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AN ITERATIVE BASED NOVEL MULTI-NUCLEUS DETECTION SCHEME FOR PROTOZOAN PARASITE MICROSCOPIC IMAGES

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Abstract. *Protozoan parasites cause many diseases, such as malaria, EHEC infection, shigellosis, amoebiasis, etc. Different kinds and growing stages of protozoan parasites would lead to different treatments. The most significant characteristic of different growing stages is the number of nuclei. But some nuclei in a cell could be unclear causing the missing in nucleus detection.Common and traditional segmentation methods can not be used to obtain satisfied results directly. This paper presents a novel multi-nucleus detection scheme which is composed from adaptive protozoan parasite boundary erasure, iterative gamma equalization, two-means clustering algorithm, modified connected component detection method, and circle mask scoring method. Except the two-means clustering algorithm, all other parts are modified methods or new methods designed for nucleus extraction. Experiments show that the proposed scheme can detect the nuclei with indistinct boundaries effectively and can obtain better results than other commonly used image segmentation methods.*

Keywords: Protozoan parasites, Microscope images, Nucleus detection, Gamma equalization, Boundary erasure, Connected component, Circular masks

1. **Introduction.** In the natural world, protozoans are classified into about 65,000 species In those species, about 10,000 species are protozoan parasites. About 40 species of them are found as human parasites [15]. Most protozoan parasites exist in lumens, body fluid, tissues or cells of human and can be classified into pathogenic and nonpathogenic protozoan parasites [18]. There are many intestinal infections parasitic diseases [31, 24, 23]. In recent years, digital medical image processing techniques [5, 12, 1, 30] and systems are gradually applied to assist doctors and pathologists to diagnose and analyze more efficiently and accurately by computers. General medical imaging techniques include: computerized tomography (CT) [2], magnetic resonance imaging (MRI) [11], ultrasound imaging [16], and electron microscopic imaging, etc [10]. Also, the electron microscopic imaging techniques are used to observe protozoan parasites, blood cells, tumor cells and so on.

Cell segmentation procedures are performed before cell recognition procedures to extract the sharps and regions of cells from cell images which contain background or other objects. The most common segmentation research issues include the segmentation of red and white blood cells, tumor cells and other tissue cells of human. Common image segmentation techniques include Sobel edge detection [6], Canny edge detection [4], gradient vector flow for snake (GVF-snake) [29], k-means clustering [17], support vector machine (SVM) [27], watersheds algorithm [26], fuzzy c-means clustering [3], and artificial neural network (ANN) [20, 7], etc. For cell segmentation, N. Gao et al. [10] proposed a multispectral imaging technique to segment white blood cell. They obtained multiple