PERFORMANCE IMPROVEMENT IN GENETIC PROGRAMMING USING MODIFIED CORSSOVER AND NODE MUTATION

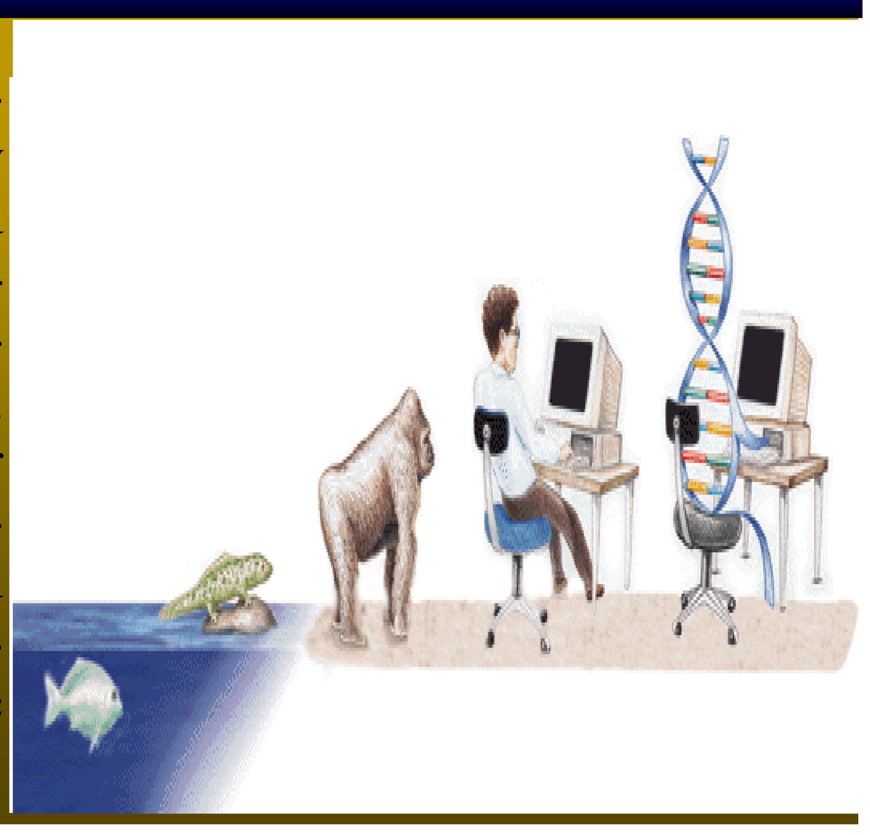
Arpit Bhardwaj, Dr Aruna Tiwari
Computer Science and Engineering Department
Indian Institute Of Technology Indore

ABSTRACT

During the evolution of solutions using Genetic Programming (GP) there is generally an increase in average tree size without a corresponding increase in fitness—a phenomenon commonly referred to as bloat. Bloating increases time to find the best solution. Sometimes, best solution can never be obtained. We are proposing a modified crossover and point mutation operation in GP algorithm in order to reduce the problem of bloat. The results obtained show that our method reduces the problem of bloat substantially without compromising the performance.

INTRODUCTION

Genetic Programming (GP) [1] is an evolutionary algorithm-based methodology inspired by biological evolution to find computer programs that perform a user-defined task. In GP, solutions to a problem can be represented in different forms, but are usually interpreted as computer programs. Darwinian principles of natural selection and recombination are used to evolve a population of programs towards an effective solution to specific problems.



CONTRIBUTIONS

To control the problem of bloat we proposed modified crossover and node mutation operation.

MODIFIED NODE MUTATION

1. In the modified node mutation technique, we replace the randomly selected function/terminal node of the parent with some randomly generated function/terminal in order to provide some diversity among the individuals.
2. *if (fitness of parent <fitness of child) Transfer child to next generation else Transfer parent to next generation.*

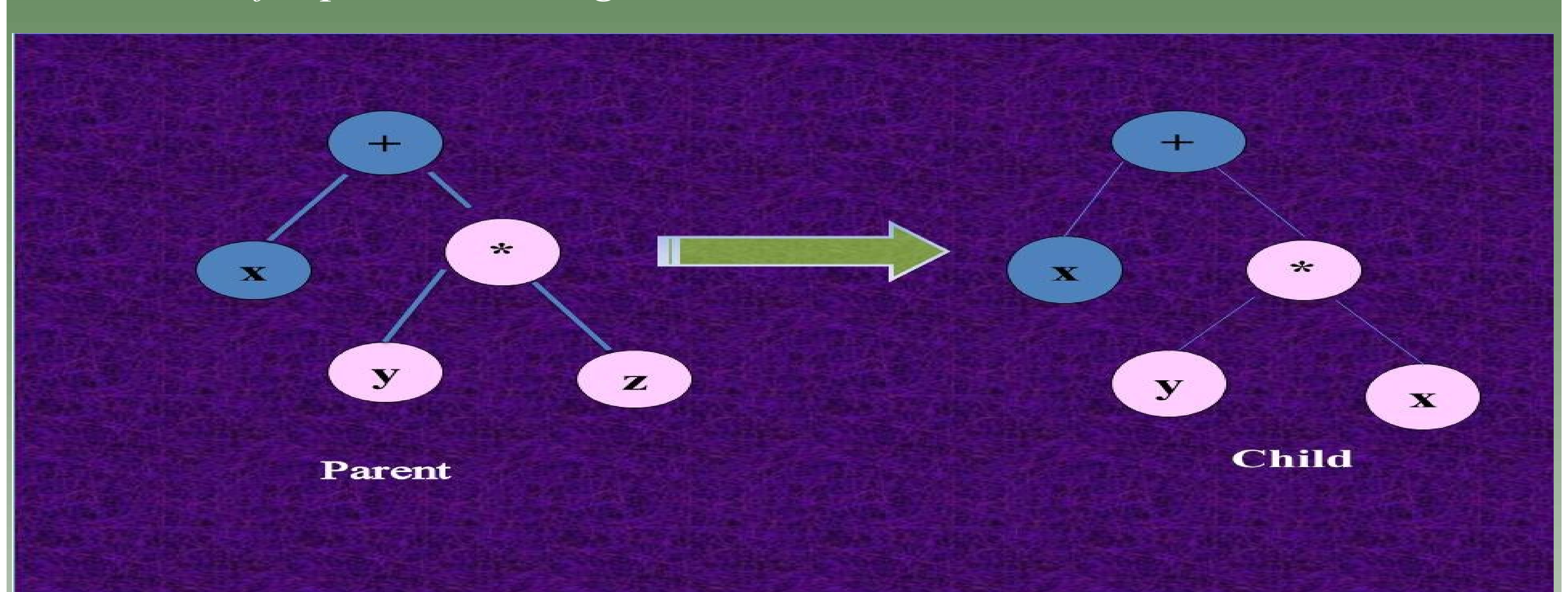


Figure 1. Node Mutation

MODIFIED CROSSOVER

1. In modified crossover we generate the four children from the two parents. Out of these four children's, two are rejected on the basis of depth and size.
2. Now we apply the elitism.
3. *if (fitness of parent <fitness of child) Transfer child to next generation else repeat the process till we get the better children.*

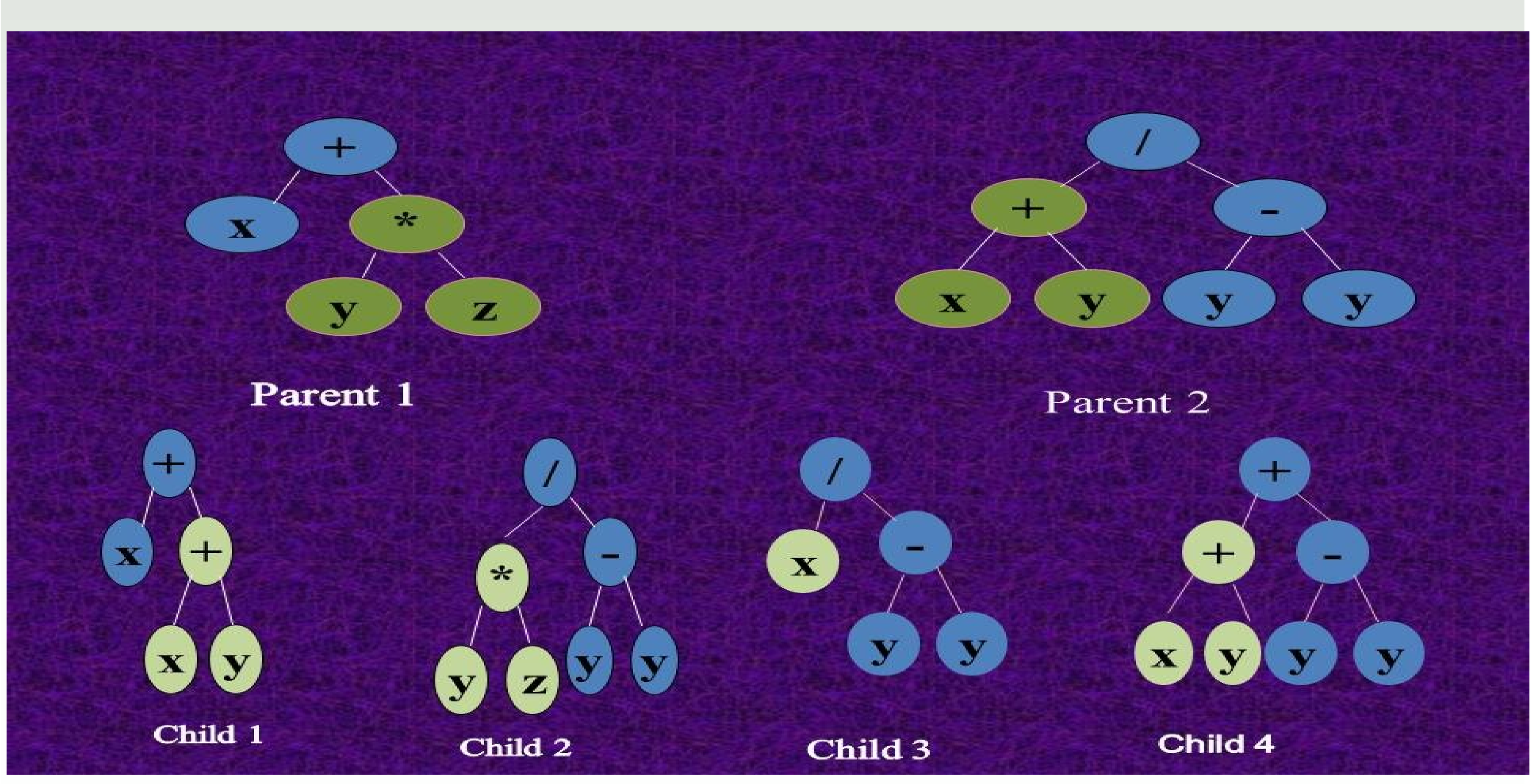


Figure 2. Modified Crossover

EXPERIMENTS AND RESULTS

We have compared the outcome of our results with the conventional crossover and mutation method and with FEDS crossover and point mutation technique [2] shown in Table 1.

TABLE 1. COMPARISON OF CONVENTIONAL CROSSOVER, MUTAION, FEDS CROSSOVER, NODE MUTATION METHOD WITH MODIFIED CROSSOVER AND MODIFIED POINT MUTATION METHOD

NAME OF DATASETS	Conventional Crossover and Mutation Method	FEDS crossover and Node Mutation Method	Modified Crossover and Modified Point Mutation Method
	Generalization Accuracy	Generalization Accuracy	Generalization Accuracy
IRIS	81.56%	97.42%	98.12%
WBC	83.64%	85.56%	87.14%
BUPA	64.93%	66.89%	69.32%

TABLE 2. PERFORMANCE OF GP BASED CLASSIFIER INT TERMS OF EXECUTION TIME

Data Sets	IRIS	WBC	BUPA
TIME (hour:min:sec)	0:0:13	0:1:52	0:2:23

APPLICATION

1. For handling the message congestion problem in various Telecom industries, in medical diagnosis etc.
2. In biometric verification system such as Face recognition, Thumb recognition and retina recognition in smart phones, tablets and computer machines.

CONCLUSION

1. In the proposed work, problem of code bloat is controlled using modified crossover and node mutation operations.
2. Our proposed method reduces the size and depth of the chromosomes.
3. It also improves the training and generalization accuracy of the classifier as represented in Table 1.

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