A new multi-objective hyperparameter optimization algorithm for COVID-19 detection from x-ray images

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Abstract

The coronavirus occurred in Wuhan (China) first and it was declared a global pandemic. To detect coronavirus X-ray images can be used. Convolutional neural networks (CNNs) are used commonly to detect illness from images. There can be lots of different alternative deep CNN models or architectures. To find the best architecture, hyper-parameter optimization can be used. In this study, the problem is modeled as a multi-objective optimization (MOO) problem. Objective functions are multi-class cross entropy, error ratio, and complexity of the CNN network. For the best solutions to the objective functions, multi-objective hyper-parameter optimization is made by NSGA-III, NSGA-II, R-NSGA-II, SMS-EMOA, MOEA/D, and proposed Swarm Genetic Algorithms (SGA). SGA is a swarm-based algorithm with a cross-over process. All six algorithms are run and give Pareto optimal solution sets. When the figures obtained from the algorithms are analyzed and algorithm hypervolume values are compared, SGA outperforms the NSGA-III, NSGA-II, R-NSGA-II, SMS-EMOA, and MOEA/D algorithms. It can be concluded that SGA is better than others for multi-objective hyper-parameter optimization algorithms for COVID-19 detection from X-ray images. Also, a sensitivity analysis has been made to understand the effect of the number of the parameters of CNN on model success.

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