

Title: CerviXpert: A multi-structural convolutional neural network for predicting cervix type and cervical cell abnormalities

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Abstract: Objectives: Cervical cancer, a leading cause of cancer-related deaths among women globally, has a significantly higher survival rate when diagnosed early. Traditional diagnostic methods like Pap smears and cervical biopsies rely heavily on the skills of cytologists, making the process prone to errors. This study aims to develop CerviXpert, a multi-structural convolutional neural network designed to classify cervix types and detect cervical cell abnormalities efficiently.

Methods: We introduced CerviXpert, a computationally efficient convolutional neural network model that classifies cervical cancer using images from the publicly available SiPaKMeD dataset. Our approach emphasizes simplicity, using a limited number of convolutional layers followed by max-pooling and dense layers, trained from scratch. We compared CerviXpert's performance against other state-of-the-art convolutional neural network models, including ResNet50, VGG16, MobileNetV2, and InceptionV3, evaluating them on accuracy, computational efficiency, and robustness using five-fold cross-validation.

Results: CerviXpert achieved an accuracy of 98.04% in classifying cervical cell abnormalities into three classes (normal, abnormal, and benign) and 98.60% for five-class cervix type classification, outperforming MobileNetV2 and InceptionV3 in both accuracy and computational demands. It demonstrated comparable results to ResNet50 and VGG16, with significantly reduced computational complexity and resource usage.

Conclusion: CerviXpert offers a promising solution for efficient cervical cancer screening and diagnosis, striking a balance between accuracy and computational feasibility. Its streamlined architecture makes it suitable for deployment in resource-constrained environments, potentially improving early detection and management of cervical cancer.

Key words: Cervical cancer; cervix cell types; computer-aided diagnostics; diagnostic cytology; multi-structural convolutional neural network.

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