ABSTRACT

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Cancer diagnosis is usually an arduous task for medicine, specially when it comes to pulmonary cancer, one of the most deadly and hard to treat types of that terrible disease. Traditional lung cancer detection starts with a visual inspection, done by medical specialists on tomography scans. For this reason, detecting pulmonary cancerous nodules in early stages is a much harder problem. However, it is definetely worth trying, as it drastically increases surviving chances. To help improving cancer detection and surviving rates, engineers and scientist have been developing computer-aided diagnosis systems, also called CAD systems.This work uses computational intelligence techniques to suggest a new approach towards solving the problem of detecting pulmonary carcinogenic nodules in computed tomography scans. The technology applied consists in using Deep Learning and Swarm Intelligence to develop different nodule classification models. In total, 14 different Swarm Intelligence algorithms and a Convolutional Neural Networks for biomedical image segmentation called “U-Net” were used to find cancerous pulmonary nodules in the Lung Image Database Consortium and Image Database Resource Initiative (LIDC-IDRI) databases. The main goal of this work is to utilize Swarm algorithms to train Convolutional Neural Networks models via Transfer Learning, and check whether this method is more efficient than the regular training algorithms, such as Backpropagation and Gradient Descent.The models developed in this work managed to reach significantly high performances, producing results compatible with the current state-of-art models for lung cancer detection applications. With the experiments conducted in this work, it was possible to verify the real effectiveness of using Swarm Intelligence algorithms to train Deep Leaning models and to state their superiority over the Backpropagation models for this application. From the 14 tested swarm algorithms, 7 performed better than backpropagation, reaching up to 93.78% in accuracy, 93.59% in precision, 93.04% in sensitivity, 98.56% specificity and operating up to 25% faster.

Keywords: Lung Cancer; Deep Learning; Swarm Intelligence; Computer Aided Diagnosis Systems.