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Analysis of IoT based Leukemia Detection Techniques

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Abstract

Acute lymphoblastic leukemia (ALL) is the most severe blood disease in both children and adults, affecting both simultaneously and in equal numbers. Using microscopy image processing software, you can perform image processing steps on microscopic images, such as improving the quality of images, segmenting them, or extracting characteristics from them. For image processing steps to be carried out on microscopic images, image processing software must be employed. The use of image-based detection does not necessitate the purchase of expensive laboratory equipment, in addition to being a quick and affordable method of detecting pathogens.

Keywords: IoT, Image processing, Leukemia, Disease.

Introduction

Image Processing is the kind of signal processing to change the way an image looks or how it behaves. There are a lot of applications for imaging where standard signal processing techniques are used. The image is assumed to be a two-dimensional signal by default. It takes time (or the z-axis) for 2D images to turn into a 3D signal. A picture can be changed in one of three ways: optically, digitally, or analogically. No matter how specific they are, the techniques in this article can be used in this situation. The process of getting images is called "imaging" (or, more specifically, the process of creating the input image in the first place). Computer graphics and computer vision are both important parts of image processing, but they don't work alone[1]. Most animated films use a camera to record real-world scenes. On the other hand, computer graphics images are made by hand from physical models of objects, environments, and lighting. Machine learning is used in computer vision to determine what is in an image or a group of images by looking at their structure (e.g., videos or 3D full-body magnetic resonance scans)[2]. Today, science and technology are becoming increasingly dependent on scientific visualizations (often of large-scale, complicated scientific or experimental data). There are two types of real-time data: microarray data that is used in genetic research and multi-asset portfolio trading in the financial

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sector [3]. Image processing is taking a picture and turning it into a digital file. Then, you can do things to it to make it better or get more information [4]. It can also be used to improve the look of an image, but it can also be used to get important information from it. A video frame or a picture is used as the input signal [5]. The output signal is a copy or a feature of the input signal, and it is the same thing as the input signal. Most of the time, images are processed as two-dimensional signals, and then they go through a number of well-known signal processing steps [6]. Technology that is one of the fastest-growing globally can be used for many business things. Image processing is an essential field of study.

Among those who are taking part in the study are engineers and computer science majors, among other things[7]. The first step is to take a picture, with an optical scanner or digital photography, you can put images on your computer. Among the techniques used for image analysis and manipulation are data compression and detecting patterns that the naked eye can't see.At the very end of the process, the output stage lets you change the image or report that was made by the image analysis software. Image processing techniques are used to make images from satellites and spacecraft look better and images from everyday life[8]. There have been a lot of changes in how images are processed over the last 50 years or so. It is being done with uncrewed spacecraft, space probes, and military inspection flights to try out these new things. As powerful computers, large memory devices, and graphics software become more common; more people are turning to image processing systems to meet their needs[9].It is used in various fields, from remote sensing to medical imaging to textiles to material science to military applications to film production to document processing to the visual and graphic arts. Images are processed by scanning, storing them in a file, enhancing them, and then figuring out what they mean. Image processing techniques can improve the quality of data (raw images) from sensors that are mounted on everyday things. Comparing this image to the original sensed image has better quality because more objects can be seen. Images need to be processed or shown in several ways. When you make an image, the pixels are put together in rows and columns. This is called the array or matrix of the image. Every time an eight-bit grey scale image is made, the intensity of every single thing change from 0 to 100-25. Grayscale implies that a grayscale image has more than just black and white pixels. Blood disorder is considered among the most dangerous of diseases that can lead to death. Many of these blood diseases are related to white blood cells such as Leukemia. Leukemia is an abnormal condition in the body because it produces excess white blood cells (leucocytes) in the bloodstream and spinal cord[10]. Therefore, these abnormal conditions will disrupt the production of other blood cells and disrupt the flow of blood into the vital organs. When the bone marrow produces an excessive number of abnormal white blood cells, this condition is referred to as leukemia[11]. Hematologists can detect leukemia in patients by performing a microscopic examination of their blood samples[12]. Patients with leukemia must be identified using methods such as microscopic color imaging, segmentation, and classification, as well as clustering. It will take several hours for hematologists to visually inspect the microscopic images, which is a time-consuming and physically demanding process that will take several hours[13].

Literature Survey

There is a strong emphasis on image segmentation in virtually all image processing techniques.

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Medical image segmentation is one of the most important of the many applications for image segmentation. With the wavelet transform, it is possible to segment medical images[14]. In the first step, the multi-scale wavelet transform algorithm was used to process the grey level histogram of the medical image[15]. As the performance was scaled down from the grand to the micro-scale, the grey threshold gradually emerged. To find out which method produced the most significant difference in results, we compared both traditional methods as well as wavelet transform methods[16]. As a result of the experimental findings, it was discovered that the last method outperforms the traditional method in image segmentation, and the validity and applicability of the findings were demonstrated[17]. Anatomical information and other exciting details from medical images can be extracted using automatic or semi-automatic image segmentation, which can aid in diagnosing patients[18].

Several image processing algorithms are described in this paper, all of which are applied to the problem of image segmentation[19]. The K-means cluster and the neural network based on pixel RGB space color are discussed in this section, similar to segmentation algorithms. It is common to practice using the K-means clustering algorithm to create homogeneous regions in images, which groups pixels in an image based on color and texture[20]. Biologically realistic models of the brain and nervous system are used to incorporate essential properties of the brain and nervous system into artificial, abstract models of different parts of the brain or nervous system[21]. These models are referred to as BNNs. BNNs. For various reasons, including segmentation, feature extraction, and object recognition, to name a few, artificial neural networks (ANNs) can be used to improve the quality of photographs. Image segmentation, which is the most critical of these, is required for high-level processing such as object recognition[22]. The K-means algorithm can produce faulty segmented pixels, whereas neural network techniques can improve performance while leaving some errors in the segmented pixels.

Medical image processing is a rapidly expanding and challenging field to work in right now. Medical imaging techniques can be used to diagnose a variety of medical conditions[23]. A malignant tumor of the brain, which can be fatal, has no known treatment or prevention. The detection of a brain tumor is accomplished through the use of image processing techniques in four stages. When it comes to detecting and classifying brain tumors, MRI images can be enhanced by incorporating image processing and neural network techniques[24]. This survey, which focuses on detecting brain tumors using magnetic resonance imaging, examines a variety of image processing techniques to achieve this goal. Several journal articles and book chapters on image processing techniques have been published in peer-reviewed journals, and several more are in preparation.

Various image processing software programs are being developed to extract useful information from medical photographs to improve patient diagnosis and treatment. As a result of their microscopic studies of human blood, hematologists have developed methods such as microscope color imaging and segmentation, classification, and clustering, which can be used to identify patients with leukemia and other blood cancers. Because of the nonspecific nature of the disease's symptoms, doctors frequently make incorrect diagnoses of ALL. Manual blood cell classification is also time-consuming and prone to error because blast cells are difficult to

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classify[25]. As a result, blood cells must be identified as quickly, precisely, and automatically as possible. The segmentation of white blood cells (WBCs) can be improved by employing an automatic Otsu's threshold blood cell segmentation method and image enhancement and arithmetic, among other techniques. When attempting to distinguish blast cells from normal lymphocyte cells in this study, the KNN classifier was employed.Use a variable threshold instead of a fixed threshold when segmenting an image with a textured or rough background[26]. In this paper, we present a new adaptive thresholding method that makes use of KFCM to achieve better performance. One parameter selection is sufficient to discover the adaptive threshold surface from the original image in an automated manner[27]. The ability to change the thresholds on a dynamic basis The fuzzy membership values for each pixel are computed by the KFCM algorithm, which makes use of adaptive tracking and morphological filtering. Our method performs admirably when it comes to detecting both large and small images simultaneously. There are methods for detecting low-contrast images that are both effective at denying and amplifying responses, and these methods are described in detail below. The algorithm's efficiency and accuracy were demonstrated in experiments using magnetic resonance imaging (MRI) brain images [28].

The CNN and the RNN are two distinct branches in the current system. CNN: To begin, we set the previously trained model to a frozen state. In order to combine the features discovered, the data is fed into an RNN model, which extracts and saves the features discovered. While the RNN is being trained, the weight parameters of the RNN are being updated on a regular basis. In addition, all network layers and models, including CNN and RNN, use training data as input to train their models. Experiment with different window sizes and weights in the CNN model to obtain a diverse set of feature maps. In this example, the models RNN and CNN are combined to make sense for each of the models involved. The results of the classification are then displayed with the assistance of Softmax. In order to generate classification results, the CNN-RNN framework is retrained with the assistance of fine-tuning. For the first time, the classification of blood cells has been improved by combining CNN and RNN models. By taking advantage of the temporal and spatial characteristics of information, this model is able to classify objects better [28].

Convolutional neural networks (CNNs) have been proposed as a potential solution to a variety of issues. This is the case because biotechnology has progressed. We are able to comprehend an image that spans the entire field of view as a result of the organisation of brain cells [29].Convolution neural networks (CNNs) can be used to extract both local and deep features from an image. RNNs are a type of neural network that can process data in a specific order, and they are used in machine learning. Each layer of a neural network is connected to the layer above it in a direct manner. The nodes between layers are also linked, starting with the input layer and progressing through the hidden layer. This type of network model makes it impossible to process data that arrives sequentially. The most effective approach is using both CNN and RNN frameworks to classify blood cell images[30]. The method, which is divided into sections, includes both training and testing. We used the Image Net dataset to train our CNN model during the training phase. We used data pre-processing techniques to improve the accuracy of the blood cell dataset when we were processing it. The following step will involve the transfer of

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knowledge. This method can be used to start a new network by utilizing an existing network. At this point in time, all layers of the CNN model are frozen in place. As a result, the RNN model is developed and tested. After the CNN-RNN models have been thawed, the training process can begin. In order to accomplish this, the mechanisms of neural network attention are employed. These mechanisms combine features from CNNs and RNNs in order to improve performance. During the testing phase, the pre-processed test images are fed into the CNN-RNN model, which has been fine-tuned. The classification results are obtained by employing the Softmax layer. These are shown on the screen[31].

It is critical to increase the dataset's size to improve the model's accuracy and avoid overfitting. Matrix transformations are required in order to increase the number of images available for processing. A rotating matrix image of a blood cell can be seen on the screen. If cell images are rotated, their high-frequency content may be reduced, which will cause the images to appear shaky[32]. This should not affect the abnormality or normality of the vast majority of cells. To be clear, this is critical to the success of our method. This step has been shown to increase the accuracy of cell image classification[33][34].

In spite of its high performance, our method has several drawbacks that may make it challenging to apply in clinical settings.[36] For a single cell image classification, approximately 3.8 seconds are required, which is far too long for clinical applications. If the performance of computer hardware is increased, or if the network structure is further optimized and data storage capacity is reduced, this problem can be resolved.[35,37]

Conclusion

The researchers used deep learning, image processing, and machine learning to understand the detection of leukemia cancer. We discovered that combining deep learning and image processing could speed up the analysis of leukemia samples while also reducing the likelihood of causing further harm to cancer patients. When witnesses' lives and health are in danger, images processed through image processing can assist in overcoming the subjectivity of a microscopist. Researchers could classify ALL cells according to their subtype rather than simply distinguishing between cancerous and non-cancerous cells. Examples of subtypes would include the l1, l2, and l3 cancers. Trying different algorithms to see if any user can improve results should be considered. Depending on how many clusters are selected automatically, it may be necessary to conduct additional research.

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