研究計画提案書 (どちらかを○で囲む：修士論文 / 課題研究)(修士) 平成 27 年 10 月 30 日

Research Proposal for Master's Thesis / Research Project (Circle one)

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＜現在の単位修得状況＞ IS courses I have obtained credits

	導入講義科目 Introductory courses	基幹講義科目 Basic courses	専門講義科目 Technical courses	コース専門講義科目 Specialized Technical courses	先端講義科目 Advanced courses	その他 Other courses
科目数 Number of courses		7	2			
単位数 Number of credits		14	4			

＜研究テーマ＞ Research Title

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

＜研究の目的＞ Research Aim

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. The goal of this study is the development of an automate method for the detection and classification leukemia cells from the blood cells images that are captured as microscope images. It is a vital step in providing the correct form of treatment. Therefore, the diagnostic process is reduced in terms of its time span from a few days to a matter of a few hours and the cost of all processes.

＜研究の背景・特色・重要性＞ Research Background, Originality, Significance

Leukemia is a cancer of white blood cells, where the disease basically develops in the bone marrow, which is the spongy tissue that fills the inside region of the bones. There are four major different forms or types of leukemia, which develop in cancer patients according to the growth speed and the improper overproduction of leukemia cells: acute lymphocytic leukemia (ALL), acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL), chronic myeloid leukemia (CML) [1]. This research will focus on AML type. In AML the bone marrow makes large numbers of abnormal immature white blood cells. The immature cells are called as blast cells.

The recognition of the blast cells in the bone marrow of the patients suffering from myeloid leukemia is a very important step. It is followed by categorizing into subtypes which will allow the proper treatment of the patients. In 1971, the diagnosis of leukemia cells was based on the morphology [2]. The whole process is currently manual in nature and thus is time consuming and exhausting. Nowadays, there are several research groups focusing on the development of image processing application for medical images that collaborates with the clinicians.

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 [3], 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 [4]. Both of above approach are used for segmentation ALL cells, which belong to Acute Leukemia type. For the AML cells, follow by W. Ismail, [5], the combination of Cellular Automata and Heuristic Search was applied. Although there are a few methods

（＜研究の背景・特色・重要性＞のつづき Continued from previous page）

was proposed, however, there are also some problems that need to solve such as the overlapping of blood cells, the noise of images, etc. Based on the results of the detection process, the classification process identify the sub-types of AML cells. Subtypes of AML can be classified M0 to M7 according to French-American-British (FAB) classification. The blast cell of these subtypes are different in size, shape, an amount of cytoplasm, shape and number of nucleus and the constituent in the cytoplasm. Especially, it is necessary to identify a subtype M3 (acute promyelocytic leukemia) with others because the treatment is different between subtypes. In this process, the features which extracted from leukemia cells have a big effect on the accuracy of classification. W. Ismail, et al. [6] performed feature extraction based on mean, median, variance, high and low for RGB that consists of 15 attributes. Then, the neural network was used to learn and classify. The big challenge of this process is the similar of leukemia cells, so we need a suitable extraction method and machine learning algorithm to increase the accuracy of the classification process.

References:

[1] C. Haworth, A. Heppleston, M. Jones, et al., Routine bone inarrow examination in the management of acute lymphoblastic leukeamia of childhood, J Clin Pathol, 1981.

[2] R., Hassan, Diagnosis and outcome of patients with Acute Leukemia, In: Haemotology department, University Sains Malaysia, Malaysia, 1996.

[3] A. Khashman, E. Al-Zgoul, Image Segmentation of Blood Cells in Leukemia Patients, CEA, 2010.

[4] M. D. Joshi, A. H. Karode, S.R. Suralkar, White Blood Cells Segmentation and Classification to Detect Acute Leukemia, IJETTCS, 2013.

[5] W. Ismail, R. Hassan, et al., Detecting Leukaemia (AML) Blood Cells Using Cellular Automata and Heuristic Search, IDA, 2010.

[6] W. Ismail, R. Hassan, et al., The Classification of Blast cells from Acute Promyelocytic Leukaemia (AML M3) blood samples using Neural Networks for clinical decision support, CIDA, 2011.

＜研究計画・方法＞ Research Plan, Method

Plan and methods

- Milestone 1: Related work (1 months, November)
  - Survey about the segmentation and classification methods.
  - Overview almost methods and algorithms in the last few years that used in leukemia cells images
- Milestone 2: Proposed Segmentation method (3 months, December - February)
  - Based on the difference in the color between the leukemia cells and the normal white blood cells, a new method, which use the color histogram and a threshold is applied to detect and locate the leukemia cells on the images. Additional, the graph cut optimization algorithm is also proposed to reduce the noise and divide some overlap leukemia cells.
- Milestone 3: Classification (4 months, March - June)
  - Firstly, we need to extract the features according to the color, the shape, the size, the attribute, etc. of each leukemia cells. Next, these features are put in a vector and use them for training and classifying. In this study, we classify subtypes of AML cells include M1, M2, M3, M5. A benchmark for almost machine learning algorithms is built to evaluate them. After that, we will choose an suitable algorithm for this study.
- Milestone 4: Evaluation (2 months, July - August)
  - Build ground truth for existing dataset.
  - Test the result of proposed methods and improve it.
- Milestone 5: Writing thesis (1 months, September)

Timeline