Test Case Optimization using Meta-Heuristic Algorithms

CSE 4099 - CAPSTONE PROJECT

Introduction

Each Requirement in the SDLC process will have a set of Test Cases to be tested for in the final deployable product. Optimization of these test cases will ensure that the importance of that particular requirement is met with.

Problem Statement

This study involves the optimization of a set of test cases involved in Software Development using Meta - Heuristic Algorithms

Project Objectives

- To optimize the test cases involved in the development of a system using different Meta-Heuristic Algorithms

- To evaluate the efficiency of the algorithm with other benchmarking techniques

Literature Study (Feasibility)

In the paper “*A Genetic Algorithm for Fault Based Regression Test Case Prioritization*”, Arvinder and Shubhra develop and implement a system, on Java IDE, for Prioritization of Test Cases using Genetic Algorithm. The results of Fault Coverage have been mentioned.

Literature Study (Feasibility)

In the paper "*Value Based Test Case Prioritization*" Ashraf, Rauf and Mahmood develop a system for optimization of Test Cases based on their importance using Genetic Algorithm. This system has been developed on MATLAB. The results of the system in comparison with a random method has been mentioned.

Literature Study (Feasibility)

In “*Genetic Algorithm by using MATLAB Program*” Mashal Alenazi mentions a methodology to implement Genetic Algorithm for different problems. The results show how Genetic Algorithm can be implemented using the inbuilt MATLAB functions.

Existing System

The existing systems have implemented Genetic algorithm for Test Case Optimization taking different factors, such as Stakeholder importance, to find the most optimum set of Test Cases to be executed.

Proposed System

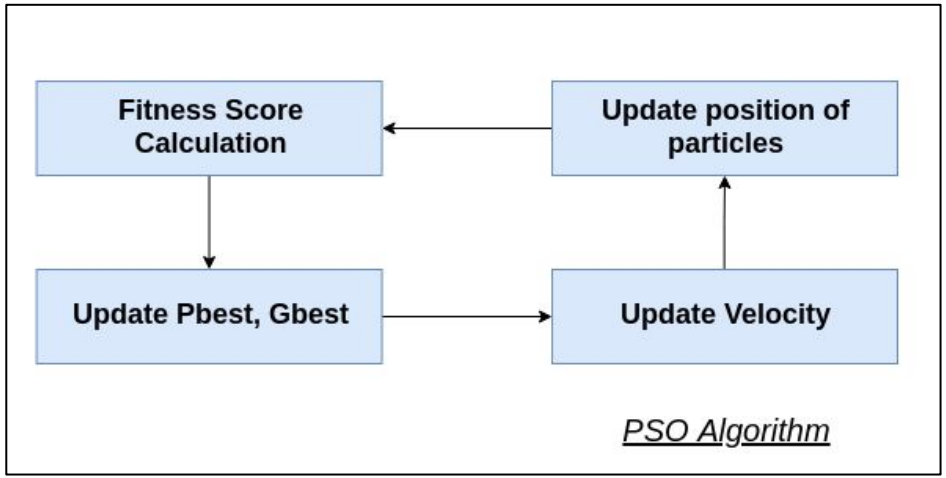
The Proposed Model aims in developing a system which will take data input, implement the meta-heuristic algorithm and hence derive a set of test cases based on their priorities obtained after executing the algorithm.

Proposed System

Initialization Phase: Test cases are taken as initial particle swarm

Cycle Phase:

- ➔ Fitness calculation
- ➔ P*best* & G*best* values are obtained
- ➔ Generation of new velocity & position values
- ➔ Inertia weight updation



Proposed System

Formula for Velocity change

$$v_i(t+1) = w.v_i(t) + c_1.r_1(t) (x_{Pbest} (t) - x_i(t)) + c_2.r_2(t) (x_{Gbest} - x_i(t))$$

Formula for Positional change

$$x_i = x_i + v_i$$

Proposed System

A set of Test Cases from a particular Software Project is taken as input and the algorithm is applied. The output from the algorithm will be the set of Optimized Test Cases.

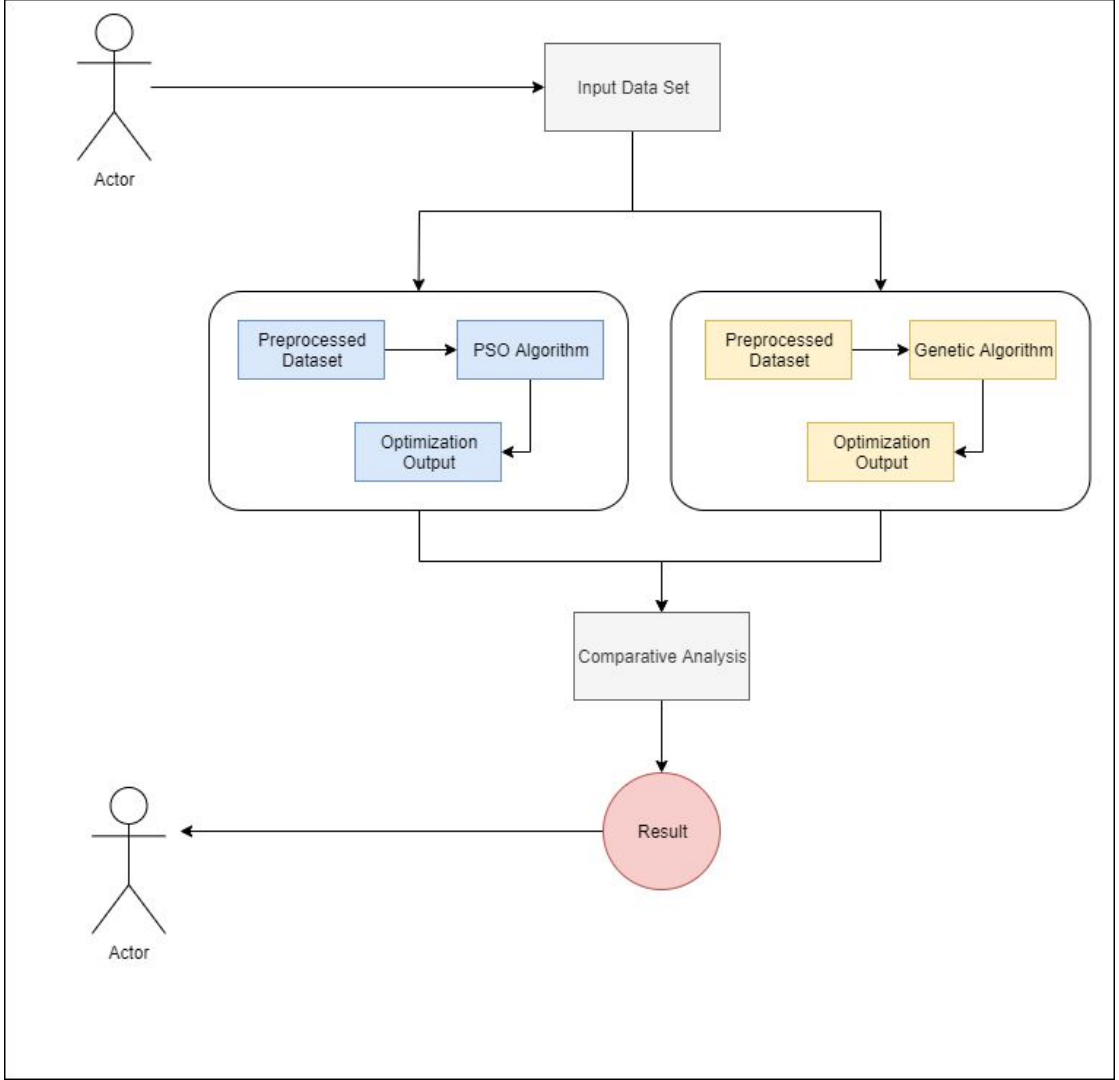
This system also aims in providing a comparative analysis against the output from a different algorithm using the evaluation criteria.

Why is the Proposed System better?

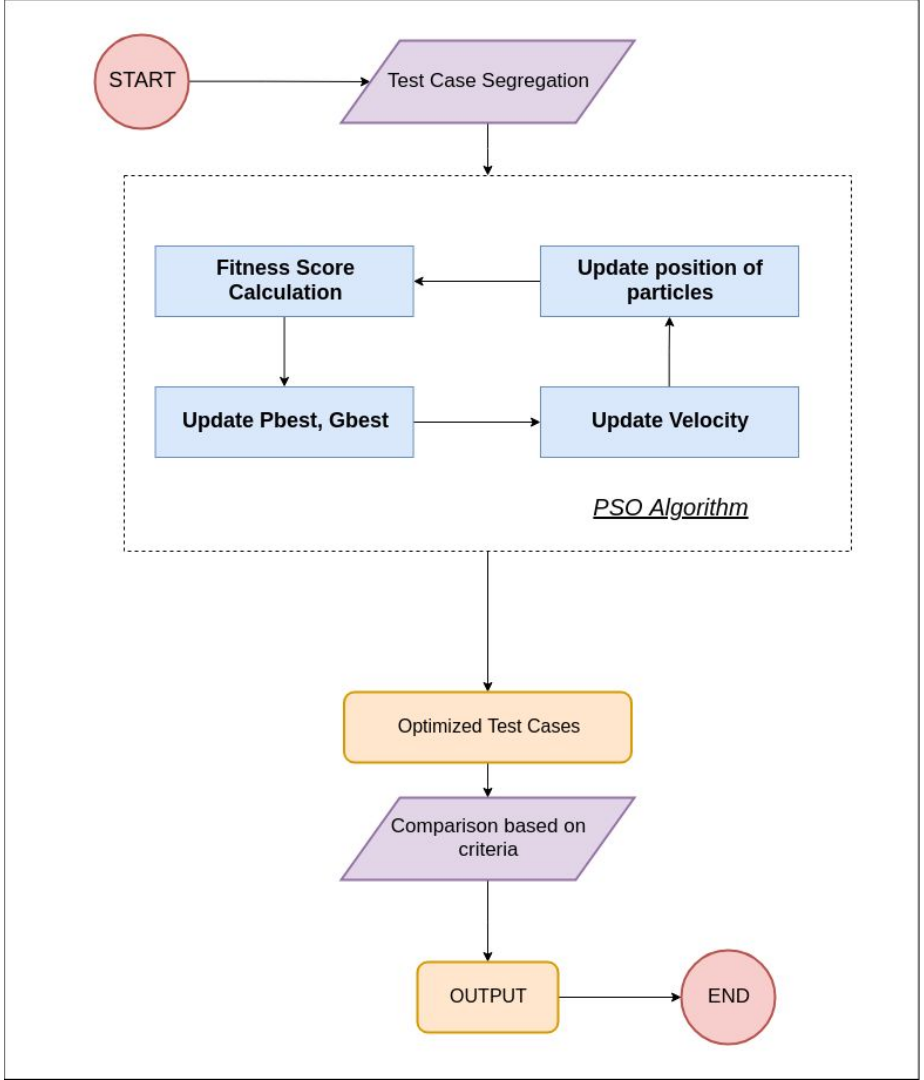
The proposed system will not be using any inbuilt functions or methodologies for algorithm execution. As equal weightage is to be given to each input case for best result, no influencing factor will be used.

The proposed system will provide more clear comparison among algorithms and will be best suited for large scale datasets.

Architecture Diagram



System Design



Algorithms

The algorithms which will be used:

➔ Particle Swarm Algorithm

➔ Genetic Algorithm (for comparison)

Evaluation Criteria

Error

Quality will be evaluated based on the error rate.

Running Time

Used to evaluate the performance of the algorithm.

Accuracy

Used to evaluate the accuracy of the proposed algorithm.

Conclusion

- ➔ Implementation of Particle Swarm Optimization to obtain a set of Optimized Test Cases.
- ➔ Comparative study against other Optimization Algorithms.
- ➔ Evaluation of these algorithms based on criterion metrics.

References

[1] Dr. Arvinder Kaur and Shubhra Goyal [2011]. “A Genetic Algorithm for Fault based Regression Test Case Prioritization.” International Journal of Computer Applications (0975 – 8887), Vol. 32

[2] E. Ashraf, A. Rauf, and K. Mahmood [2012]. “Value based Regression Test Case Prioritization.” Proceedings of the World Congress on Engineering and Computer Science 2012 Vol. I

[3] Mashal Alenazi. “Genetic Algorithm by using MATLAB Program”. International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 11, November 2015