing. The second phase involves counting the blood components in the blood.

Images of the patient's blood sample will be used as testing images. For more accurate results, it is recommended that the testing images be captured under the same conditions (lighting and camera settings) as the images used to train the model. The model would then run these images through its paces. Images with each RBC and the types of WBC identified would be the results of the testing. The classifier and regressor are fed these regions/feature maps as well as the ground truth boxes. The classifier compares the regions to ground truth boxes and classifies them as foreground or background. Only the labelled boxes in the foreground are fed to the regressor. The bounding box is generated by the regressor. To save time and data, the CNNs used in the model can be pretrained.

RELATED WORK OR LITERATURE SURVEY

[1] "Non-invasive modeling of heart rate and blood pressure from a photoplethysmography by using machine learning techniques"

Author: Govinda Rao Nidigattu † , Govardhan Mattela _ ,Sayan Jana †

Cardiovascular diseases(CVD) is one of the major causes of deaths in the world, which may damage the endothelium cells which may lead to atherosclerosis and cardiac arrhythmias. Blood pressure is an important parameter and indicator in cardiovascular disease, patients with CVD who have multiple risk factors such as hypertension, stress, and obesity have been increasing. Therefore, it is important in the field of cardiovascular disease prevention to predict those at risk of cardiovascular diseases in the general population

[2] Broadband IR-fingerprinting of human blood as a universal tool for diseases diagnostics

Author: **Cristina Leonardo**1,2**, Kosmas V. Kepesidis**2, **Birgit Linkohr**3**, Liudmila Voronina**1,2**, Marinus Huber**1,2**,**

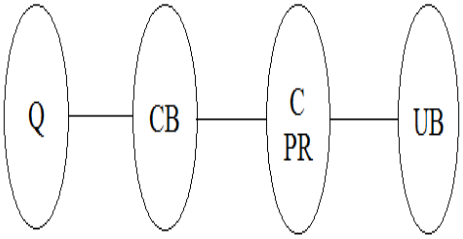
Many diseases cause characteristic changes in the molecular composition of biofluids such as human blood. Thus, a sufficiently sensitive and specific blood analysis could be used for disease detection. Particularly, physiological phenotypes (health as well as disease states) are reflected by minor changes in the concentration of several, possibly thousands, of different molecules in blood which cover a wide concentration dynamic range [1]. An approach that could thus quantitatively detect different molecular groups of blood simultaneously (such as e.g. proteins, metabolites, carbohydrates) would be generally very advantageous.

[3] Deep CNN with LM learning based myocardial ischemia detection in cardiac magnetic resonance images

Author: M. Muthulakshmi1 and G. Kavitha2*

Cardiovascular disease (CVD) is a chronic dysfunction caused by deterioration in cardiac physiology. It results in about 31% of mortality worldwide. Among CVDs, myocardial ischemia (MI) leads to restriction in blood supply to heart tissues. There is a need to develop an effective computer aided detection (CAD) system to reduce the fatality. In this work, an attempt is made to perform mass screening of myocardial ischemic subjects and left ventricle (LV) volum estimation from cardiac magnetic resonance (CMR) images using deep convolutional neural network (CNN) with Levenberg-Marquardt (LM) learning

MATHEMATICAL MODELING



Where,

Q = User entered input
CB = preprocess
C = feature selection
PR = preprocess request evaluation
UB = predict outcome

Set Theory

1) Let S be as system which input image

S = {In, P, Op, Φ}

2) Identify Input In as

In = {Q}

Where,

Q = User entered input image(dataset)

3) Identify Process P as

P = {CB, C, PR}

Where,

CB = Preprocess

C = feature selection

PR = Preprocess request evaluation

4) Identify Output Op as

Op = {UB}

Where,

UB = Predict outcome

Φ=Failures and Success conditions.

Failures:

1. Huge database can lead to more time consumption to get the information.
2. Hardware failure.
3. Software failure.

Success:

1. Search the required information from available in Datasets.
2. User gets result very fast according to their needs.

Space Complexity:

The space complexity depends on Presentation and visualization of discovered patterns. More the storage of data more is the space complexity.

Time Complexity:

Check No. of patterns available in the datasets= n

If (n>1) then retrieving of information can be time consuming. So the time complexity of this algorithm is O(n^n).

Above mathematical model is NP-Complete.

EXISTING SYSTEM AND DISADVANTAGES

In existing system there is no computerizes system to identified the blood disease. Firstly, it is only suitable for the instance-level approaches that require an instance classifier, As we mentioned

before, existing popular approaches of MLwith neural networks are treat separated instances as inputs, then use a deep neural network use for only two classes..

ADVANCED SYSTEM AND ADVANTAGES

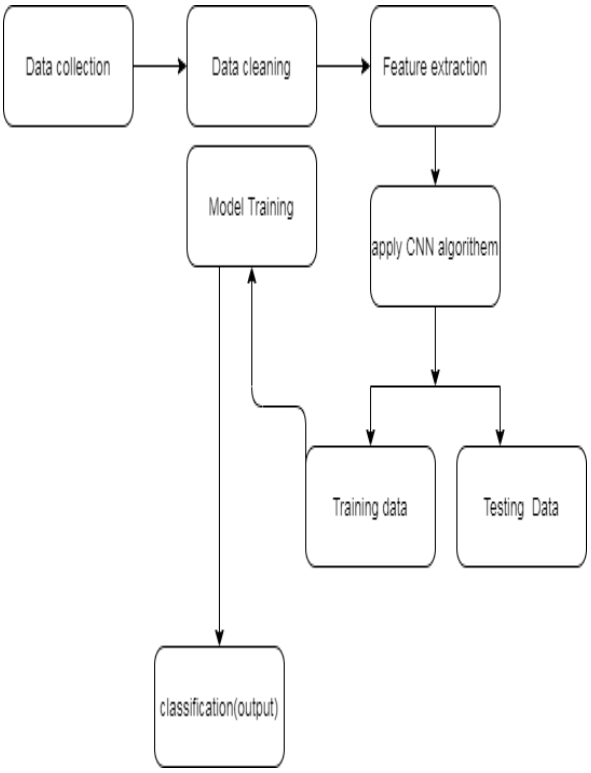


Figure: Advance System Architecture

Advantages:

1) Confirming those infected is essential to manage and contain the virus successfully. Without reliable testing, it would be hard to determine the actual rates of cases. Thus, it is vital to identify what these available tests can and can't do to use them appropriately.
2) Secure and efficient system.

CONCLUSION

In this project we studied essential technique for modeling the human process in many disciplines, especially in the medical field, because of the high availability of data.One of the essential disease detectors is the blood analysis; as it contains many parameters with different values that indicates definite proof for the existence of the disease.The machine learning algorithm

accuracy depends mainly on the quality of the dataset; for this reason, a high-quality dataset is collected and verified from experts. This dataset is used for training the classifiers for obtaining high accuracy. This work would be implemented in our final year project. Deep learning models can recognize disease-related blood images that are beyond current medical knowledge, resulting in higher diagnostic accuracy compared to traditional quantitative interpretations based on reference ranges for blood parameters. Adopting a image processing approach in blood cell images diagnosis could lead to a fundamental change in differential diagnosis and reduce the late detection of disease which may cause to death. We can expand the scope of this system to another type of disease.(covid-19 ,cancer , etc.) By expanding the learning algorithm, a deep learning model was proposed in this paper to diagnose diabetic peripheral neuropathy, hyperlipidemia, diabetes mellitus, and peripheral angiopathy. This paper investigated the performance of various models in diagnosing various diseases. In addition, this paper investigated the impact of various data quantification methods on model performance. Intelligent medical diagnosis requires an accurate and robust auxiliary diagnosis system based on medical text data. The goal of such intelligent medical diagnosis is to reduce clinicians' workload.

Furthermore, computer-assisted diagnosis lowers the risk of inter- and intra-observer variability. These systems have the potential to benefit patients by speeding up the medical diagnosis process. Because the method we propose does not artificially reduce raw data, new pathogenic factors may be discovered for clinical studies.

REFERENCES

[1] Choi, H., and Jin, K. H., Predicting cognitive decline with deep learning of brain metabolism and amyloid imaging, *BehaviouralBrain Research*, *344*, 103-109, 2018

[2] Wong, D., and Yip, S. , Machine learning classifies cancer, Nature, 555(7697), 446-447, 2018.

[3] Shahin, A. I., Guo, Y., Amin, K. M., and Sharawi, A. A., White blood cells identification system based on convolutional deep neural learning networks, Computer Methods & Programs in Biomedicine, 2017.

[4] Barbedo, J. G. A., Factors influencing the use of deep learning for plant disease recognition, Biosystems Engineering, 172, 84-91,2018.

[5] D. Hoover, V. Kouznetsova and M. Goldbaum, Locating blood vessels in retinal images by piecewise threshold probing of a matched filter response, in IEEE Transactions on Medical Imaging, vol. 19, no. 3, pp. 203-210, March, 2000.

[6] Rajendra Acharya, U. , Faust, O. , Adib Kadri, N. , Suri, J. S. , & Yu, W. . (2013). Automated identification of normal and diabetes heart rate signals using nonlinear measures. Computers in Biology and Medicine, 43(10), 1523-1529.

[7] Webb, S., Deep learning for biology. Nature, 2018. 554(7693): p. 555-557

[8] Taddeo, M. and L. Floridi, How AI Can Be a Force for Good. Science, 2018. 361(6404): p. 751-752.

[9] Faust, O. , Hagiwara, Y. , Hong, T. J. , Lih, O. S. , & Acharya, U. R. . (2018). Deep learning for healthcare applications based on physiological signals: a review. Computer Methods and Programs in Biomedicine, S0169260718301226.

[10] Camacho, D.M., et al., Next-Generation Machine Learning for Biological Networks. Cell, 2018. 173(7).

[11] Liang, Z., Liu, J., Ou, A., Zhang, H., Li, Z., and Huang, J. X.,Deep generative learning for automated EHR diagnosis of traditional chinese medicine, Computer Methods & Programs in Biomedicine, 2018.

[12] Kermany, D. S., Goldbaum, M., Cai, W., Valentim, C. C. S., Liang, H., and Baxter, S. L., et al., Identifying medical diagnoses and treatable diseases by image-based deep learning, Cell, 172(5), 1122–1131.e9, 2018.

[13] Coudray, N., et al., Classification and mutation prediction from non–small cell lung cancer histopathology images using deeplearning. Nature Medicine, 2018.

[14] Gers, F. A., Schmidhuber, J. A., and Cummins, F. A., Learning to forget: continual prediction with lstm. Neural Computation,12(10), 2451-2471, 2014.

[15] Cun, Y. L., Generalization and network design strategies, Connectionism in Perspective, 1989.

[16] Ahlawat, S., and Rishi, R., Off-line handwritten numeral recognition using hybrid feature set – a comparative analysis, Procedia Computer Science, 122, 1092-1099, 2017.

[17] Weiming Yang, Meirong Zhao, Yinguo Huang, Yelong Zheng.(2018). Adaptive Online Learning Based Robust Visual Tracking.IEEE Access, 6:14790-14798.

[18] Simard, P. Y., Steinkraus, D., and Platt, J. C., Best practices for convolutional neural networks applied to visual document analysis,International Conference on Document Analysis and Recognition (pp.958), IEEE Computer Society, 2003.

[19] Denicola, D. B., Advances in hematology analyzers, Topics in Companion Animal Medicine, 26(2), 52-61, 2011.

[20] Li, C., Ni, Z. M., Ye, L. X., Chen, J. W., Wang, Q., and Zhou,Y. K., Dose-response relationship between blood lead levels and hematological parameters in children from central china,Environmental Research, 164, 501, 2018.

[21] Kachekouche, Y., Dalisahi, M., Benmansour, D., and Dennounimedjati, N., Hematological profile associated with type 2 diabetes mellitus, Diabetes & Metabolic Syndrome, 2017.

[22] Letsky, E., Haematology of pregnancy, Medicine, 32(5), 42-45, 2004.

[23] Chen, H., Tan, C., Lin, Z., and Wu, T., The diagnostics of diabetes mellitus based on ensemble modeling and hair/urine element level analysis, Computers in Biology & Medicine, 50(4), 70-75, 2014.