A two population evolutionary framework for handling NAS problems

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I. Description

In this report, we have exploited a two population evolutionary framework for handling NAS problems, named CMOSMA_NCHU. The flow-chart of CMOSMA_NCHU is shown in Fig. 1, whose basic framework is similar to CMOSMA [1] (reproduction and iteration). In CMOSMA_NCHU, we simultaneously maintain two collaborative and complementary populations. Specifically, FP is mainly responsible for promoting the diversity of population. Therefore, CMOSMA_NCHU adopts the environmental selection strategy of NSGA-II [2] to select the solutions for the next generation. Different from FP, AP is a complement, which is used to assist in exploring the areas that have not been exploited by the FP. We use the convergence update strategy of Two_Arch2 [3] as the selection principle for FP to improve the convergence on NAS problems. As shown in Fig. 1, the proposed CMOSMA_NCHU begins with the random initialization of two populations FP and AP with size N. Then, two SOMs are initialized. During the initialization of SOM1, we assign each neuron weight vector a randomly chosen training point from FP. As for SOM2, the same initialization strategy is adopted. In the reproduction phase, two mating pools are selected from FP and AP by the mating selection strategy, respectively. Afterwards, each of the mating pools is used to generate an offspring population by the reproduction operators. Then, both FP and AP are combined with the offspring populations, and further truncated by the environmental selection strategy. In this way, useful information is shared between the two populations. Next, the SOM update strategy is used to iteratively update weight vectors. The above steps are repeated until a termination condition is met. Finally, the FP is reported as the final output.

II. Experimental result

All experiments in this report are implemented in the PlatEMO4.1, Pymoo 0.6.0.1 and EvoXBench 1.0.3. Table I presents the HV values obtained by CMOSMA_NCHU on C10MOP and IN1KMOP test suites. And Table II presents

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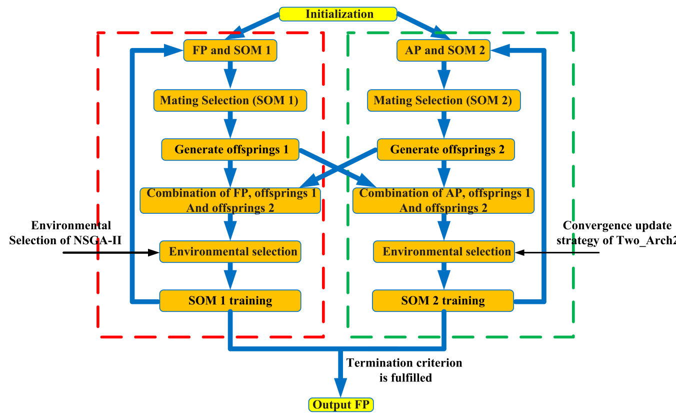

Fig. 1. Flow chart of CMOSMA_NCHU.

TABLE I
HV VALUES OBTAINED BY CMOSMA_NCHU ON C10MOP AND IN1KMOP

Problem	M	D	CMOSMA_NCHU
C10MOP1	2	26	9.4340e-1 (7.05e-3)
C10MOP2	3	26	9.1788e-1 (2.72e-3)
C10MOP3	3	5	8.2726e-1 (3.56e-3)
C10MOP4	4	5	7.7810e-1 (7.63e-3)
C10MOP5	5	6	7.1270e-1 (5.46e-5)
C10MOP6	6	6	7.4040e-1 (5.93e-5)
C10MOP7	8	6	5.7849e-1 (7.71e-3)
C10MOP8	2	32	9.7757e-1 (1.72e-3)
C10MOP9	3	32	9.6232e-1 (1.19e-3)
IN1KMOP1	2	25	9.2620e-1 (4.54e-3)
IN1KMOP2	2	25	8.8520e-1 (1.09e-3)
IN1KMOP3	3	25	8.1162e-1 (4.54e-3)
IN1KMOP4	2	34	9.9375e-1 (5.37e-3)
IN1KMOP5	2	34	9.9461e-1 (8.38e-3)
IN1KMOP6	3	34	9.8063e-1 (1.25e-2)
IN1KMOP7	2	21	8.9537e-1 (1.67e-2)
IN1KMOP8	3	21	7.0954e-1 (6.93e-3)
IN1KMOP9	4	21	6.0820e-1 (1.18e-2)
$+/-/\approx$			

TABLE II
IGD VALUES OBTAINED BY CMOSMA_NCHU ON C10MOP AND IN1KMOP

Problem	M	D	CMOSMA_NCHU
C10MOP1	2	26	2.0324e-2 (3.08e-3)
C10MOP2	3	26	1.9513e-2 (2.26e-3)
C10MOP3	3	5	2.2752e-2 (2.40e-3)
C10MOP4	4	5	5.9756e-2 (3.18e-3)
C10MOP5	5	6	6.2924e-3 (2.08e-3)
C10MOP6	6	6	3.1207e-3 (2.88e-3)
C10MOP7	8	6	6.6643e-2 (5.07e-3)
$+/-/\approx$			

the IGD values obtained by CMOSMA_NCHU on C10MOP and IN1KMOP test suites.

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