A* Pathfinding Acceleration with use of Auto-Generated Waypoints for Grid Traversal

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March 19, 2019

Abstract– Sammanfattar rapporten Varför är vår rapport värd att läsa? Syfte, metod Viktiga resultat och slutsatser Nyckelord "Tänk på att detta skall kunna läsas fristående"

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1 Introduction

Pathfinding is a fundamental part of games [1][2] and it is often supplemented by a waypoint graph to make traversal of a given region easier [1]. Every node in a waypoint graph is called a waypoint and they represent key locations in the region [1]. Each waypoint has edges towards other waypoints to where an object can travel through without risk of colliding with the surroundings [1].

In this paper, we propose a method to reduce execution time of the A* pathfinding algorithm. We improve our previously implemented A* algorithm with automatically generated and connected waypoints in a two-dimensional grid coordinate system. The waypoint generation is done in two steps. First, we generate a waypoint for each corner of an obstacle. Second, we check connections for every waypoint by sending a ray towards all other waypoints in the region. The waypoints are connected if the rays path is unblocked. Our waypoint generation method is heavily influenced by the one suggested in the work of Weiping et al. [1].

Executing pathfinding in dynamic environments is more challenging than in static environments [1], and this study is therefore limited to completely static environments. The difference between the two terms path and shortest path is significant [3]. We conducted studies of several pathfinding combinations, with and without waypoints, but we decided not to measure the time consumption of the shortest path with only A* pathfinding.

This is introduction lol
Syfte
Frågeställning
Hypoteser
Avgränsningar

2 Background

Stort spel
Bakgrundsfakta (Definitioner som du använder dig av senare)
Saker som läsaren behöver veta för att förstå din rapport
Vad har gjorts tidigare?

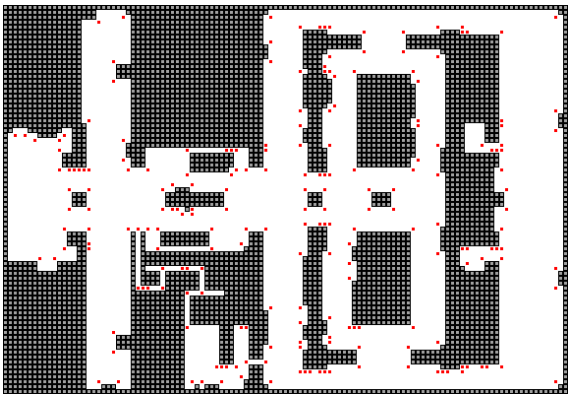

Figure 1: Map Edgy
9085 tiles, 4226 blocked (46.5%). 214 waypoints with 2228 connections

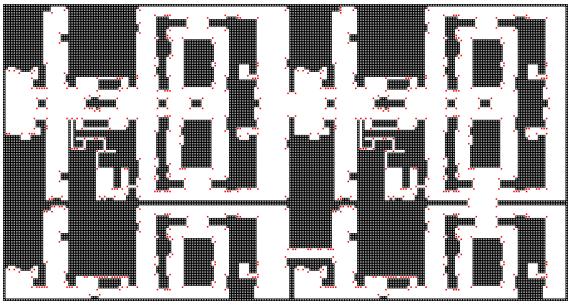

Figure 2: Map Edgy2
26550 tiles, 12854 blocked (48.4%). 658 waypoints with 6458 connections

3 Related work

Informationssökning
Urval av litteratur - skriv inte om allt utan det viktigaste för din rapport

4 Method

Hur vi autogenerar (mycket referens till research articles)
Vad har du gjort?
Vilka metoder har du använt?
Vad har du kommit fram till?
Var noggrann och utförlig så att det går följa vad du gjort?
Motivera om du antar något
Diskutera begränsningar

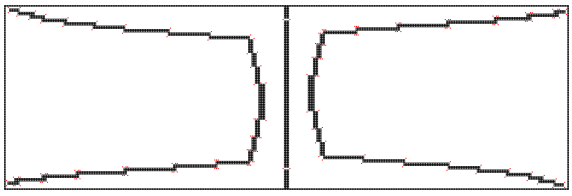

Figure 3: Map UMAP2
35748 tiles, 2890 blocked (8%). 179 waypoints with 2038 connections

5 Result

Every experiment done has shown a P value below 0.5. The results show that the the waypoints prove to be helpful for the A* algorithm in form of speed, which is the initial purpose of this research, whith an exception of the smallest map Edgy. On this map, the based on the results, it dosnt matter what heuristics

6 Discussion

On smaller maps with a lot of waypoint connections, raw A* is quicker than with our generation of waypoints. But when the map starts to scale, waypoints are significantly better than just A* by itself.

References

[1] Weiping Zhu, Daoyuan Jia, Hongyu Wan, Tuo Yang, Cheng Hu, Kechen Qin, Xiaohui Cui, *Waypoint Graph Based Fast Pathfinding in Dynamic Environment*, International Journal of Distributed Sensor Networks, vol. 2015, Article ID 238727, 12 pages, August 2015. https://doi.org/10.1155/2015/238727.

[2] Zeyad Abd Algfoor, Mohd Shahrizal Sunar, Hoshang Kolivand, *A Comprehensive Study on Pathfinding Techniques for Robotics and Video Games*, International Journal of Computer Games Technology, vol. 2015, Article ID 736138, 11 pages, 2015. https://doi.org/10.1155/2015/736138.

[3] Geethu Elizebeth Mathew, *Direction Based Heuristic For Pathfinding In Video Games*, Procedia Computer Science, vol. 47, pp. 262-271, 2015.

[4] Leslie Lamport, *LaTeX: a document preparation system*, Addison Wesley, Massachusetts, 2nd edition, 1994.