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第八章作业分享

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纲要

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➢ Heuristic Functions of A* Algorithm

- No Heuristics
- Manhattan Distance
- Diagonal Distance
- Euclidean Distance

```
double AstarPathFinder::getHeu(GridNodePtr node1, GridNodePtr node2)
{
    /*
    choose possible heuristic function you want
    Manhattan, Euclidean, Diagonal, or 0 (Dijkstra)
    Remember tie_breaker learned in lecture, add it here ?
    */
    bool tie_breaker = true;
    double distance_heuristic;
    Eigen::Vector3d node1_coordinate = node1->coord;
    Eigen::Vector3d node2_coordinate = node2->coord;
```

- Different from Lecture, here we consider 3D case.

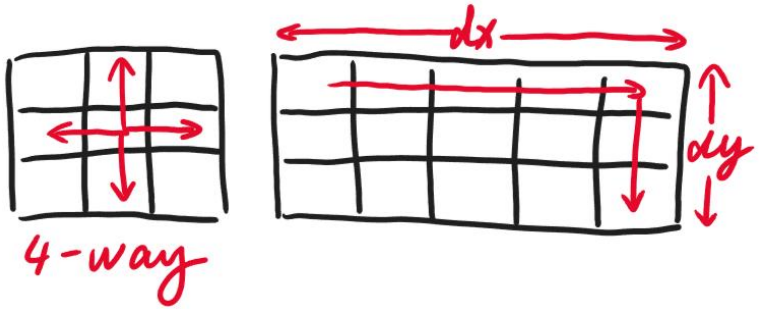
Heuristic Functions of A*

- No Heuristics
- A* Algorithm → Dijkstra's Algorithm

```
// Additional: Dijkstra
distance_heuristic = 0;
```

Heuristic Functions of A*

- Manhattan Distance
- Consider 1-norm distance
- $H = |\Delta x| + |\Delta y| + |\Delta z|$



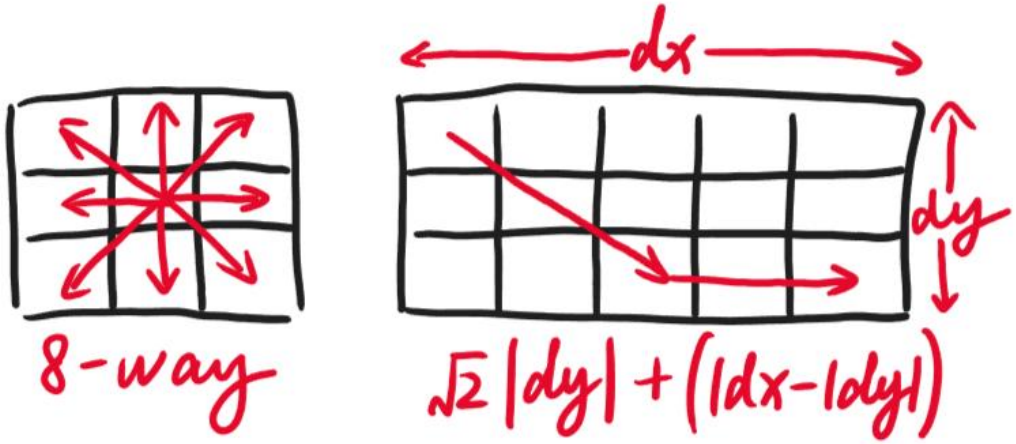

```
// **** TODO: Manhattan *****
// Reference to Lecture Slide P49
double dx = abs(node1_coordinate(0) - node2_coordinate(0));
double dy = abs(node1_coordinate(1) - node2_coordinate(1));
double dz = abs(node1_coordinate(2) - node2_coordinate(2));

double D1 = 1;
double D2 = sqrt(2);
double D3 = sqrt(3);

distance_heuristic = D1 * (dx + dy + dz);
```

Heuristic Functions of A*

- Diagonal Distance
- For 2D case:
- $H = |\Delta x| + |\Delta y| + (\sqrt{2} - 2) \min(|\Delta x|, |\Delta y|)$



Heuristic Functions of A*

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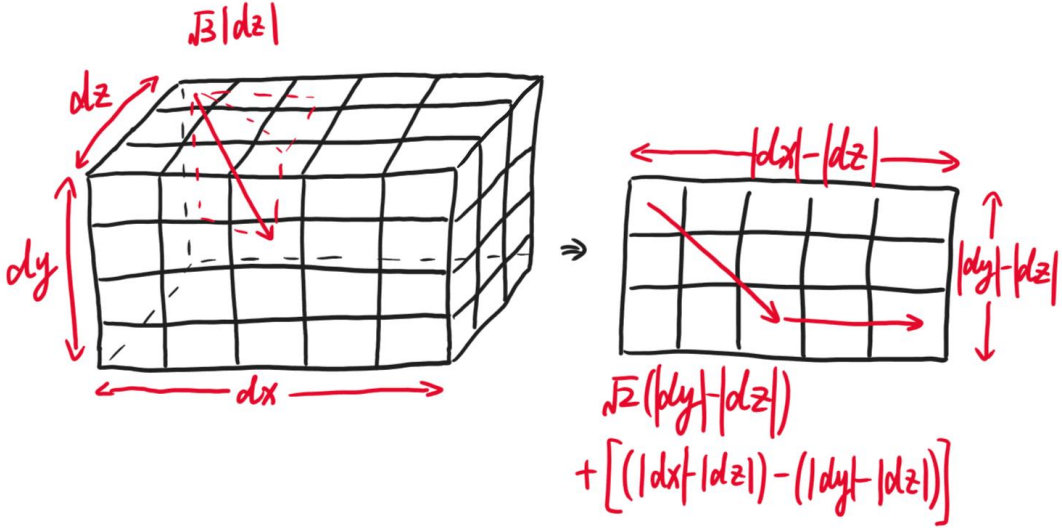
- Diagonal Distance
- Extension to 3D case:

https://stackoverflow.com/questions/53116475/calculating-diagonal-distance-in-3-dimensions-for-a-path-finding-heuristic

- $H_{2D} = |\Delta x| + |\Delta y| + (\sqrt{2} - 2) \min(|\Delta x|, |\Delta y|)$
- $H_{3D} = dmax + (\sqrt{2} - 1)(|\Delta x| + |\Delta y| + |\Delta z| - dmin - dmax) + (\sqrt{3} - \sqrt{2})\, dmin$

Heuristic Functions of A*

- Diagonal Distance
- $H_{3D} = dmax + (\sqrt{2} - 1)\,(|\Delta x| + |\Delta y| + |\Delta z| - dmin - dmax) + (\sqrt{3} - \sqrt{2})\,dmin$
- $H_{3D} = |\Delta x| + (\sqrt{2} - 1)\,|\Delta y| + (\sqrt{3} - \sqrt{2})\,|\Delta z|$



Heuristic Functions of A*

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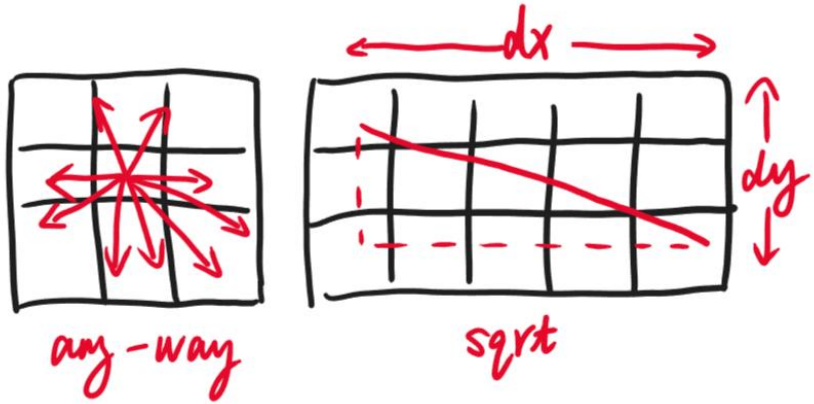
- Diagonal Distance
-

$$H_{3D} = dmax + (\sqrt{2} - 1)\,(|\Delta x| + |\Delta y| + |\Delta z| - dmin - dmax) + (\sqrt{3} - \sqrt{2})\,dmin$$

```
// **** TODO: Diagonal  *****
// Reference to Lecture Slide P50, where the case is 2D
// here for 3D case, reference to https://stackoverflow.com/questions/
double dmin = min({dx, dy, dz});
double dmax = max({dx, dy, dz});
double dmid = dx + dy + dz - dmin - dmax;
distance_heuristic = (D3 - D2) * dmin + (D2 - D1) * dmid + D1 * dmax;
```

Heuristic Functions of A*

- Euclidean Distance
- Consider 2-norm distance
- $H = \sqrt{|\Delta x|^2 + |\Delta y|^2 + |\Delta z|^2}$




```
// **** TODO: Euclidean  *****
// Reference to Lecture Slide P51
distance_heuristic = D1 * sqrt(pow(dx, 2) + pow(dy, 2) + pow(dz, 2));
```

在线问答

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Q&A

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感谢各位聆听！

Thanks for Listening