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Report for Natural Computation Methods for Machine Learning

Genetic Algorithm on SAT Problem

Group 06

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Abstract

abstract

Keywords: A, B, C

1   Introduction

Here write the introduction.

2   Backgrounds

3   Methods

4   Experiments & Results

Here we performed our algorithms in different datasets with variant clause numbers to determine both its efficiency and effectiveness. We choose datasets with 100, 150, 200 and 250 variables, corresponding to 430, 645, 860 and 1075 clauses respectively. That is to say, the rates of a number of variables and clauses are fixed and equals to 4.3. The datasets we used are all generated randomly. Datasets with 100, 150 and 200 variables are downloaded from SATLIB, an online published by UBC[1]. Datasets with 250 variables are generated by ourselves. All of the datasets are satisfiable for 3-SAT problems. In order to reduce contingency, we run the genetic algorithm-based method and the Walk-SAT method in each dataset 10 times, and then we computed the average time used and average flip times to measure the efficiency. In addition, we had set a two minutes timeout for the two algorithms, which means that failing to find an available solution in two minutes would seem a failure to solve the dataset. We would count the number of failures to determine the effectiveness of the algorithms. The detailed experiments results could be found in table 1.

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[1] https://www.cs.ubc.ca/ hoos/SATLIB/benchm.html

In our experiments we tested five kinds of crossover methods for genetic-based algorithm, they were CC, FF, uniform, one-point and two-point crossover respectively. Besides we run WalkSAT on the same dataset as the contrast.

5   Discussions

6   Conclusion

References

Table 1: Experiments Results.

		Genetic Based-Algorithm															WalkSAT		
		CC			FF			Uniform			OP			TP					
		AFS	AT(ms)	SR	AFS	AT(ms)	SR	AFS	AT(ms)	SR	AFS	AT(ms)	SR	AFS	AT(ms)	SR	AFS	AT(ms)	SR
UF-100	0404	9177.4	53.4	1.0	9633.0	53.7	1.0	9529.4	55.4	1.0	14731.7	79.9	1.0	16413.6	88.2	1.0	7255.5	41.2	1.0
	0647	15930.1	87.8	1.0	24728.8	128.5	1.0	33237.3	177.2	1.0	25046.2	131.0	1.0	31038.8	161.2	1.0	28321.3	147.1	1.0
	0720	13826.8	76.9	1.0	27329.1	142.2	1.0	16999.4	93.6	1.0	19317.5	102.8	1.0	16049.8	86.1	1.0	11183.2	61.1	1.0
	0835	73864.9	386.2	1.0	120311.8	607.4	1.0	70826.9	371.2	1.0	135137.5	685.1	1.0	104195.1	528.3	1.0	73663.1	376.4	1.0
	0925	33489.4	178.5	1.0	28828.7	149.2	1.0	38156.2	202.4	1.0	19596.8	103.8	1.0	33367.7	172.9	1.0	24007.9	124.9	1.0
UF-150	016	21526.1	169.6	1.0	10625.7	82.3	1.0	20516.0	162.2	1.0	21600.0	165.5	1.0	22829.2	174.7	1.0	17521.0	136.4	1.0
	025	410056.8	3116.7	1.0	148867.1	1092.7	1.0	234302.9	1780.7	1.0	178405.0	1321.9	1.0	178955.2	1327.7	1.0	248282.3	1874.6	1.0
	027	1556158.2	11978.0	1.0	201949.8	1478.6	1.0	637603.0	4864.7	1.0	366749.4	2717.2	1.0	319983.2	2373.6	1.0	282071.3	2127.9	1.0
	089	34081.2	264.8	1.0	44668.5	328.2	1.0	57147.8	439.4	1.0	54248.0	405.8	1.0	36884.2	279.0	1.0	45971.1	350.7	1.0
	093	16817.7	134.0	1.0	14447.8	110.4	1.0	17689.0	140.8	1.0	37797.9	284.9	1.0	33640.0	254.2	1.0	24792.6	191.3	1.0
UF-200	018	371425.5	3706.8	1.0	314467.2	3002.8	1.0	383495.1	3840.5	1.0	270917.4	2641.1	1.0	505483.3	4927.6	1.0	279120.8	2803.0	1.0
	024	1337897.9	13435.2	1.0	907525.4	8847.3	1.0	1213634.6	12200.6	1.0	1362716.6	13389.9	1.0	975747.7	9542.9	1.0	2346452.8	23529.8	0.9
	051	1074383.1	10784.6	1.0	1365475.4	13591.9	1.0	935085.4	9385.3	1.0	1209651.5	11847.2	1.0	887628.7	8684.6	1.0	2396565.5	24034.6	1.0
	068	3074382.4	31095.2	0.5	2675314.1	26672.3	0.6	479945.1	14907.8	0.7	4232634.8	41823.3	0.6	1740682.9	17109.7	1.0	1802523.3	18111.5	0.6
	072	59105.7	593.8	1.0	37188.5	352.9	1.0	82337.7	827.5	1.0	83066.0	813.8	1.0	53628.1	527.8	1.0	82984.3	836.6	1.0
UF-250	004	886070.3	10958.0	1.0	820759.3	9799.9	1.0	844263.0	10432.6	1.0	994404.5	12008.9	1.0	682684.1	8227.3	1.0	4053239.0	50826.1	1.0
	005	1056567.4	13096.9	1.0	1046032.8	12579.3	1.0	1145335.5	14195.0	1.0	990259.0	11972.8	1.0	1382175.6	16753.1	1.0	5483059.7	68762.1	0.8
	008	4402336.0	55131.0	0.4	3598460.5	44488.0	0.4	3369114.6	42127.8	0.6	6358087.1	77834.5	0.6	7008261.7	85854.2	0.4	\	\	0
	009	3670606.3	45996.5	0.9	4414599.2	54914.8	1.0	4012810.7	50326.5	1.0	3446733.4	42100.3	0.9	2886818.8	35266.3	0.8	4588804.5	57555.5	0.2
	011	2633192.1	32936.5	1.0	1501120.3	18285.3	1.0	1216875.7	15107.6	1.0	1123454.1	13590.2	1.0	978018.1	11830.0	0.9	6556025.0	82199.6	0.3

Table 1: Experiments Results. The column 'AFS' represents the average flip times over ten times running, which represents the computation complexity of the algorithm. The column 'AT' represents the average time usage over ten times running, which represents the time complexity of the algorithm. The column 'SR' represents the success rate of the algorithm. '\' means that there were no available solution for the algorithm in the certain dataset. 'OP' means 'one-point crossover and 'TP' means 'two-point crossover' in the table.