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CLASSIFICATION OF CELL BIOMATERIAL INTERACTION TOXICITY LEVEL USING CONVOLUTIONAL NEURAL NETWORKS

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Summary: The medical image analysis field is highly dependent on good quality research time offering a noninvasive analysis and diagnosis of a medical problem. The most recent research credits the developments of different machine learning techniques for higher accuracy compared to traditional methods when analyzing more complex problems. Lots of research is being done towards the interactivity of the cells with different biomaterials, in order to provide an automatic model to determine the toxicity level. In this research, we will focus on different classification techniques using a convolutional neural network (CNN) of cells residing in different biomaterials. The problem is studied as multiclass classification: healthy, unhealthy, and severely disintegrated. The images are taken using a brightfield microscope, hence several image preprocessing techniques are applied to achieve high accuracy levels of predictions. The dataset used in this study includes approximately 20000 images for training and two different datasets with each more than 8000 images of size 128x128 pixels. LeNet architecture is used to analyze and classify the images. The network has four convolutional layers with kernels of size 5x5 applied, followed by max-pooling layers with the purpose of decreasing the number of weights. Without the preprocessing steps, the highest accuracy reached was 95%, whereas using several image preprocessing techniques increased the accuracy significantly. The highest resulting accuracy after preprocessing only the healthy part of the dataset with the Sobel filter was that of 99%.