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Combining multi-objective genetic algorithm and neural network dynamically for the complex optimization problems in accelerator physics

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Neural network (NN) has been tentatively combined into multi-objective genetic algorithms (MOGAs) to solve the optimization problems in physics. However, the computationally complex physical evaluations and limited computing resources always cause the unsatisfied size of training set, which further result in the combined algorithms handling strict constraints ineffectively. Here, the dynamically used NN-based MOGA (DNMOGA) is proposed for the first time, which includes dynamically redistributing the number of evaluated individuals to different operators as well as some other improvements to handle constraint and preference of objectives. Radio frequency cavity is designed by this algorithm as an example, in which four objectives and an equality constraint (a sort of strict constraint) are considered simultaneously. As a result, DNMOGA considerably improves both the number and competitiveness of the final feasible individuals, and shows the potential to completely replace the manual procession in this question. In general, DNMOGA is instructive for dealing with the complex situations of strict constraints and preference in multi-objective optimization problems in accelerator physics.
(The corresponding paper has been accepted).

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Footnotes

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Yes

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