

Steepest Ascent Hill Climbing Algorithm To Solve Cases In Puzzle Game 8

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Abstract

The 8th puzzle compiling game is part of searching. Puzzle 8 is an implementation of the steepest ascent hill climbing algorithm by following the established rules. The working process of this algorithm is by looking at the initial position of the puzzle arrangement, after carrying out the process, the results of the shift are seen, whether it is approaching the correct arrangement position. The problem that often occurs is the lack of knowledge in solving game cases quickly so that it takes a long time to obtain the final state. The main purpose of this study is to provide information so that it is easy to solve puzzle game cases using an algorithm. The final result is a puzzle arrangement that is in accordance with the rules by using the concept of an algorithm so as to obtain a decision-making system to complete the puzzle game correctly.

Keywords: Artificial Intelligence Searching, Puzzle 8, steepest ascent hillclimbing algorithm.

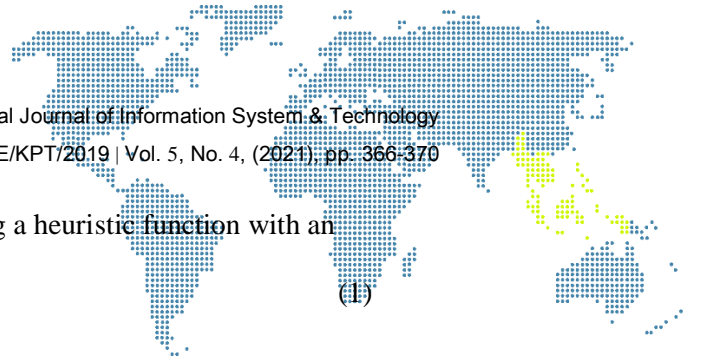
1. Introduction

In this day and age, puzzle games are no stranger to children, teenagers and parents. This puzzle game has been circulating in the wider community. This puzzle game used to be only in the form of a simple game, but the era of advanced technology has grown so that puzzle games can already be seen in games based on Android. Puzzle game is a game that has educational value, very useful for brain development for children in the process of thinking, besides puzzles can be applied as a learning medium that functions for emotional and mental learning because this game also produces an attitude of patience, calm, and perseverance to learn. After completing this game, this attitude can shape the personality pattern of children for the future. In addition, according to the opinion of [1] Puzzel is a game in the form of a puzzle, a problem by testing someone's knowledge or ingenuity. The Steepest Ascent Hill Climbing algorithm is an algorithm that is often used to solve optimization cases. The implementation of this algorithm is to find the shortest path by maximizing or minimizing the function of the optimization value it has. The reason for the Steepest Ascent Hill Climbing Algorithm is because this result is obtained from variations in hill climbing. The final result of simple hill climbing is based on the best or owned heuristic search [2]. The search method for hill climbing is divided into 2 parts, namely [3]:

- a) Simple Hill Climbing;
- b) Steepest Ascent Hill Climbing.

To complete the Steepest Ascent Hill Climbing algorithm, there are several stages that must be carried out including:[4]

- a) Count the squares that occupy the correct place;
- b) Calculate the movement;
- c) Will get the value of $h(n)$ by using manual calculations by looking at the number;
- d) Comparing the previous city using a heuristic system Using the Steepest Ascent.



For the solution process in the search algorithm using a heuristic function with an equation process:

$$f'(n) = h'(n)$$

Information :

$F'(n)$ = heuristic function

$H'(n)$ = evaluation function used

(1)

This formula serves to estimate how well each node will be generated so that when implemented it can produce how well the node will be generated [5]. To get good results in the search we must create a system to solve them, including 1. Define a problem 2. Analyze the problem 3. Gather knowledge 4. Have a technique that matches the case at hand [6]. According to Aida Putri's 2016 research, it explains that the difference between the generation method and the test method lies in the feedback procedure carried out in finding a solution that is immediately discarded or omitted in a search space. Not all cases can be solved by the ascending hill climbing algorithm, there are some risks where the solution cannot be found because it only calculates based on the smallest number of heuristics, where the steps that have the smallest number of errors are used [7]. The basic principle of Steepest-Ascent Hill Climbing with the concept of choosing a slope in a steeper and sharper form. Simple hill climbing, initially the next state will be determined by comparing the current state with one successor [8]. This comparison process starts from the left. If a new successor is found that is better than the current state, the successor will become the next state. While on the steepest ascent hill climbing in determining the next state, the current state is directly compared with all the successors that are nearby, so that the next state obtained is the best successor and is close to the expected optimization results [9].

2. Research Methodology

Methodology is the steps taken in making a study in order to obtain maximum results. The process of completing this research are:

- Determine the theme, title of the research to be carried out;
- Searching the literature for materials related to the Ascent Hill Climbing algorithm;
- Compile the Ascent Hill Climbing algorithm process from initial data, process and final results to get the goal state.

Make a conclusion from the results that have been obtained

3. Results and Discussion

3.1. Iteration 1

See the initial state generates the goal value

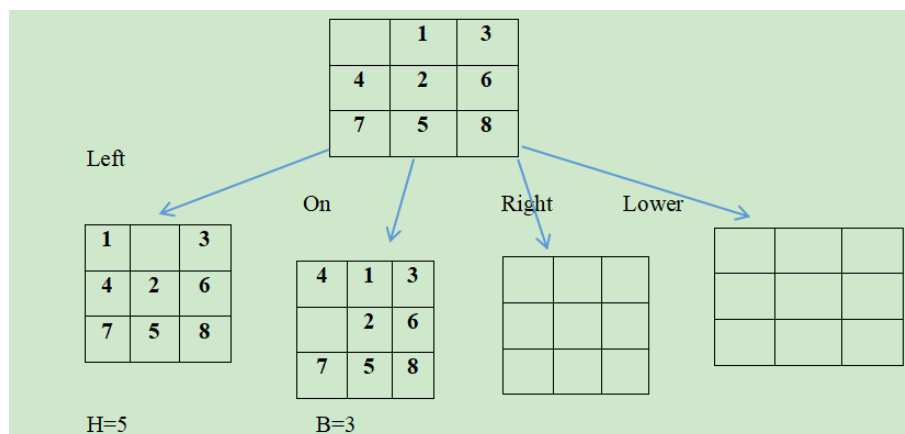


Figure 1. Iteration Step 1

Iteration 1:

The Figure above explains that each puzzle has to change positions to get the final goal state value. Each node has a heuristic value each in the process has a correct position. The first iteration process (1) can be seen that the correct position is 5 digits by sliding the numbers up, the value that holds the correct position is 1,3,4,6,7 and the wrong position is 3, namely 2,5,8. The acquisition of the heuristic value is obtained with the correct position being equated with the number 1 and the wrong position being equated with 0, The heuristic search process can be seen below:

$$= 1-0-1-1-0-1-1-0$$

$$= 5$$

3.2. Iteration 2

From the data process that has been processed, the correct position is obtained, followed by dilution.

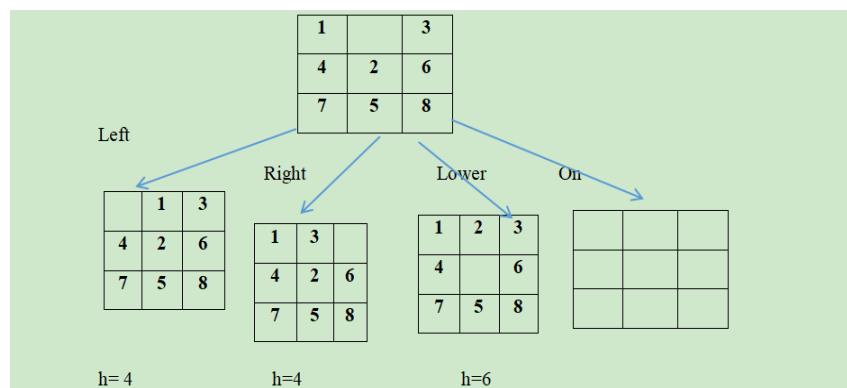


Figure 2. Iteration Step 2

The Figure above explains that each puzzle has to change positions to get the final goal state value. Each node has a heuristic value each in the process has a correct position. The first iteration process (1) can be seen that the correct position is 6 digits by sliding the numbers up, the value that holds the correct position is 1,2,3,4,6,7 and the wrong position is 2, namely 5,8. The acquisition of the heuristic value is obtained with the correct position being equated with the number 1 and the wrong position being equated with 0, The heuristic search process can be seen below:

$$= 1-1-1-1-0-1-1-0$$

$$= 6$$

3.3. Iteration 3:

See the initial state generates the goal value

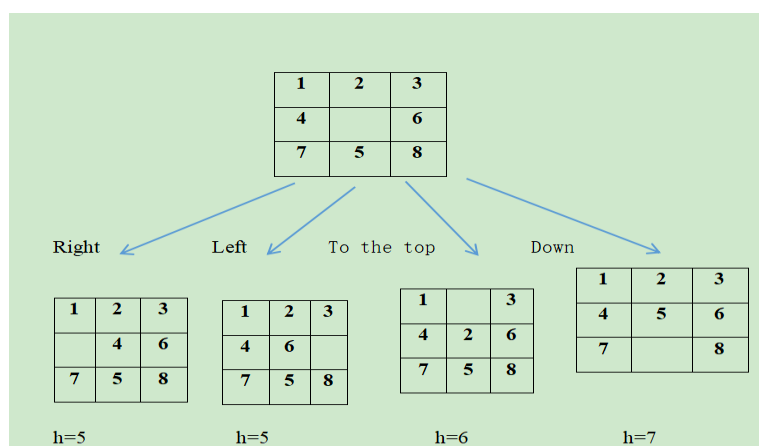
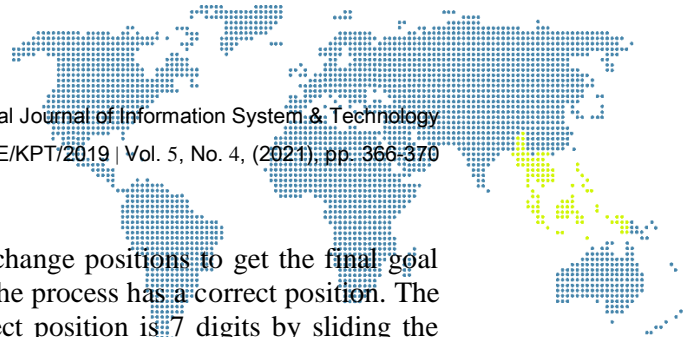


Figure 3. Iteration Step 3



Iteration 3:

The Figure above explains that each puzzle has to change positions to get the final goal state value. Each node has a heuristic value each in the process has a correct position. The first iteration process (1) can be seen that the correct position is 7 digits by sliding the numbers up, the value that holds the correct position is 1,2,3,5,4,6,7 and the wrong position is 1, which is 8 The acquisition of the heuristic value is obtained with the correct position being equated with the number 1 and the wrong position being equated with 0, The heuristic search process can be seen below:

$$= 1-1-1-1-1-1-1-0$$

$$= 7$$

3.4. Iteration 4

See the initial state generates the goal value. From the data process that has been processed, the correct position is obtained, followed by dilution.

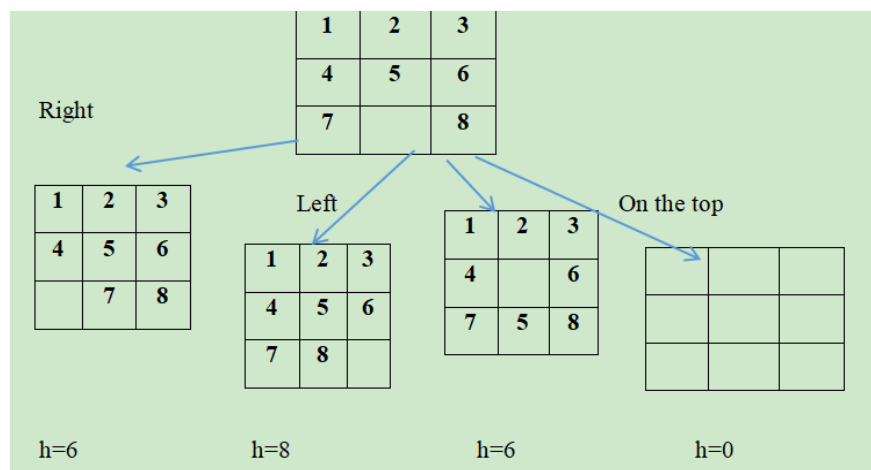


Figure 4. Iteration Step 4

Iteration 4:

The Figure above explains that each puzzle has to change positions to get the final goal state value. Each node has a heuristic value each in the process has a correct position. The first iteration process (1) can be seen that the correct position is 7 digits by sliding the numbers up, the value that holds the correct position is 1,2,3,5,4,6,7,8 and the wrong position is 0 The acquisition of the heuristic value is obtained with the correct position being equated with the number 1 and the wrong position being equated with 0, The heuristic search process can be seen below:

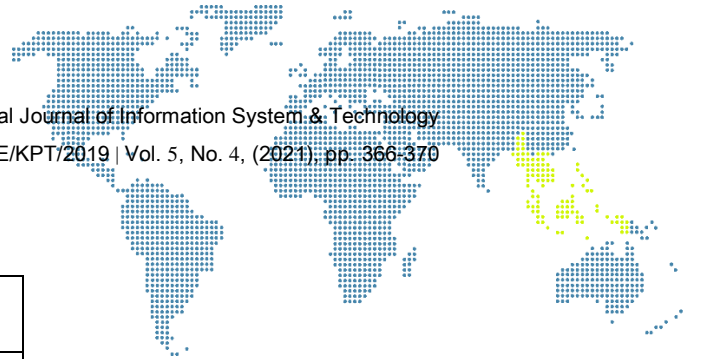
$$= 1-1-1-1-1-1-1-1$$

$$= 8$$

Based on the 4 iteration process above, the position of the goal state puzzle has 8 correct positions. The table iteration process is shown below:

Table 1. Iteration Results

Iterasi	Puzzle Position Value	Heuristic Results
Starting position	0-0-1-1-0-1-0-0	4
1	0-0-1-1-0-1-1-0	5
2	1-1-1-1-0-1-1-0	6
3	1-1-1-1-1-1-1-0	7
4	1-1-1-1-1-1-1-1	8



The final result after doing the process

1	2	3
4	5	6
7	8	

Figure 5. Fifth Iteration

From the data process that has been processed, 8 correct positions are obtained so that they meet the final destination Goal. The search is stopped.

4. Conclusion

The final result after the search has been carried out, it can be concluded that the steepest ascent hill climbing algorithm method can be applied to the puzzle game 8 by paying attention to the heuristics from the initial step to the final step with the concept of following the procedures that have been applied using the logic of shifting position, left, shifting position right, slide the position down and finally slide the position up. The completion process The steepest ascent hill climbing algorithm method depends on the initialization where the initial state position will lead to the heuristic process to be searched. Not all case settlements The steepest ascent hill climbing algorithm method obtains a goal state, it depends on the position to be processed, there is after doing the search process, but the position value does not find results, then the search is stopped, because not all cases can be resolved properly.

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