ROMANIAN JOURNAL OF INFORMATION SCIENCE AND TECHNOLOGY
Volume X, Number X, XXXX, XXX–XXX

Supplementary material of the paper A.M. Karadeniz, C. Hajdu and L.T. Kóczy

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This PDF file contains the Introduction part, its references and the steps of the ”A* Graph based Path Finding Algorithm” for the ”Mobile Robot Environment Representation through Fuzzy Signatures-Integrated Quadtrees” entitled article submitted to Romanian Journal of Information Science and Technology. The article link will be shared after the publication.

1. Introduction

Research on environment representation is an essential aspect of robotics. It deals with creating data structures that can capture details about a robot's immediate surroundings. Commonly included in these structures is information about obstacles or other detected features. The primary purpose of these representation formats is to supply crucial data that can be used for reasoning within various algorithms and tasks. Notably, these formats are heavily utilized by motion planning methods, which depend on the accuracy and reliability of the provided environmental data.

Navigating autonomously and circumventing both static and dynamic obstacles in indoor environments is a crucial challenge that mobile robots must overcome to perform their tasks safely. Path optimization stands as a significant area of research, with navigation in static environments proving simpler than in dynamic ones. Addressing this complex issue has led to a multitude of studies, yielding a diverse range of approaches. These vary based on their performance criteria and the nature of the navigation workspace, whether it be static or dynamic [1].

Numerous representation formats have emerged from research in this field, each suited to a variety of scenarios. A popular and practical format is the occupancy grid-based representation [2], which stores important information in a discrete manner. There are also geometry-based formats, such as motion primitives, that capture details about objects of interest. To support these alternative representations, there is an array of spatial data structures designed to index the stored geometric features.

Additionally, studies in fuzzy-based inference systems have yielded various methods for representing information that is uncertain or imprecise. Some systems are organized in a tree-like fashion to enhance structure and improve the performance of inferences. Fuzzy signatures are one such organizational technique that originates from fuzzy graphs.

In this paper, we present an extended exploration of the novel method initially introduced by us in our previous study [3], which integrates fuzzy signatures with quadtrees to effectively capture information about environmental features. We delve into the intricacies of our methodology, examining the intersections between quadtree-based structures and fuzzy signature-based representations. This approach enables us to encode environmental features in a format that is not only adaptable but also inherently sparse. To demonstrate the adaptability of our method, we include a detailed example of a reconstructed grid, which is the output of the inference process performed on the quadtree we constructed.

2. Steps of the A* Graph based Path Finding Algorithm

Steps of the A* graph based path finding algorithm is described in Algorithm 1.

Algorithm 1 A* Path Finding Algorithm

```
Initialize open list with Start node, closed list as empty
while open list is not empty do
    Take node with lowest f from open list
    if node is Goal then
        Reconstruct path from Start to Goal
        return Path
    end if
    Move node to closed list
    for each neighbor of node do
        Calculate g, h, and f for neighbor
        if neighbor is not in open list with lower f then
            Update neighbor's parent, g, h, and f
            Add neighbor to open list if not present
        end if
    end for
end while
return Failure
```

References

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