

Test Case Optimization using Meta-Heuristic Algorithms

CSE 4099 - CAPSTONE PROJECT
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Introduction

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

Project Objectives

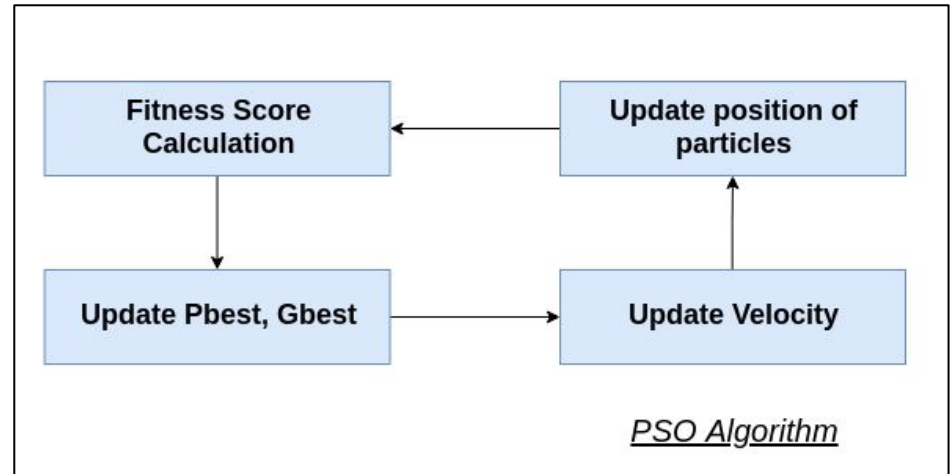
- To optimize the test cases involved in the development of a system using different Meta-Heuristic Algorithms
- To evaluate the efficiency of the algorithm with other benchmarking techniques

Proposed System

A system to derive optimized test cases obtained from the meta-heuristic algorithm.

Steps involved

- Initial swarm
- Fitness calculation
- *Pbest* & *Gbest* values are obtained
- New velocity & position values generated



Dataset Preparation

Attributes of the dataset:

- Test Case ID
- Test Cases
- Pre-conditions
- Precedence
- Pass / Fail

| | A | B | C | D | E | F | G | H | I | J |
|----|-----------------|---|-----------------|------------------------------------|------------|-------------|-----------|-----------------|---------------|-----------|
| 1 | TEST ID | TEST CASE | PRE-CONDITIONS | TEST STEPS | PRECEDENCE | TEST EFFORT | TEST DATA | EXPECTED RESULT | ACTUAL RESULT | PASS/FAIL |
| 2 | LOAD_001 | Test Page load functionality through URL | None | Enter Invalid URL | H | 8 | | | | |
| 3 | LOAD_002 | Test Page Reload without crashes | None | | H | 3 | | | | |
| 4 | LOAD_003 | Test 404 Error for Invalid URL in domain | None | | L | 7 | | | | |
| 5 | SELECT_CITY_001 | Test City Choice using Icons | LOAD_001 | Choose city from name and icons | M | 4 | | | | |
| 6 | SELECT_CITY_002 | Test Search City using Search Bar | LOAD_001 | Choose city by Search Bar | M | 6 | | | | |
| 7 | SELECT_CITY_003 | Test City Choice from Region List | LOAD_001 | Click View all cities button | H | 7 | | | | |
| 8 | HOME_001 | Test load of Home Page | LOAD_001 | View entire Home page layout | H | 6 | | | | |
| 9 | HOME_002 | Test load of Home Page after City Icon Choice | SELECT_CITY_001 | | M | 5 | | | | |
| 10 | HOME_003 | Test load of Home Page after City Search Choice | SELECT_CITY_002 | | M | 7 | | | | |
| 11 | HOME_004 | Test load of Home Page after Region List Choice | SELECT_CITY_003 | View additional options in menubar | M | 7 | | | | |
| 12 | HOME_005 | Test Return to Home Page on Logo Click | HOME_001 | | L | 5 | | | | |
| 13 | SIGN_IN_001 | Check initiation of Sign In | HOME_001 | View Sign Up button in menu bar | H | 6 | | | | |
| 14 | LOGIN_001 | Test Login functionality | SIGN_IN_001 | | H | 4 | | | | |
| 15 | LOGIN_002 | Test Login API | SIGN_IN_001 | | M | 5 | | | | |
| 16 | SIGN_UP_001 | Check switch to Sign Up button | SIGN_IN_001 | | M | 7 | | | | |
| 17 | SIGN_UP_002 | Test Sign Up functionality | SIGN_UP_001 | Click on Sign Up button | H | 7 | | | | |
| 18 | SIGN_UP_003 | Test Sign Up API Integration | SIGN_UP_001 | | M | 3 | | | | |
| 19 | LOGIN_003 | Check switch to Login Button | SIGN_IN_001 | | L | 4 | | | | |
| 20 | SEARCHBAR_001 | Check Input of Searchbar | HOME_001 | View searchbar in menubar | H | 5 | | | | |
| 21 | SEARCHBAR_002 | Check Return back to Home | SEARCHBAR_001 | | M | 5 | | | | |
| 22 | SEARCHBAR_003 | Test Search Functionality | SEARCHBAR_001 | | H | 6 | | | | |
| 23 | CATEGORY_001 | Test Choose Category Functionality | HOME_001 | | M | 6 | | | | |
| 24 | HOME_006 | Test load of Home Page after Category choice | CATEGORY_001 | | M | 8 | | | | |
| 25 | CATEGORY_002 | Test Category change while search | SEARCHBAR_001 | | M | 7 | | | | |
| 26 | SEARCHBAR_004 | Test Search Results based on chosen Category | CATEGORY_001 | | M | 5 | | | | |
| 27 | RECOMMEND_001 | Check Recommended list while Search | SEARCHBAR_001 | | M | 2 | | | | |

Dataset

Data Pre-processing

Steps involved:

- Drop columns not required for processing
- Convert H/M/L text values to integer
- Determine Pre-condition count

```
In [2]: dfile = pd.read_csv("Test Case Dataset.csv")
dfile
```

Out[2]:

| | TEST ID | TEST CASE | PRE-CONDITIONS | TEST STEPS | PRECEDENCE | TEST EFFORT | TEST DATA | EXPECTED RESULT | ACTUAL RESULT | PASS/FAIL |
|-----|-------------------|--|----------------|---------------------------------|------------|-------------|-----------|-----------------|---------------|-----------|
| 0 | LOAD_001 | Test Page load functionality through URL | None | Enter Invalid URL | H | 8 | NaN | NaN | NaN | NaN |
| 1 | LOAD_002 | Test Page Reload without crashes | None | NaN | H | 3 | NaN | NaN | NaN | NaN |
| 2 | LOAD_003 | Test 404 Error for Invalid URL in domain | None | NaN | L | 7 | NaN | NaN | NaN | NaN |
| 3 | SELECT_CITY_001 | Test City Choice using Icons | LOAD_001 | Choose city from name and icons | M | 4 | NaN | NaN | NaN | NaN |
| 4 | SELECT_CITY_002 | Test Search City using Search Bar | LOAD_001 | Choose city by Search Bar | M | 6 | NaN | NaN | NaN | NaN |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 95 | BOOK_EVENT_003 | Test Add & Remove person functionality | BOOK_EVENT_001 | NaN | M | 6 | NaN | NaN | NaN | NaN |
| 96 | BOOK_EVENT_004 | Test choice of seats | BOOK_EVENT_003 | NaN | H | 7 | NaN | NaN | NaN | NaN |
| 97 | EVENT_CONFIRM_001 | Test transfer to Payment Init | BOOK_EVENT_004 | NaN | H | 4 | NaN | NaN | NaN | NaN |
| 98 | EVENT_CONFIRM_002 | Test transfer to Confirmation Page after payment | PAY_PORTAL_003 | NaN | H | 4 | NaN | NaN | NaN | NaN |
| 99 | HELP_001 | Test help link functionality | HOME_001 | NaN | L | 5 | NaN | NaN | NaN | NaN |

100 rows × 10 columns

Dataset before Pre-processing

In [9]: dfile

Out[9]:

| | TEST ID | TEST CASE | PRE-CONDITIONS | PRECEDENCE | TEST EFFORT | H | L | M | PRE_CON_COUNT |
|-----|-------------------|--|----------------|------------|-------------|-----|-----|-----|---------------|
| 0 | LOAD_001 | Test Page load functionality through URL | None | H | 8 | 1 | 0 | 0 | 4 |
| 1 | LOAD_002 | Test Page Reload without crashes | None | H | 3 | 1 | 0 | 0 | 0 |
| 2 | LOAD_003 | Test 404 Error for Invalid URL in domain | None | L | 7 | 0 | 1 | 0 | 0 |
| 3 | SELECT_CITY_001 | Test City Choice using Icons | LOAD_001 | M | 4 | 0 | 0 | 1 | 1 |
| 4 | SELECT_CITY_002 | Test Search City using Search Bar | LOAD_001 | M | 6 | 0 | 0 | 1 | 1 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 95 | BOOK_EVENT_003 | Test Add & Remove person functionality | BOOK_EVENT_001 | M | 6 | 0 | 0 | 1 | 1 |
| 96 | BOOK_EVENT_004 | Test choice of seats | BOOK_EVENT_003 | H | 7 | 1 | 0 | 0 | 1 |
| 97 | EVENT_CONFIRM_001 | Test transfer to Payment Init | BOOK_EVENT_004 | H | 4 | 1 | 0 | 0 | 0 |
| 98 | EVENT_CONFIRM_002 | Test transfer to Confirmation Page after payment | PAY_PORTAL_003 | H | 4 | 1 | 0 | 0 | 0 |
| 99 | HELP_001 | Test help link functionality | HOME_001 | L | 5 | 0 | 1 | 0 | 0 |

100 rows × 9 columns

Pre-processed Data

Implementation steps

- Add overall weightage column
- Compute coefficient values for influential factors
- Devise an objective function containing an appropriate mathematical equation
- Formulate an algorithm to find the best value for the equation

Implementation Steps

Equation in the Objective Function:

$$\text{WEIGHTAGE} = (H*0.9 + M*0.5 + L*0.1 + (\text{PRE_CON_COUNT}/\text{cbo})) * \text{TEST EFFORT}$$

Future Steps

- Obtain best results after applying the algorithm
- Re-organize the data according to the output of the algorithm
- Implement the same steps for a different algorithm and compare their results