Multi Armed Bandits for Many Task Optimization

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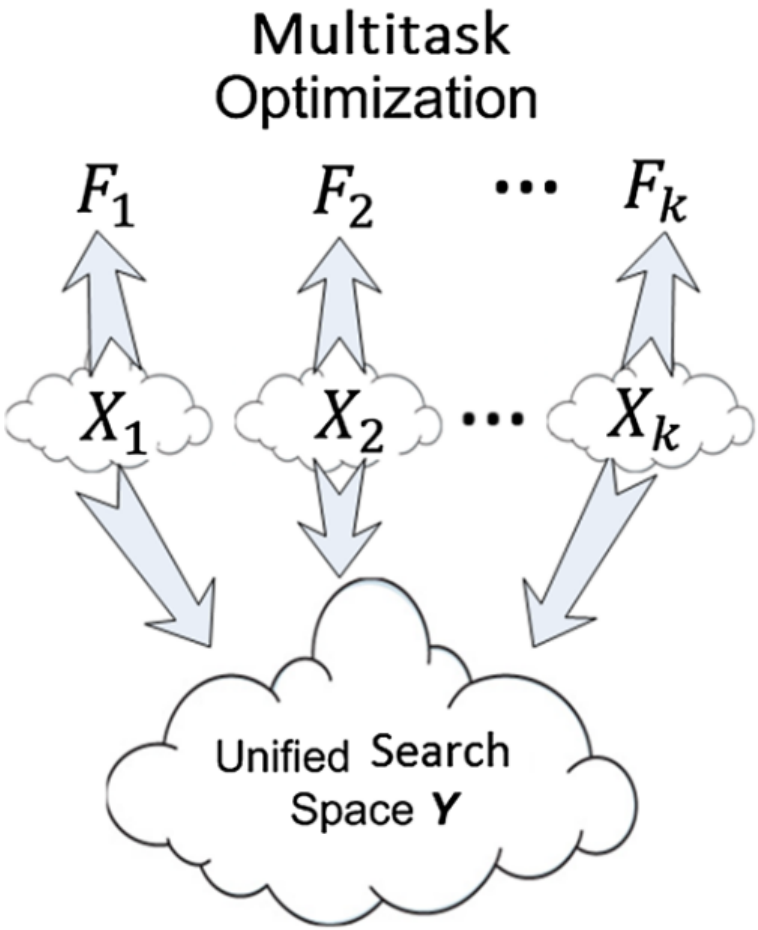
Agenda

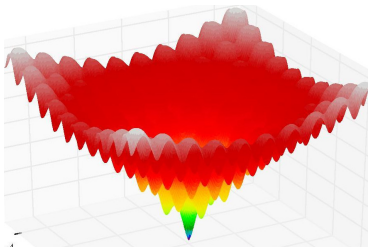
1. Introduction
2. Related works
3. Proposed method
4. Experimental results

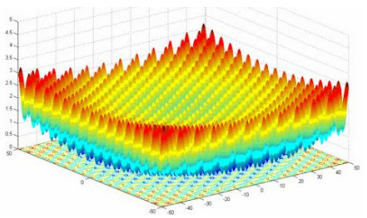
Agenda

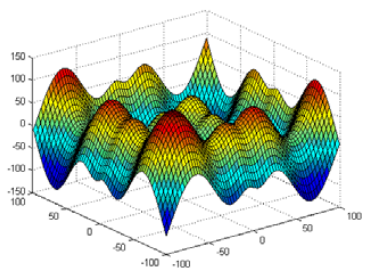
Many task optimization - MaTSOO benchmark



Single Objective Optimization (SOO)







Agenda

MFEA

MFEA

A. Gupta, Y.-S. Ong, and L. Feng, "Multifactorial evolution: Toward evolutionary multitasking," *IEEE Transactions on Evolutionary Computation*, vol. 20, no. 3, pp. 343–357, 2015

Problem

- Do not group ideal assist tasks

MaTGA

MaTGA

Y. Chen, J. Zhong, L. Feng, *et al.*, "An adaptive archive-based evolutionary framework for many-task optimization," *IEEE Transactions on Emerging Topics in Computational Intelligence*, 2019

Problem

- Store past solutions
- Measure KLD between past solutions
- Complex, many parameters

Agenda

Task selection as a MAB problem

Reward

UCB

Algorithm

Linear decay of rmp

Agenda

Benchmark

Task	Function	Ideal Assisted Task
T_1	Sphere1	None
T_2	Sphere2	None
T_3	Sphere3	None
T_4	Weierstrass25D	None
T_5	Rosenbrock	T_1
T_6	Ackley	T_2
T_7	Weierstrass50D	T_3, T_4
T_8	Schwefel	None
T_9	Griewank	T_4
T_10	Rastrigin	None

Parameter setting

MFEA

- Population size: 30
- rmp: 0.3
- sbxdi: 2
- pmdi: 5

MAB-MFEA

- rmp_{min}: 0.1
- rmp_{max}: 0.9
- α: 0.01 - discounted coefficient
- c: 0.5 - UCB explore/exploit trade-off coefficient

MaTGA

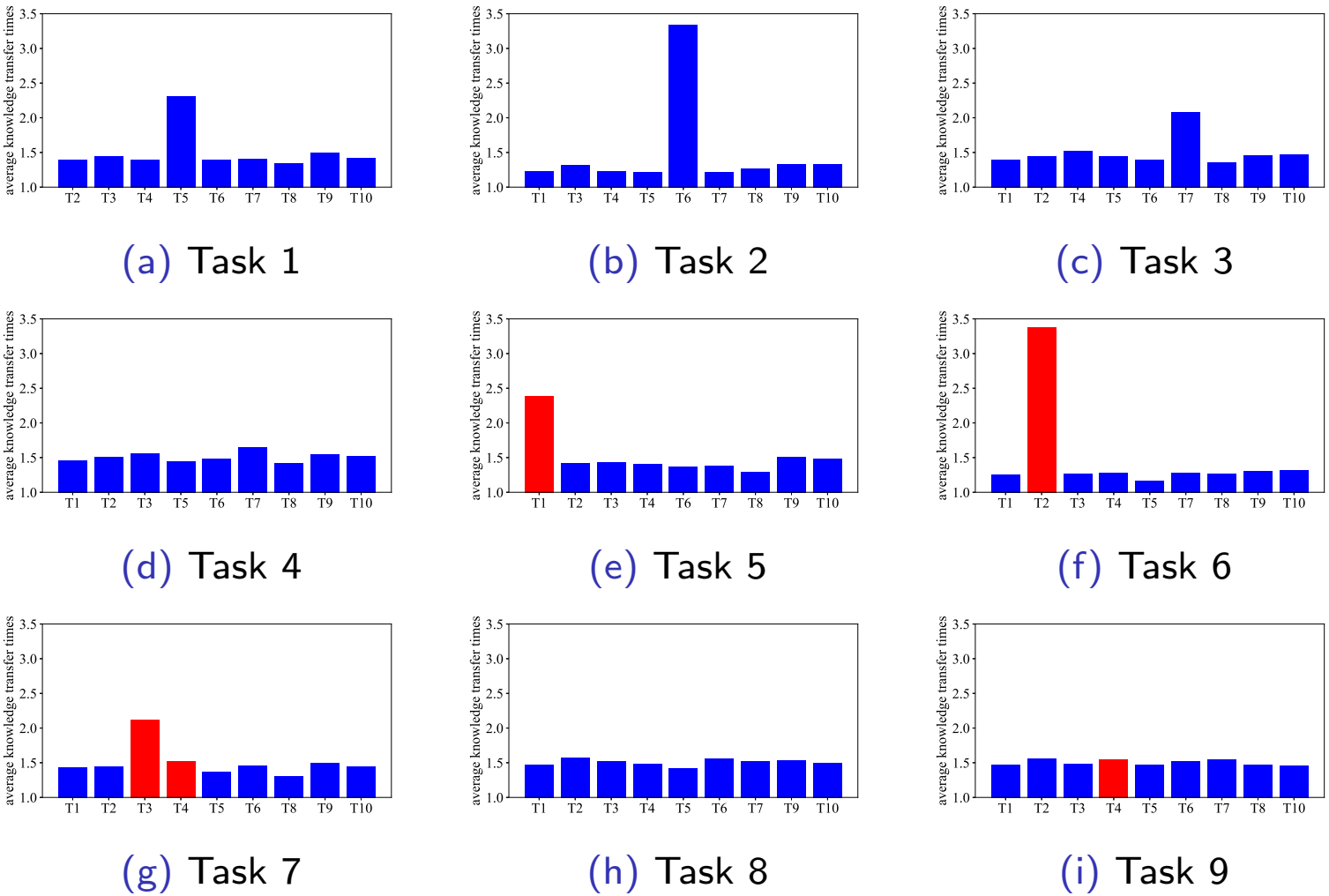
- NP:
- λ: 0.8 - reward shrink rate
- ρ: 0.8 - attenuation coefficient
- α: 0.1 - knowledge transfer rate
- UR: 0.2 - archive update rate
- AcS: 300 - archive size

Table

	MFEA	MaTGA	MAB-MFEA
T_1	1.32E+00	**2.45E-04**	2.85E-03
T_2	1.27E+00	4.75E-04	**1.15E-12**
T_3	1.17E+00	**0**	**6.30E-09**
T_4	3.37E+00	**1.00E-06**	5.37E-04
T_5	8.15E+02	**2.16E-02**	1.01E+01
T_6	1.99E+01	3.61E-03	**1.05E-07**
T_7	1.05E+01	**5.57E-04**	1.52E-03
T_8	2.34E+03	**3.40E-02**	9.21E+02
T_9	4.11E-02	4.52E-03	**4.50E-03**
T_10	1.55E+01	1.57E+01	**7.77E+00**

Table 1: The performance of 3 algorithms for 30 independent runs

Analysis



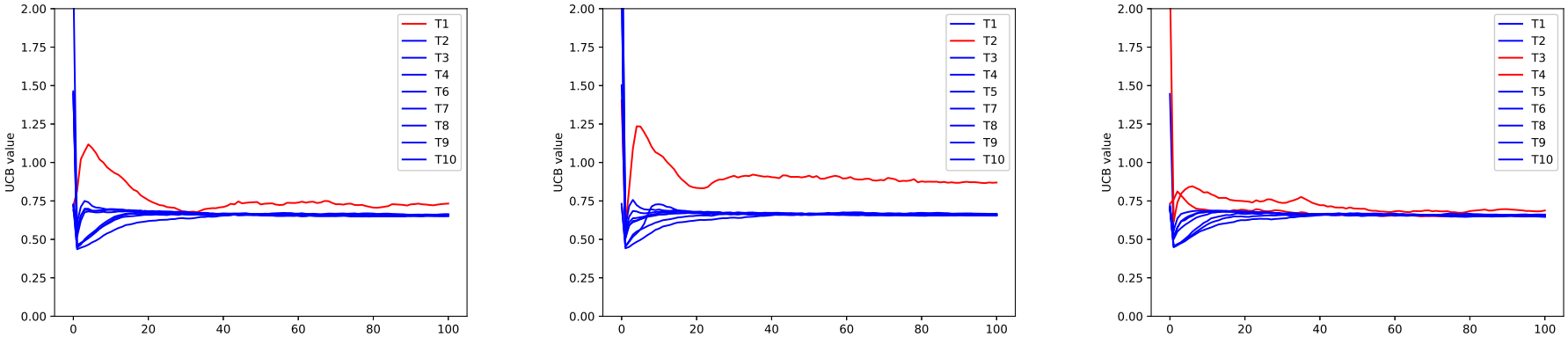
(a) Task 1 (b) Task 2 (c) Task 3

(d) Task 4 (e) Task 5 (f) Task 6

(g) Task 7 (h) Task 8 (i) Task 9

Figure 1: The average times of choosing knowledge transfer target, the assisted task is highlighted in red

Analysis



(a) Task 5 (b) Task 6 (c) Task 7

Figure 2: The UCB function value for choosing knowledge transfer target, the assisted task is highlighted in red

Conclusion

Contribution

- Trade of between explore and exploit task relationship.
- Better than MFEA, less complex but performs equally well to MaTGA.
- The best on 5/10 tasks.
- Analyse on 10 task benchmark shows MAB-MFEA correctly identify ideal assist task.

Future task to complete the study

- Adjust *rmp_min* and *rmp_max* paramter.
- Finish experiment on CEC Complex 50 tasks benchmark.

Thank you for your attention!