Shortest Path Algorithm

Soft Computing || Artificial intelligence

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What is the link between Artificial intelligence and Soft computing ?

01

Soft Computing gives Solutions to problems which are too complex to be exactly solved.

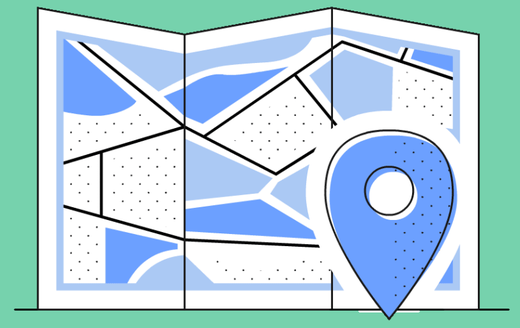
02

Development of systems which able to perform tasks normally requiring human intelligence.

03

SC can therefore be seen as overlapping with a subset of the problems arising in the field of AI.

A* Algorithm



A* is an informed search algorithm, or a best-first search, starting from a specific starting node of a graph, it aims to find a path to the given goal node having the smallest cost (least distance travelled, shortest time, etc.). It does this by maintaining a tree of paths originating at the start node and extending those paths one edge at a time until its termination criteria is satisfied.

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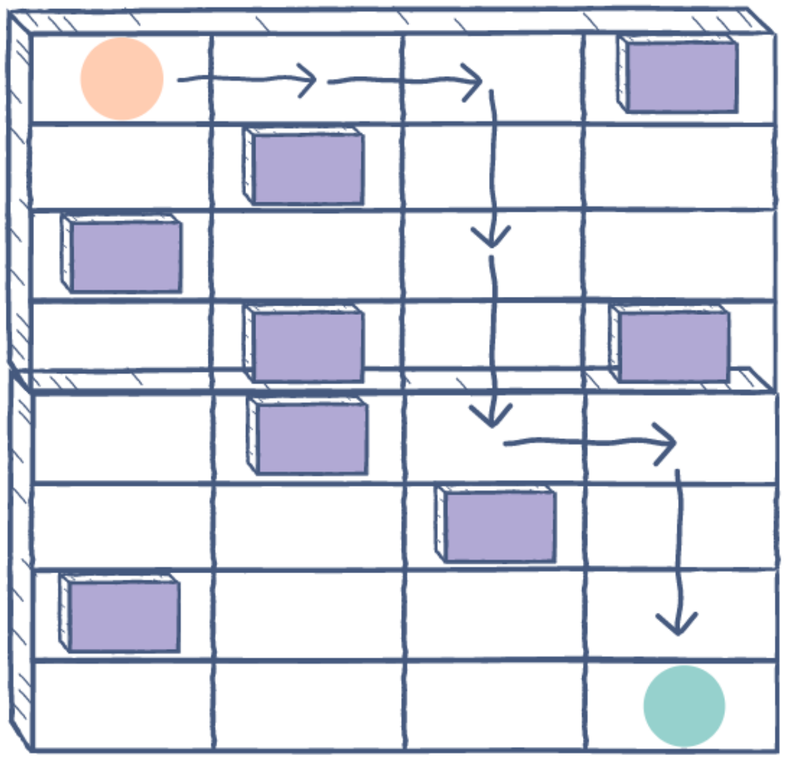
$$f(n) = g(n) + h(n)$$

A* algorithm has 3 parameters:

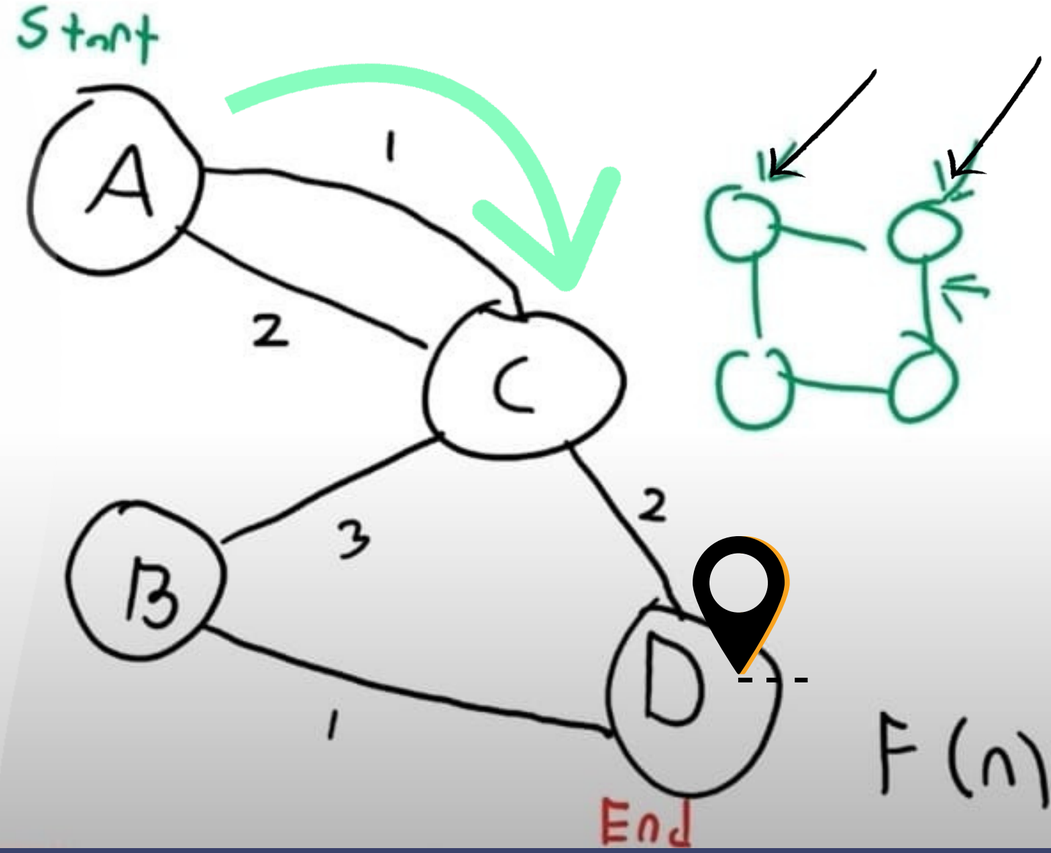
- g : the cost of moving from the initial cell to the current cell. Basically, it is the sum of all the cells that have been visited since leaving the first cell.

- h : also known as the heuristic value, it is the estimated cost of moving from the current cell to the final cell. The actual cost cannot be calculated until the final cell is reached. Hence, h is the estimated cost. We must make sure that there is never an over estimation of the cost.

- f : it is the sum of g and h. So, f = g + h

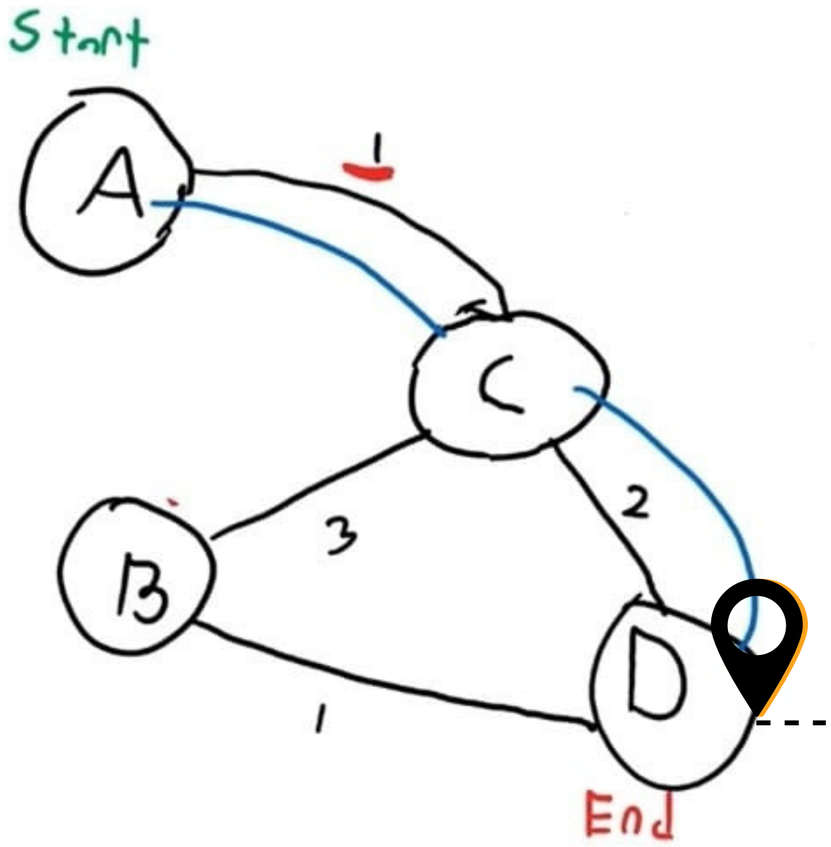


$$f(n) = g(n) + h(n)$$



Node	F	G	H	Last
A				
B				
C				
D				

$$F(n) = G(n) + H(n)$$



Node	F	G	H	Last
A	0	0	0	-
B	6	4	2	C
C	2	1	1	A
D	3	3	0	C

$$F(n) = G(n) + H(n)$$

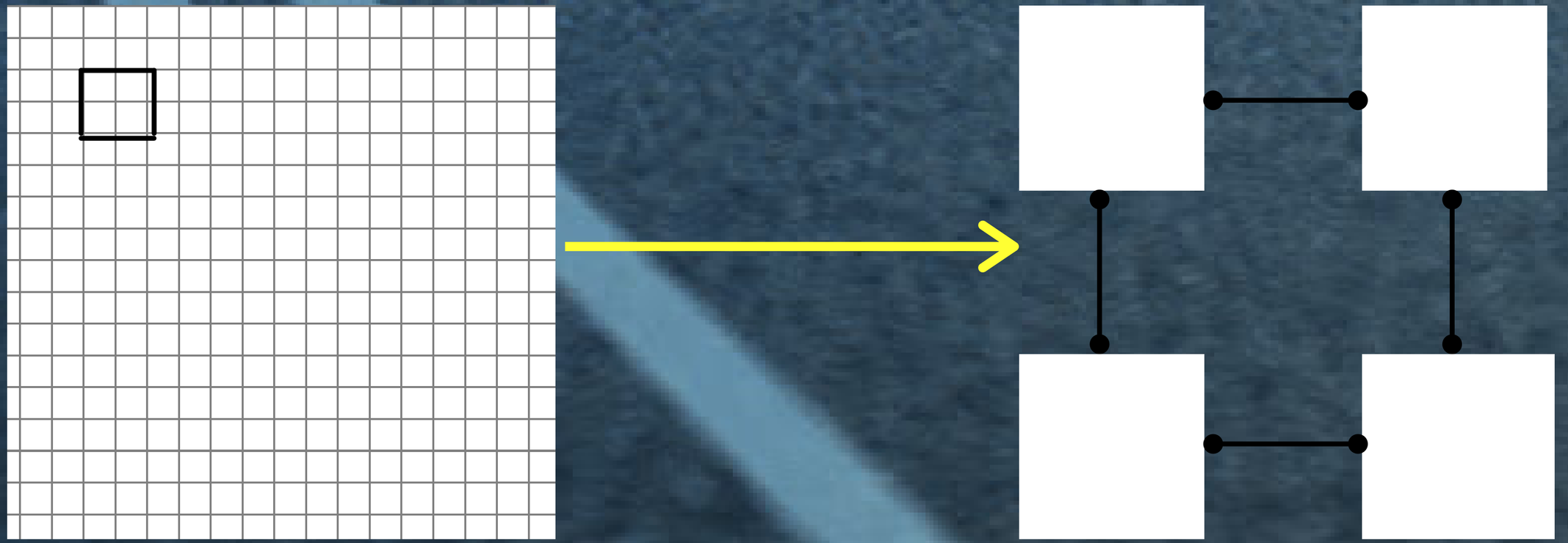
IMPLEMENTATION !

Walkthrough the Code.

pygame is a Python wrapper for the SDL library, which stands for Simple DirectMedia Layer.

SDL provides cross-platform access to your system's underlying multimedia hardware components, such as sound, video, mouse, keyboard, and joystick.

Walkthrough the Code.



A-Star in Soft Computing.

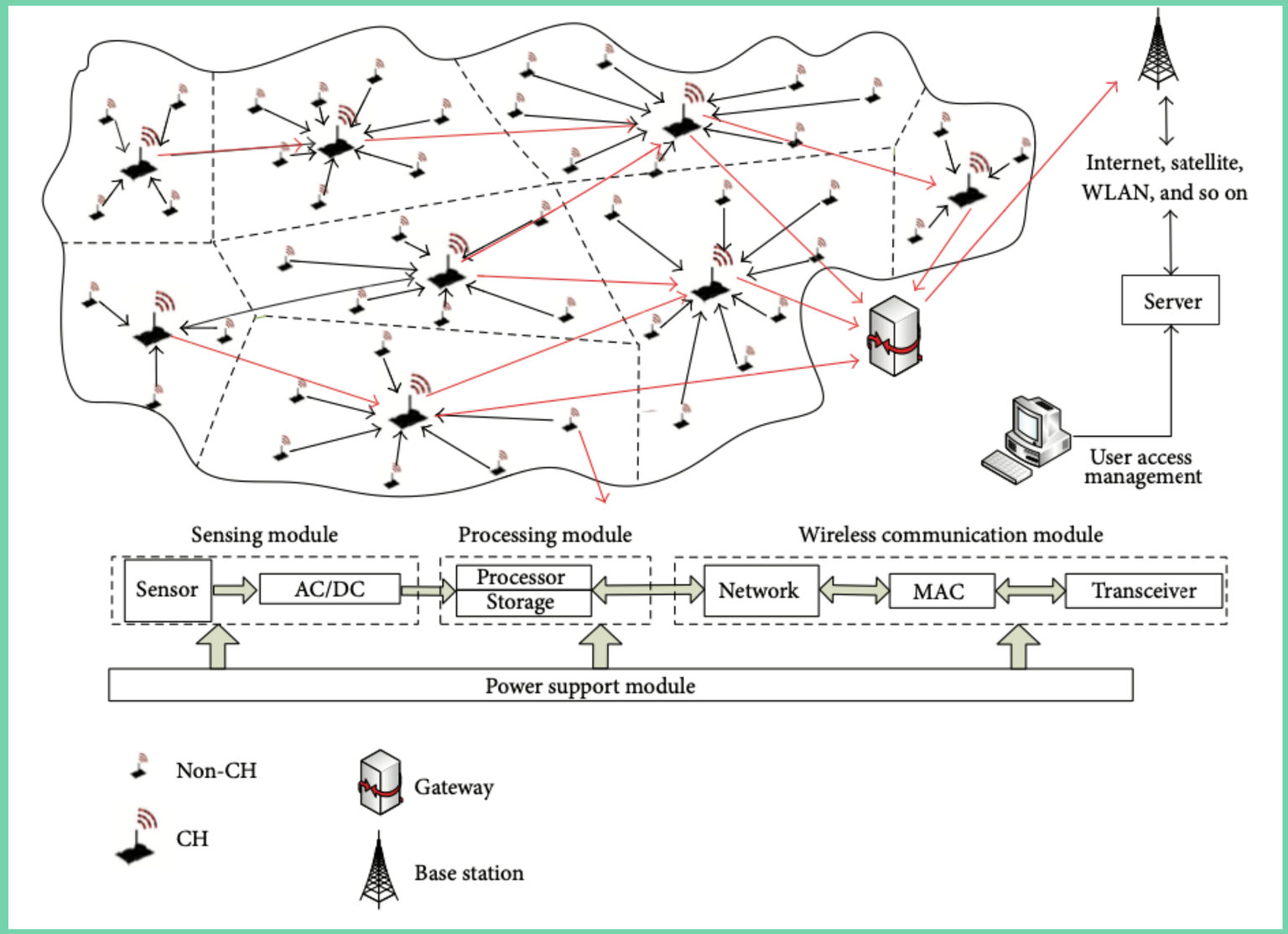
How do we combine the concepts of A-Star and Soft Computing?

CAF: Cluster Algorithm and A-Star with Fuzzy Approach in Wireless Sensor Networks

What are Wireless Sensor Networks?

(WSN) refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. WSNs measure environmental conditions like temperature, sound, pollution levels, humidity, wind, and so on

Wireless Sensor Networks



In WSNs, the death of one node can cause the termination of the entire network

Because the data transmission takes place in hops, each node, being battery powered, may have different amount of energy left in the battery.

SEP Method

Organizing WSNs into clusters enables the efficient utilization of the limited energy resources of the deployed sensor nodes.

The main objective of the SEP method is to avoid the node with low energy becoming a Cluster Head(CH) and control the number of the CHs to the optimal number as well as reducing the uneven distribution of CHs during every round.

In this way, it can reduce the energy cost and extend the life of the network

Fuzzy Approach

(1) Knowledge base: it includes the definition of fuzzy sets and fuzzy operators.
(2) Inference mechanisms: they perform all of the output calculation.
(3) Fuzzifier: it represents the true input value as a fuzzy set.
(4) Defuzzifier: it transfers the output fuzzy sets into real value.

Proposed CAF Algorithm

The primary goal is to design a protocol which can extend the network lifetime by limiting energy consumption and balance the distribution of energy cost.

This approach proposes the CAF routing method which makes use of the SEP(Stable Election Protocol) method, fuzzy approach, and A-star algorithm.

Continued...

Setup Phase:

1. Nodes with more energy left ----> Cluster Heads
2. Nodes with lower energy left ----> Non-CH

Stability Phase:

This is the cluster communication phase. Here, a combination of A-Star and Fuzzy approach will take place.

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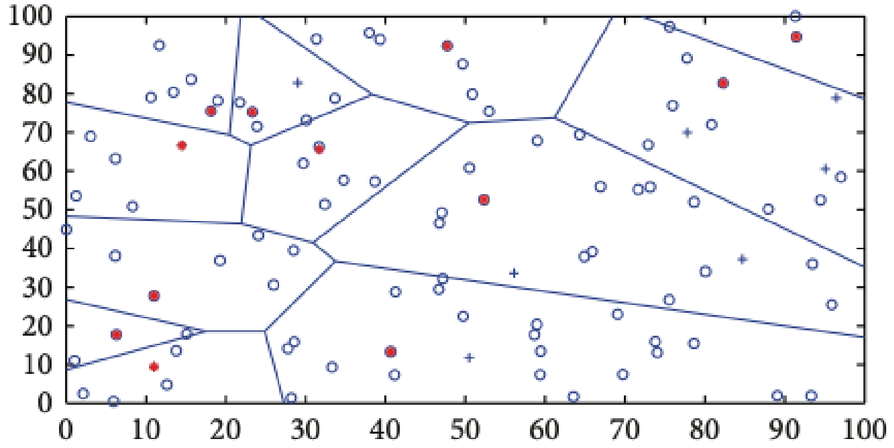

FIGURE 3: A clustering wireless sensor network with all nodes being alive.

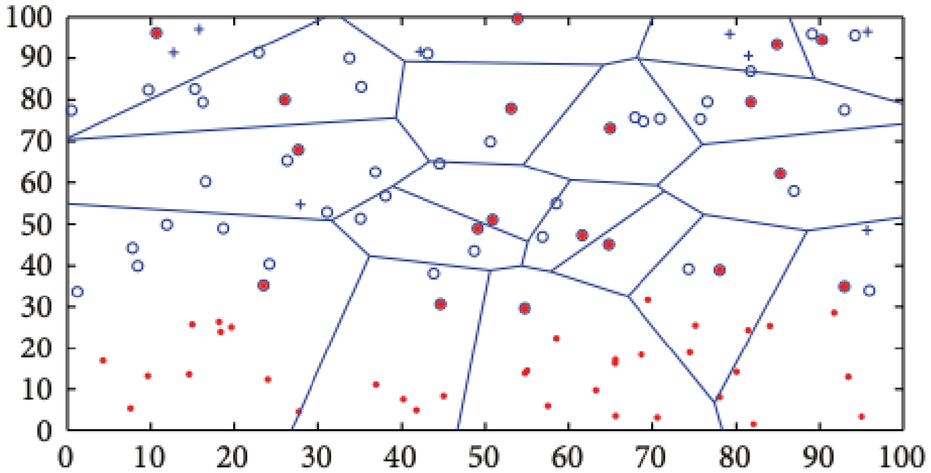

FIGURE 4: A clustering wireless sensor network with some nodes being dead.

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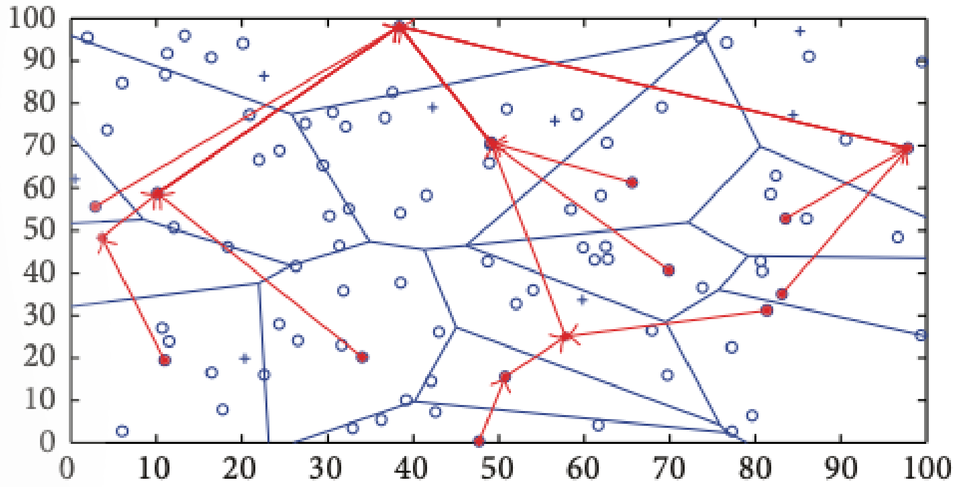

FIGURE 10: The CAF routing method result with all nodes being alive.

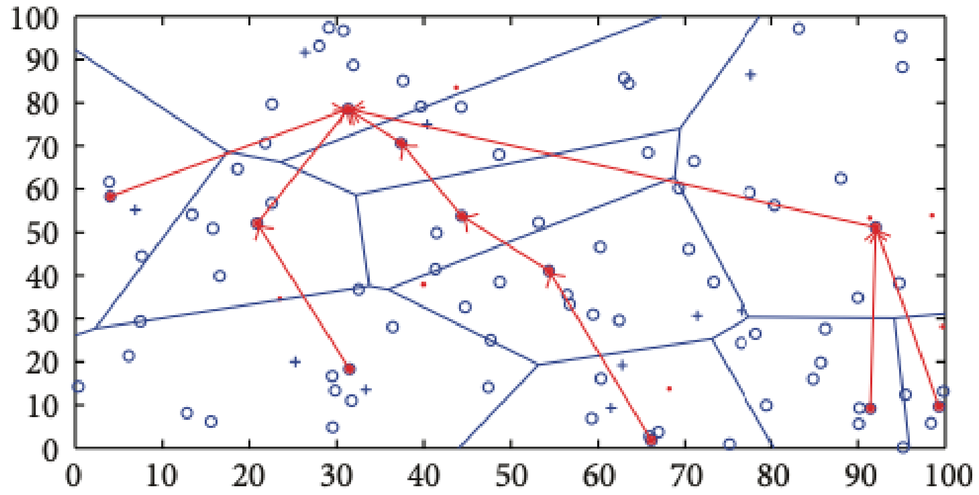

FIGURE 11: The CAF routing method result with some nodes being dead.

Results

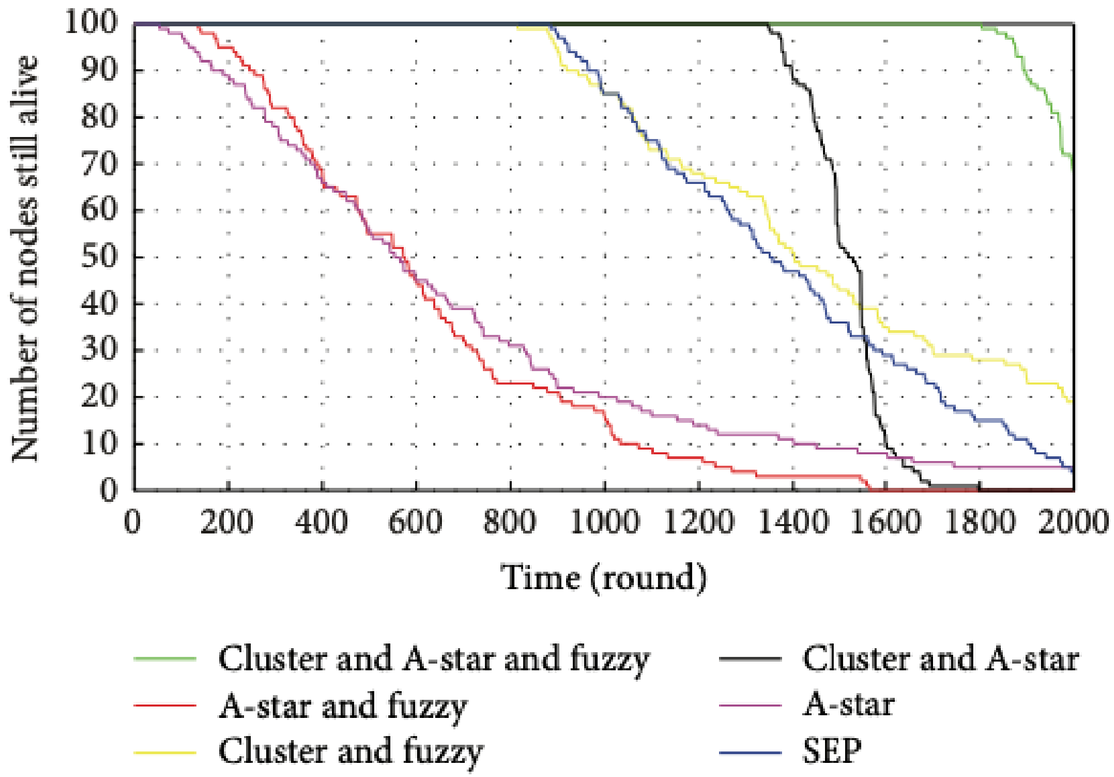

FIGURE 15: Distribution of the nodes being alive according to the number of rounds in Area A.

Results

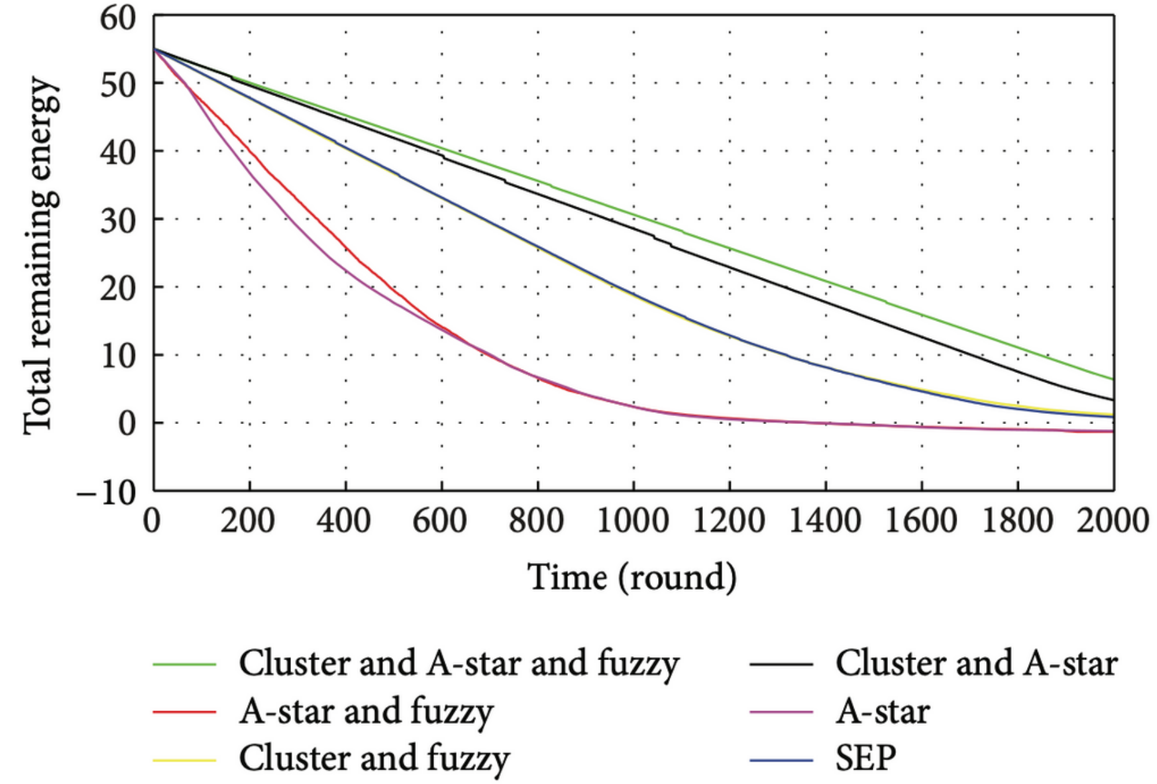

FIGURE 18: Distribution of the total remaining energy according to the number of rounds in Area B.

Reference(s)

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Thank You!