Detection of the Acute Myeloid Leukemia cells in the images of white blood cells

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Abstract: Leukemia is a cancer of white blood cells that affects blood forming cells in the body. Acute myeloid leukemia (AML) is a form of leukemia and are caused by replacement of normal bone marrows with leukemic cells, which cause a drop in red blood cells, platelets, and normal white blood cells. Early classification of the subtype of AML cells is necessary for proper treatment management. In this study, to increase the accuracy of classification, we develop an automate method for the detection and classification leukemia cells from the blood cells images that are captured as microscope images. In contrast to other methods that focus on identifying the nuclei, we proposed a method based on the color conversion to identify both the nuclei and the cytoplasm. This is useful for classification stage. We test our method on 320 images. The accuracy of both nuclei and cytoplasm detection is 73%.

Keyword: Acute myeloid leukemia (AML), Leukemia

1. Introduction

In recent decades, image processing is applied to many applications of life. In particular, imaging applications are emerging as a new opportunity for innovation at the meeting point between medicine and computer science. By the help of image processing, we can extract many useful information from medical images in order to assist and improve patient diagnosis especially in the cancer area. Currently, with a blood cell image of leukemia patient, the process of detection and classification depends on human look and it takes up to a few days.

2. Related work

From the images of blood smear microscope slides, the researchers have to detect and locate the AML cells. The image segmentation algorithms were used to solve this problem. In [1], the pixel-based segmentation via bi-modal thresholding was presented. M.D. Joshi, et al., proposed automatic Otsu's threshold blood cell segmentation method along with image enhancement and arithmetic [2]. Both of above approach are used for segmentation ALL cells, which belong to Acute Leukemia type. For the AML cells, follow by W. Ismail, [3], the combination of Cellular Automata and Heuristic Search was applied.

3. Proposed method

Other methods aim first to identify the nuclei of AML cells, which are more prominent than other components. In this study, we proposed a method for both the nuclei and cytoplasm detection based on the color conversion and the improvement of threshold technique. There are 4 steps in detection stage: preprocessing, segmentation, separation and cropping. In the preprocessing step, the color space of input image is RGB space. In this step, we convert the RGB color space to CYMK space. In fact, AML cells are more contrasted in the Y component of CMYK color model because the yellow color is present in all elements of the image, except AML cells. As you can see in the Y component image, the contrast between AML cells and another is clearly. With this conversion, we can segment easily the AML cells from the input image. Then, an improvement of threshold method based on the location of nuclei and cytoplasm, we can segment the AML cells from another component. After that, we have a binary images, which are result of segmentation step. There are many hold inside the object and we have to fill these hole. In this study, we focus on classifying the AML cells, so we have to separate the connected cell. This step will help us extract the features more effectively. After use watershed algorithm, we have the cutting line between the connected cells. Finally, we will remove some noises by a filter and get the single AML cells.

4. Conclusion

In this study, we propose an automated method for the nuclei and cytoplasm detection in blood smear images. By using the color conversion method and the improvement of threshold, the accuracy of detection stage is increase. In future work, the result of this study can be used as the basis for extracting the features from AML cells and classifying the subtypes of AML cells.

References

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