Chapter 22
Prediction of Cancer Blood Disorder Using Adaptive Otsu Threshold and Deep Convolutional Neural Networks

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ABSTRACT

Cancer blood disorder affects blood cell formation and function. Blood disorders may affect platelets, plasma, and white and red blood cells. The goal of this study is to identify blood problems with cancer. In this study, cancer and blood problem images are enhanced and filtered. Remove noise from photos using image filtering. The authors recommended an adaptive anisotropic diffusion filter (2D AADF) for noise reduction. Image enhancement improves clarity. Enhancement uses de-noised photos. The authors propose picture improvement using adaptive mean adjustment (AMA). Real-time data was used for picture preprocessing. The proposed filtering approach is the most effective compared to 2D AADF, 2D adaptive log color filter, and 2D frequency domain filter. The suggested image improvement algorithm performed best compared to contrast limited adaptive histogram equalization, adaptive otsu threshold, image coherence improvement, and 2D adaptive mean adjustment.

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INTRODUCTION

A flaw in cellular development and behavior causes cancer. In healthy people, old, dying white blood cells are replaced every so often (Condition Topics, 2022). Abnormal white blood cell production in the bone marrow causes blood malignancies (Singh et al., 2011). Extreme fatigue, weight loss, nighttime chills, and enlarged lymph nodes might indicate blood malignancy. Blood cancer affects blood cells (Schumaker et al., 2021a). Leukemia, lymphoma, and myeloma are common blood cancers (Blood Cancer, 2021). Changes in blood cell DNA cause cancer. Abnormal blood cell behavior ensues. Certain blood cancers afflict children. Children and adults may have different symptoms and treatments. Leukemia, a blood malignancy, kills almost 0.3 million people per year (Gupta et al., 2022). B-Lineage C-NMC, a microscopic image collection of approximately 15000 high-resolution cancer cell pictures, was created from B-ALL (Schumaker et al., 2021b). This collection includes malignant and non-cancerous patient photos (Rafi et al., 2022). Early identification of life-threatening disorders, including leukemia and blood cancer, relies on microscopic inspection of blood cells (Das et al., 2022).

The biggest challenge in medical image processing is capturing the picture without losing data (Mohana Dhas & Suresh Singh, 2022). Noise or other components may harm picture data during acquisition or processing. Since medical pictures have low contrast and make it hard for professionals to locate illnesses, this noise affects image quality (Rafi et al., 2019). Medical imaging equipment needs image denoising. Medical imaging is used for computer-aided diagnosis (CAD), especially for cancer (Mohammed & Abdulla, 2021). Autonomous CAD systems aim to extract specific diseases more precisely and cheaply than current approaches. These methods can also detect breast, lung, skin, and blood malignancies via medical imaging (Senthil Kumar et al., 2019). A hybrid median filter enhances the median filter by removing impulse noise and maintaining picture corners (Karapinar Şentürk & Uzun, 2022). Due to their poor signal-to-noise ratio, they divide picture edges, produce spurious noise edges, and cannot decrease medium-tailed (Gaussian) noise distributions (Rafi et al., 2020).

Image processing is prevalent and growing quickly, making it a promising research subject. Picture processing converts a physical picture into a computer file that may be used for information extraction or image improvement (Sharma & Parveen, 2021). Image filtering alters size, shape, color, and smoothness. It shapes picture pixels using a graphic design and editing application (Dodvad et al., 2012). Image filtering is essential to image processing. It can identify edges, blur, reduce noise, etc. Linear filters are most popular since they're fast and simple. Unlike non-linear filters, linear filters apply the method to both the input and surrounding pixels. Image filtering improves pixel quality (Sun et al., 2019). It involves blurring and smoothing picture pixels. When it includes analog image improvement, this procedure is called "photo retouching," whether the image is photochemical, digital, or an illustration. Raptor and vector graphic editors, three-dimensional modelers, and others are also used. These programs are the primary technique to alter a photo.

Over the last few years, researchers have proposed various filtering methods and strategies to aid in detecting blood cancer. There have been several efforts to detect cancer blood disorders using image filtering and enhancement methods. As a best result, we suggest new methods for detecting cancer blood disorders in our study. This paper has two main additions as follows:

- A novel image filtering algorithm for Adaptive Anisotropic Diffusion Filter (2D AADF).
- A novel image enhancement algorithm for Adaptive Mean Adjustment.