Integrated Platform for Bio-Image Processing and Identification of Cervical Cancer

Larisa-Dalina LAZĂR*, Diogen BABUC, and Todor IVAŞCU

Computer Science Department, West University of Timişoara, Vasile Pârvan Blvd., no. 4, 300223 Timişoara, Romania.
E-mails: larisa.lazar02@e-uvt.ro; diogen.babuc@e-uvt.ro; todor.ivascu@e-uvt.ro

* Author to whom correspondence should be addressed;

Abstract
Cervical cancer is a major global health issue, ranking among the leading causes of death in women. Early detection is essential in reducing mortality rates, but traditional diagnostic methods, such as manual examination of cytological and histological images, are time-consuming and prone to human error. To address these limitations, our study presents a comprehensive platform for bio-image processing and early diagnosis of cervical cancer, employing advanced machine learning and deep learning techniques. The proposed methodology consists of several stages, starting with the preprocessing of medical images, including normalization, augmentation, and noise reduction. Following this, the cervical cells are segmented and classified using a combination of machine learning algorithms, such as shallow machine learning models and Convolutional Neural Networks (CNN). We selected publicly available datasets, including Herlev and SIPaKMeD, to evaluate the performance of the proposed models, which are a very respectful base in the state-of-the-art analysis. Considering convex models and papers, CNN showed the best results on augmented cervical cells data. In comparison, traditional machine learning algorithms, concretely K-Nearest Neighbors and Naive Bayes, produced lower results, emphasizing the advantages of deep learning models in medical image analysis. The integration of artificial intelligence in medical imaging can contribute to early detection and contribute to reduction of mortality rates associated with this disease. A future direction is to explore the applications of Vision Transformers, which have demonstrated excellent performance in capturing complex patterns in image data, to further improve data preprocessing and classification accuracy.

Keywords: Cervical Cancer; Artificial Intelligence (AI) Enhancement; Bio-Image Processing; Deep Learning; Automated Results.