

College of Engineering Chengannur
Department of Computer Engineering
M. Tech. Computer Science (Image Processing)
03CS6901 Seminar I
Abstract of Proposed Seminar Topic
Deepnet for Detecting Analyzable Metaphases

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Abstract

Metaphase is the stage in mitotic cell division where chromosomes are clearly visible, which makes them more suitable for visual analysis. Usually, cytogenetic experts use Giemsa banded (G banded) microscopic metaphase images for chromosome analysis. The intention of cytogenetic experts is to karyotype metaphases for identifying both numerical and structural chromosome abnormalities. Studies reveal that these abnormalities lead to genetic disorders or even cancers. G banded metaphases are prepared through a labour intensive laboratory procedure. In the standard cytogenetic procedure for getting metaphase images slides prepared from the samples may contain 100 to 1000 metaphases based on the pellete count. All these metaphases may not be analyzable and the slide contain not only the metaphases but also nuclei, interphase cells and other debris. Therefore, experts generally, scan the slides through microscope in 10x magnification to detect metaphases. Images are captured in 100x through microscopic camera. These images are analyzed individually by experts to detect and select only 20 to 30 analyzable metaphases for karyotyping in order to confirm the diagnosis. The objective of karyotyping is to segment each and every chromosomes in the metaphase and to classify these chromosomes into 24 classes based on length, centromere position, banding patterns and other features.

Usually, the very first stage of fully automated karyotyping system is to detect the metaphases and to classify the metaphase into analyzable and unanalyzable. Generally, experts label the metaphases as analyzable only when it has prominent band information for most of chromosomes, enough spread among them and good chromosome morphology. Many challenges have been faced by researchers for designing a fully automated system. One among them is the detection of analyzable metaphases, which are the input to the system. Conventional machine learning as well as deep learning techniques were adopted by researchers to classify the analyzable and unanalyzable metaphases. Here as well, a Convolutional Neural Network(CNN) is proposed to efficiently detect analyzable metaphases. It is found that the testing accuracy of the classifier is 85% even though the dataset is scarce.

References

- [1] "Deepnet for Detecting Analyzable Metaphases " R S Remya, S Hariharan, M. Sooraj, V Keerthi, Abhijith S. Raj, C Gopakumar 2020 Advanced Computing Communication Technologies for High Performance Applications (ACCTHPA).
- [2] H. Yilmaz and M. Kamil Turan, FahamecV1:A Low Cost Automated Metaphase Detection System," Eng. Technol. Appl. Sci. Res., vol. 7, no. 6, pp. 2160-2166, Dec. 2017.
- [3] Tanvi Arora and Renu Dhir, "An automatic human chromosome metaspread image selection technique," Knowledge and Information Systems, Volume 52, Pages 773-790, 2017.