# A Survey on Applications of Genetic Algorithms and Fuzzy Logic in Caching

**Mr. S. N. Sarda**
(Department of Information Technology, P.R.M.I.T. & R., Badnera-Amravati)
Shrikantnsarda@gmail.com
**Mr. M. R. Dhande**
(Department of Computer Technology, V.Y.W.S.Polytechnic, Badnera-Amravati)
Milinddhande98@gmail.com
**Mr. R. A. Tiwari**
(Department of Computer Technology, V.Y.W.S.Polytechnic, Badnera-Amravati)
softyraja@gmail.com
**Mr. S. P. Thakare**
(Department of Information Technology, P.R.M.I.T. & R., Badnera-Amravati)
Spthakare82@gmail.com

## Abstract

*To reduce penalty occur due to page fault and to optimize performance of Caching. Designer of system are always looking for a novel approach for page replacement policies. This paper, discuss the various neural approaches that were designed based on creatures and fuzzy logic to optimize the performance of caching .The proposed system we discussed here is more effective in solving the problems than a systems used earlier in this problem domain.*

*Keywords: Genetic algorithms, Evolutionary program, Cache replacement, Fuzzy logic.*

## I. Introduction

Due to small storage capacity of cache memory, System always requaire to call garbage collection at certain time interval.Some time garbage collection invoked at arrival of new objects. When allocation of space is become an issue. For replacement of suitable object from cache we desired an appropriate cache replacement algorithm.This area is always attract peoples working for system optimization.In this paper we work for finding the ability of genetic fuzzy based techniques that could be enhanching performance of cache significantly by implementing.

## II. A General View For Cache Replacement By Genetic Algorithm

Application of *genetic* algorithms and evolutionary programming is previously studied by various researchers. A. Vakali presented a model that introduced the concept of applying genetic algorithms and evolutionary programming to cache replacement process[5]. The proposed models adapted the idea of evolutionary computation in order to preserve a consistent cache state of information objects. The aim was to improve the cache state in terms of locality of reference. For better utilization of the cache area, genetic algorithm approach was considered for the cache replacement process. The reasons for considering the genetic algorithms for cache replacement are as follows:

**a.** Survival of the fittest is a phrase that Originated from an evolutionary theory. cache should contain the fittest information objects. Fittest object is a object that frequently accessed and

**b.** Cache content that had a large number of information objects (stored files) required optimization.
The cached objects were modeled as fit considered for reproduction. To create stronger cache generation we applied different genetic operators. Evolutionary programming techniques were similar to genetic algorithm, but they placed emphasis on the behavioral of fittest cached objects and their offspring.
By providing proper objective function to the genetic algorithm, one cans achive significant improvements in cache performance.

## III.A Survey for Fuzzy Logic

Fuzzy logic is a extension of a form of algebra in which all values are reduced to either TRUE or FALSE. The general fuzzy logic system consist three basic functional blocks are

a) Fuzzifier refer as input stage

b) Defuzzifier refer as output stag and

c) An inference engine i.e. processing stage, containing a fuzzy rule.

And some important tools

a) a tool that changes the input values into fuzzy input sets. This tool is known as Fuzzification .

b) one another tool is a rule-based way to store and manipulate knowledge to interpret information in a useful way.

It set relationship between inputs and outputs.

*c) a* tool that makes conclusions using the rule base, is Inference Engine.

d) defuzzification is a reverse process of fuzzification

that represents the final decision.

Performance of the system depends on the proper choice of input and output variables. The fuzzy algorithm has the ability to easily adapt to the characteristics of the workload.

## IV. A General View for Cache Replacement by Fuzzy logic

The locality of reference is the important parameter considered for cache replacement decisions. It is quite difficult task to derive an exact mathematical formula to describe this . The solution on difficulty is to implement a model that based on fuzzy logic.

An algorithm is needed that applied to a set of fuzzy control rules. This algorithm can help to identify the objects for replacement from the cache. G. Valli et. al. Proposed an algorithm that represent the process state. In their algorithm they used three input variables

a) The variables described page in terms of its size

b) Page hit and

c) Belonging to a time last access

The output of alogrithm represents the probability of replacement for each object. For such object Fuzzy sets were defined. Defuzzification used in the algorithm that represents the final decision [2].

Mojtaba Sabeghi *et al.* [1] proposed a fuzzy algorithm for cache replacement, which treats decision parameters as fuzzy variables. The algorithm was confined to replacement of uniform cache objects with fuzzy logic. The most common shape of a membership function used in the fuzzy approach is triangular. In the proposed model, the input stage consisted of three linguistic variables:

a) spatial locality of references

b) temporal locality of references and

c) the distance between two consecutive references to the object.

The algorithm steps are as follows:

1. Inference engine takes as input the page size,page hit and time last access of each used object in the cache.

2. Output of the inference engine is considered as object to swap.

3. Object that has the highest swap priority will be removed from the cache.

A survey result reflect that the fuzzy approach is suitable for looping, probabilistic and temporal patterns of reference, and it performs better in mixed reference patterns.

## VI. Conclusion

This paper is a deliberate effort taken to gather information about various neural approaches that are useful for cache replacement policy. We include different neural approaches proposed by authors to improve the performance of caching, like genetic algorithm and fuzzy logic. The techniques proved to be effective in providing solutions and improving the performance of the caching compared to conventional approaches.

Every technique required different inputs and experiment setup. It was difficult to compare the performance of different techniques at this level. We found that it is easy, if the experiments for these techniques had been conducted with similar inputs and similar experimental setups, and the results then compared.

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