

# Application of artificial intelligence methods for route planning on multilayered maps

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## Problem at hand:

- Pathfinding on weighted maps
- Input is vectorized or rasterized
  
- Graph based approach
- Geometry based approach

# Graph based algorithm

- Why use this?
- Dijkstra finds optimal path to everywhere
- We only need one end destination
- How to search nodes "closer" to goal?
- With heuristic!
- $g(v) = f(v) + heu(v)$

# Graph based algorithm

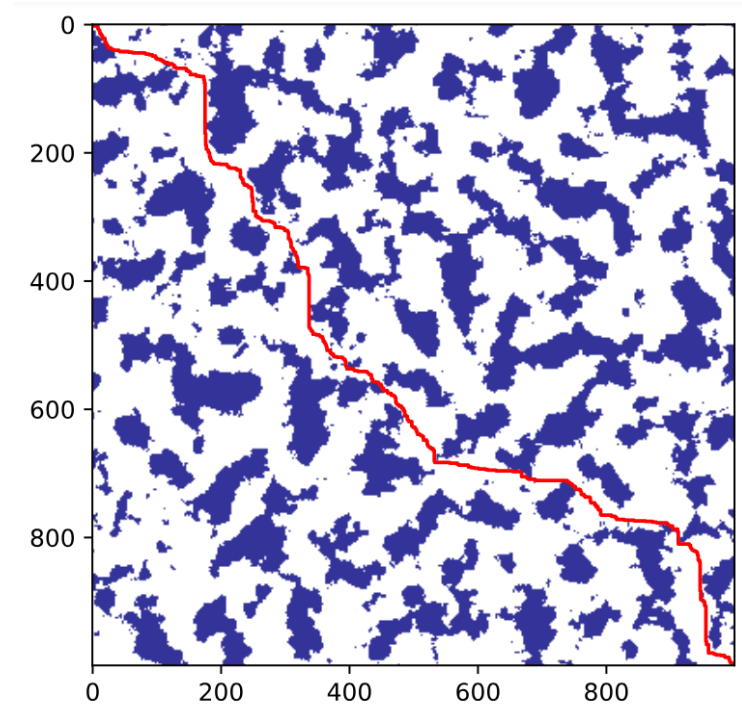
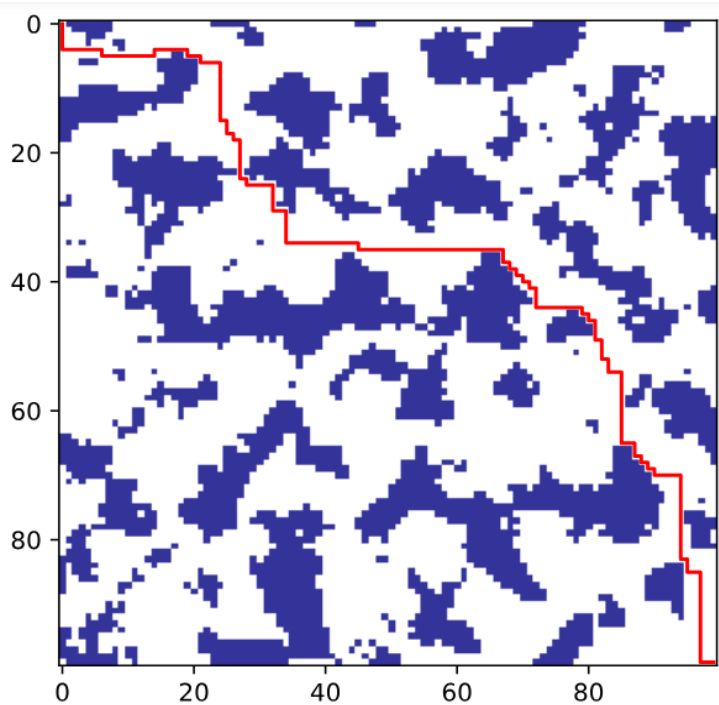
- The first paper with A\* in 1968
- It is already well documented
- When is it optimal?
- **Admissible** if it never overestimates the cost of reaching the goal
  - For all X:  $h(X) \leq h^*(X)$
  - Where  $h(X)$  is cost indicated by heuristic and  $h^*(X)$  is the optimal cost to reach the goal from X

# Graph based algorithm

- The first paper with A\* in 1968
- It is already well documented
- When is it optimal?
- **Consistent** if its estimate is always less than or equal to the estimated distance from any neighbouring vertex to the goal, plus the cost of reaching that neighbour.
  - $h(X) \leq c(X,Y) + h(Y)$  and  $h(\text{goal}) = 0$

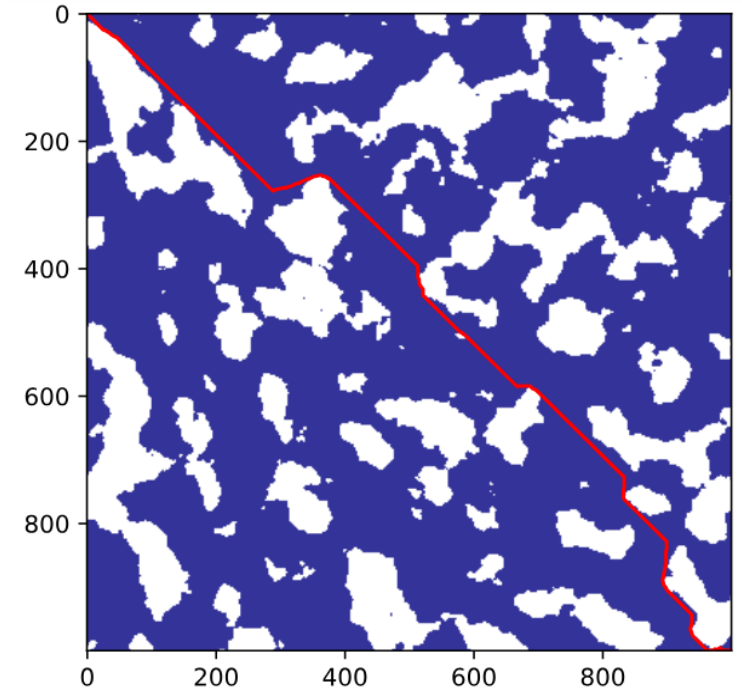
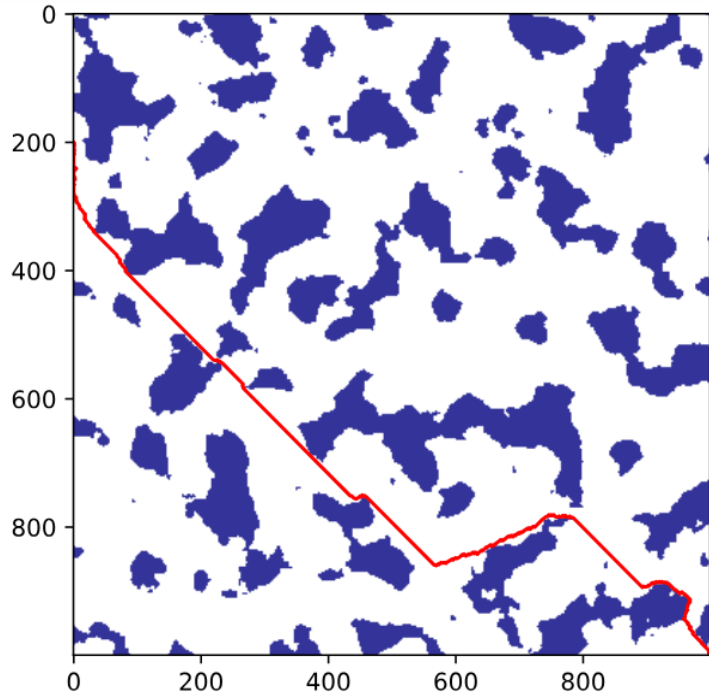
# Graph based algorithm

Every node has 4 neighbours



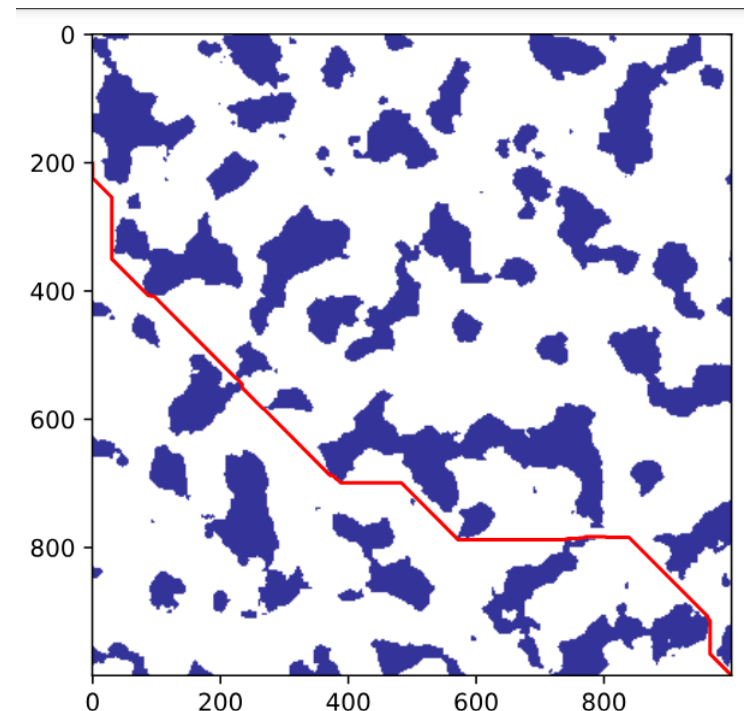
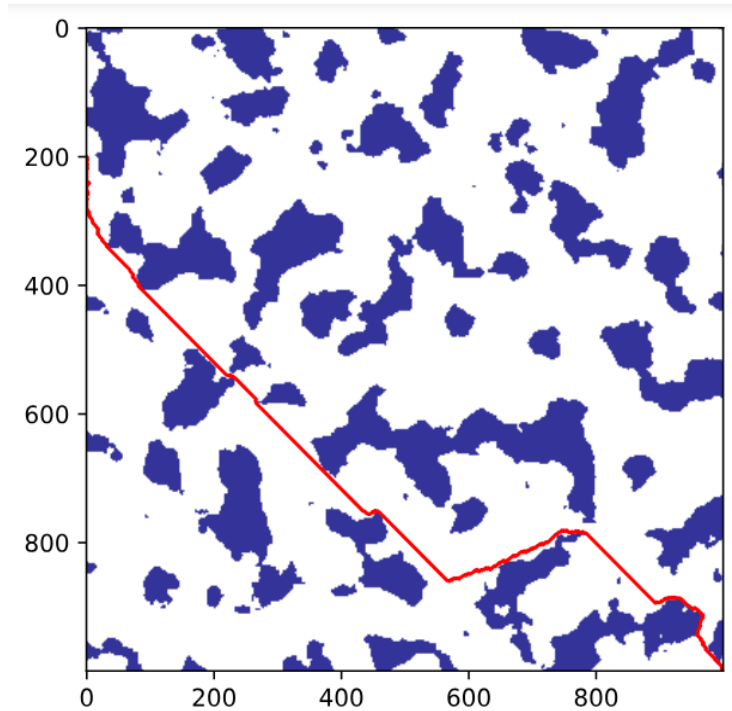
# Graph based algorithm

Every node has 8 neighbours but  
bad heuristic



# Graph based algorithm

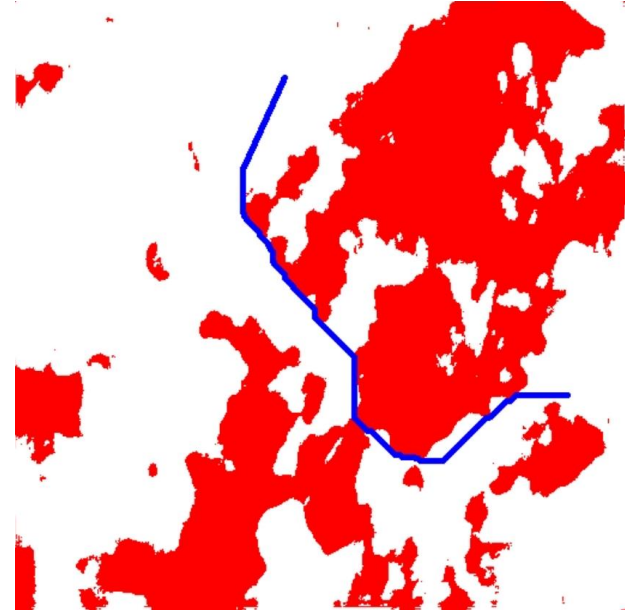
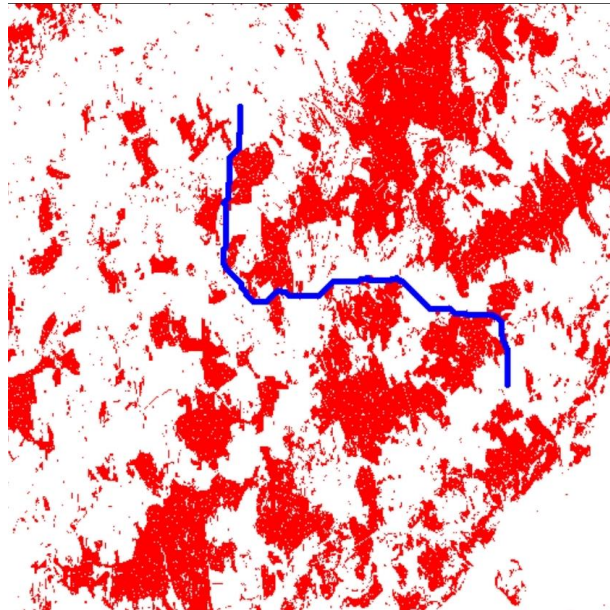
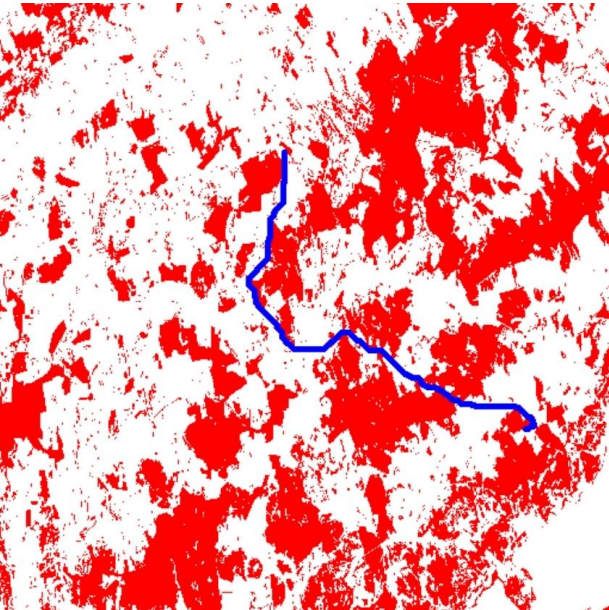
## Bad heuristic vs good heuristic





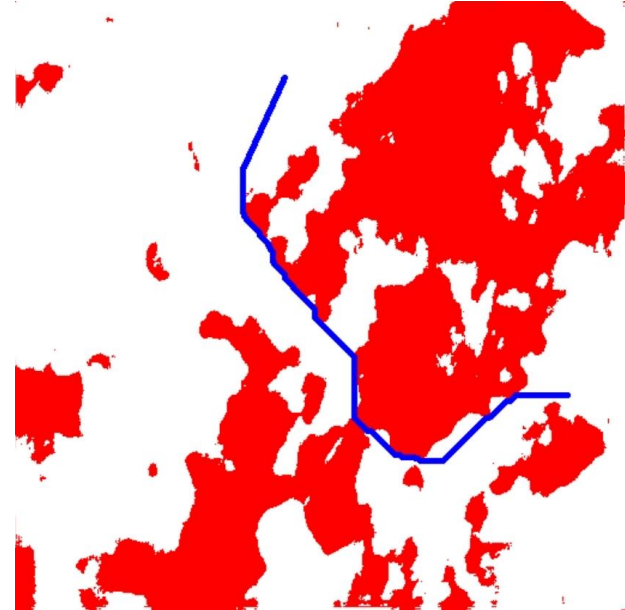
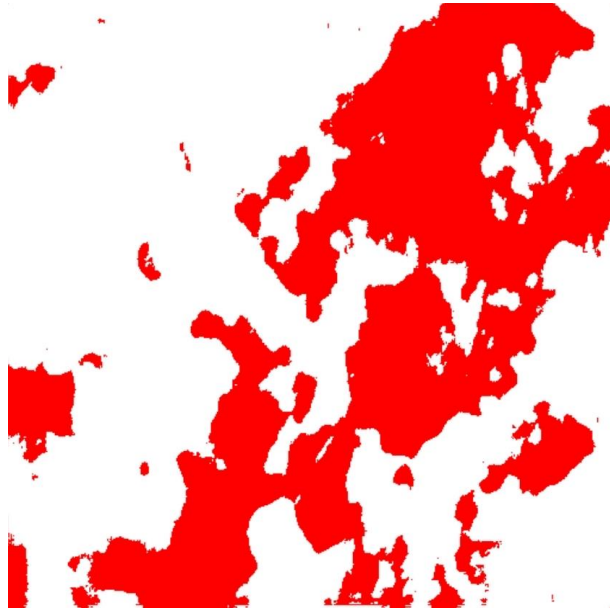
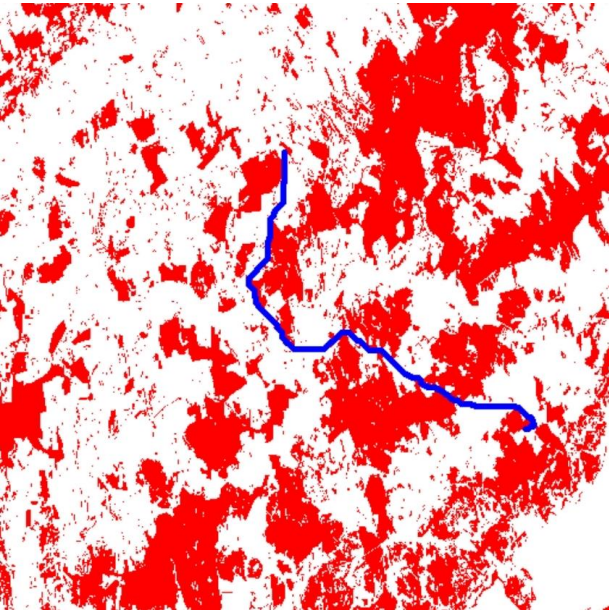
# Graph based algorithm

Using it on real data



# Graph based algorithm

Using it on real data





# Geometry based approach

Why use this?

1. Straight path
2. If no blocking --> finished
3. If blocking try to bypass
  - Two ways: left and right
4. Store the two paths, look for the shortest, and iterate from step 2

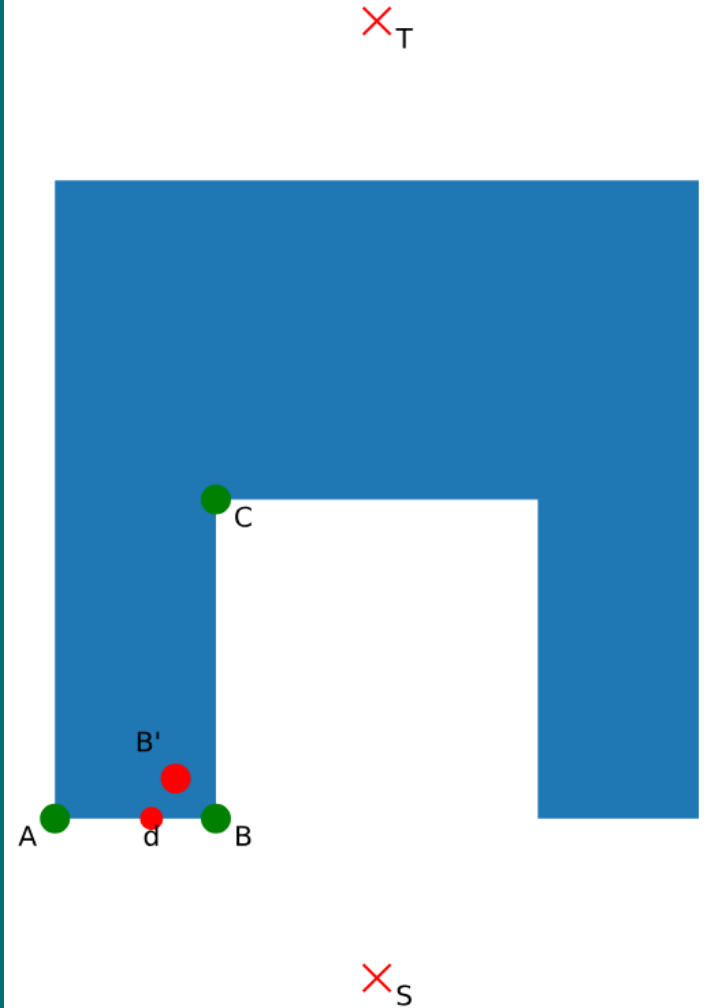


# Geometry based approach

- How to bypass two ways?
- How to find visible points?
- What order to reach them?
- Next steps, other improvements

# Geometry based approach

- How to bypass two ways?
- How to find visible points?





## Geometry based approach

- What order to reach them?
  - Continuous dijkstra, wavefronts
- Next steps, other improvements

A decorative header consisting of a pattern of teal and dark blue triangles of various sizes and orientations, creating a geometric, low-poly effect.

Thank you for your attention!