Exercise Cartographic Explorer (ECE)

Team 042

OUR MISSION

Empowering sports enthusiasts with the tools to discover and access the best outdoor experiences effortlessly

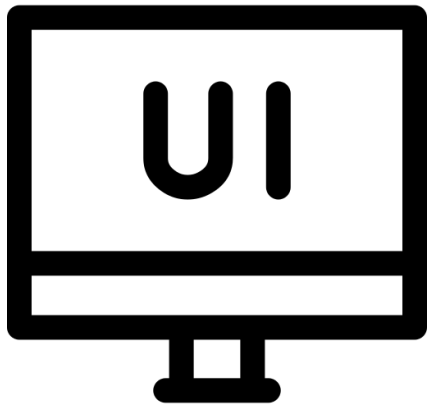
MEET OUR TEAM

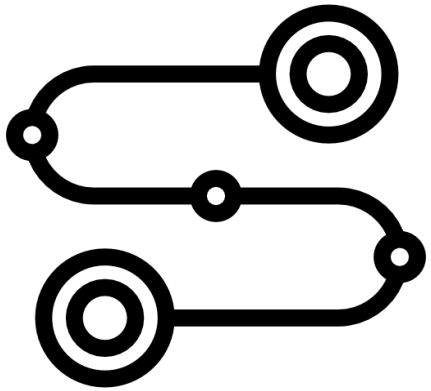
Yangyijian Zhou

Ruibo Zhang

Yikun Wang

Structure





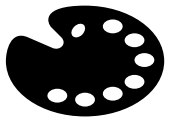
UI Design/ features

Algorithm

Future Pitch

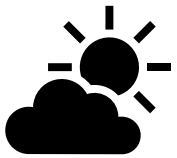
UI Design/ features

Color Scheme



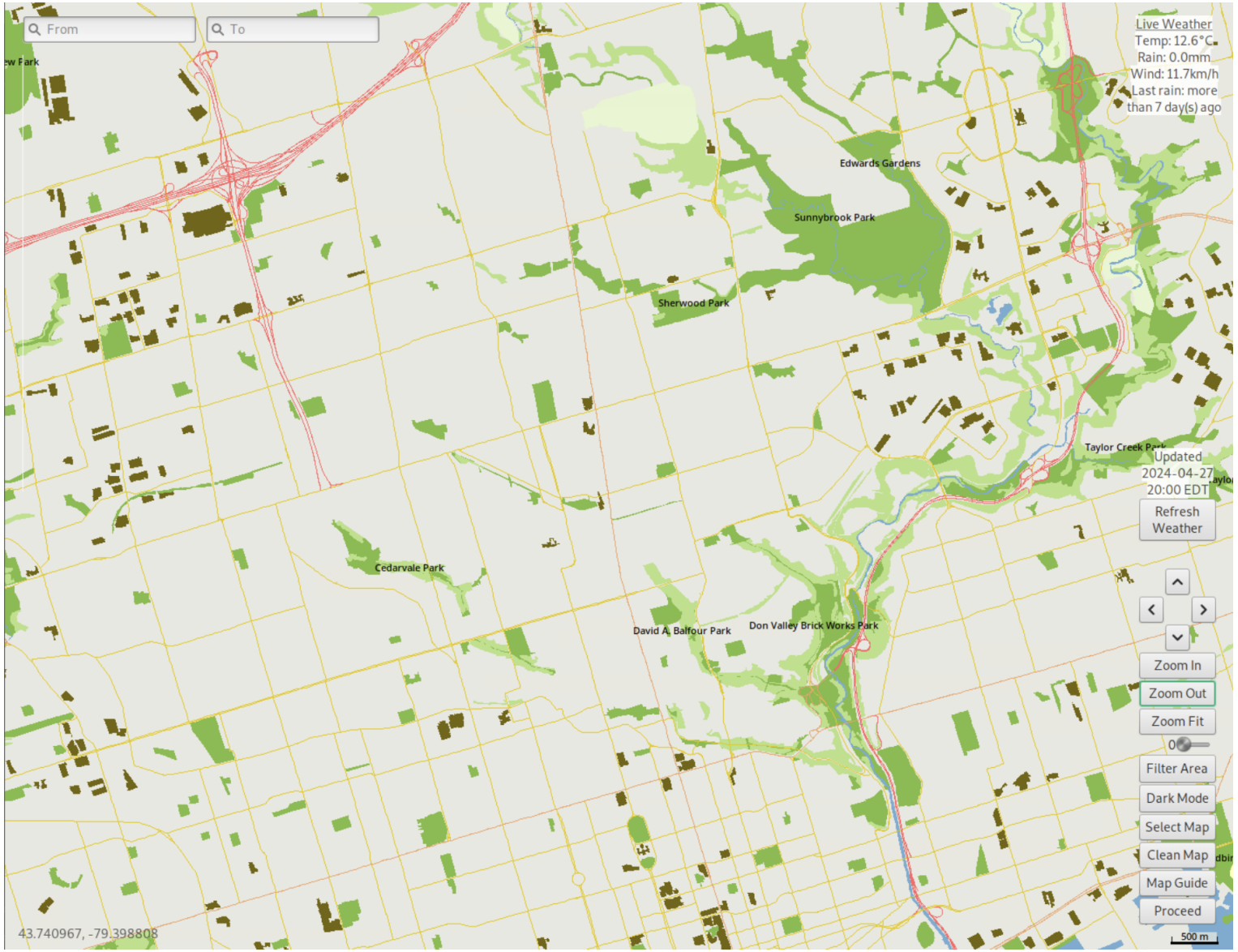
Filtering

Weather



Path Visualization

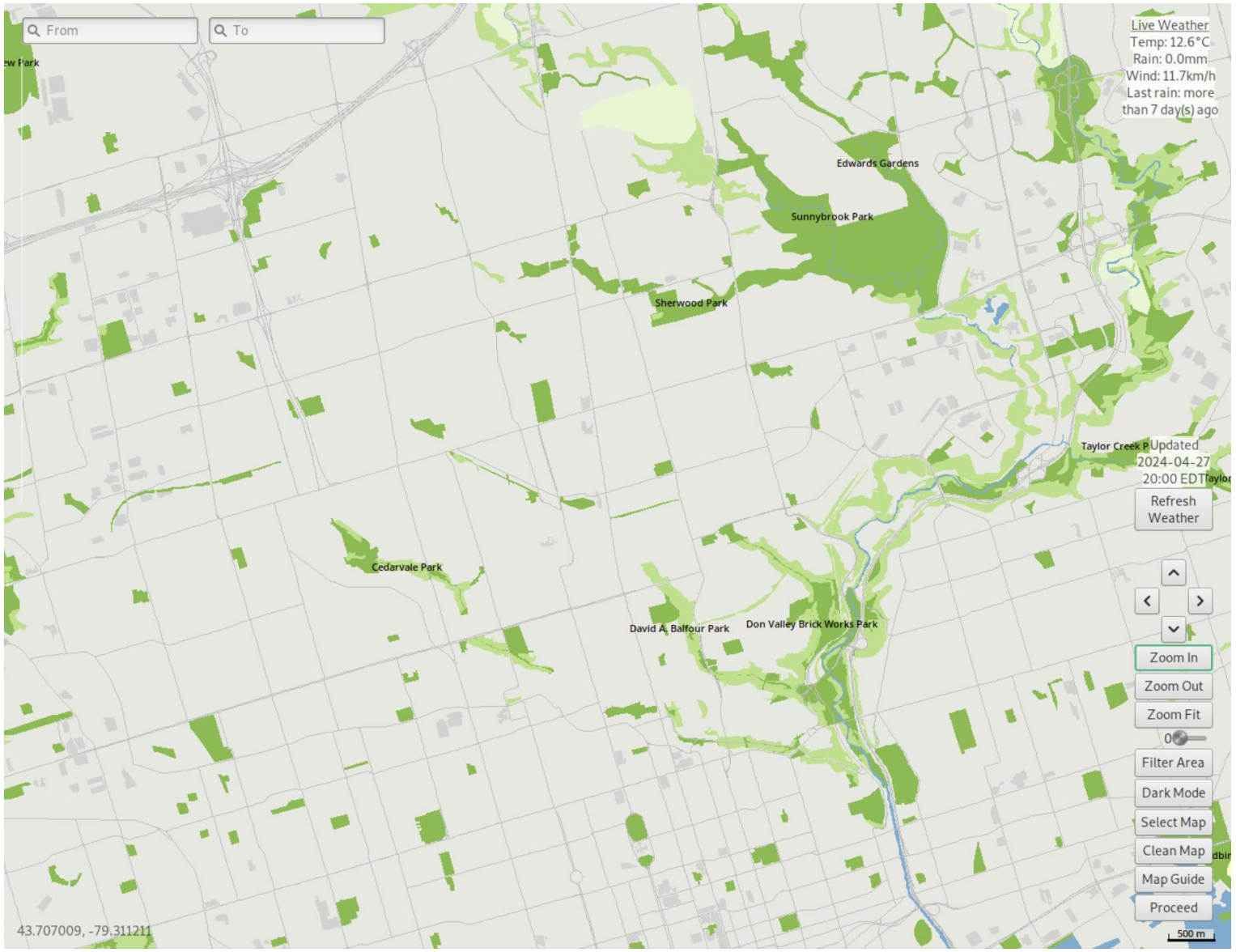
COLOR SCHEME Make Green Stand Out



- Easy Identification and navigation
- Universally recognized association:

  Green to Greenspaces [1]

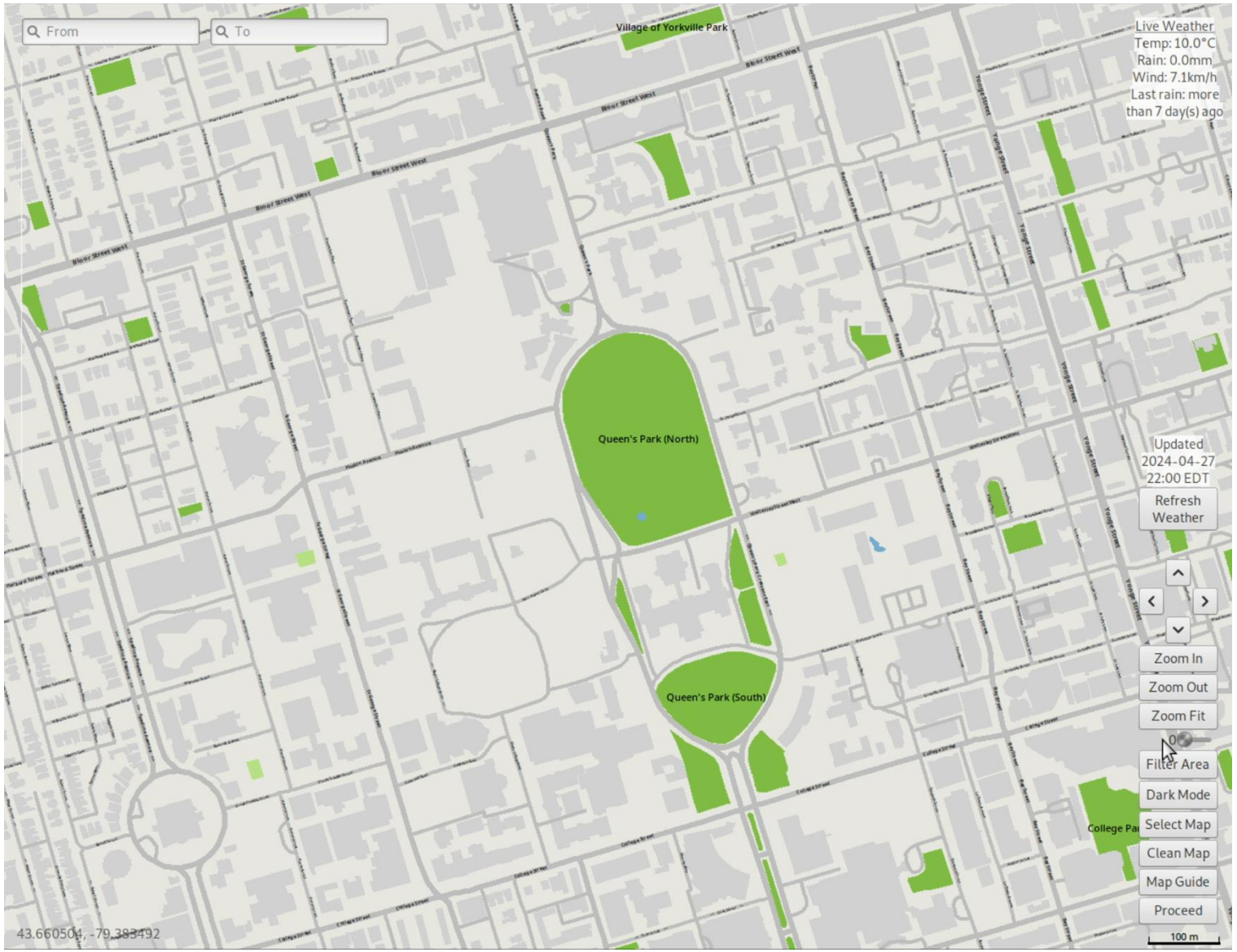
COLOR SCHEME Make Green Stand Out



- Easy Identification and navigation
- Universally recognized association:

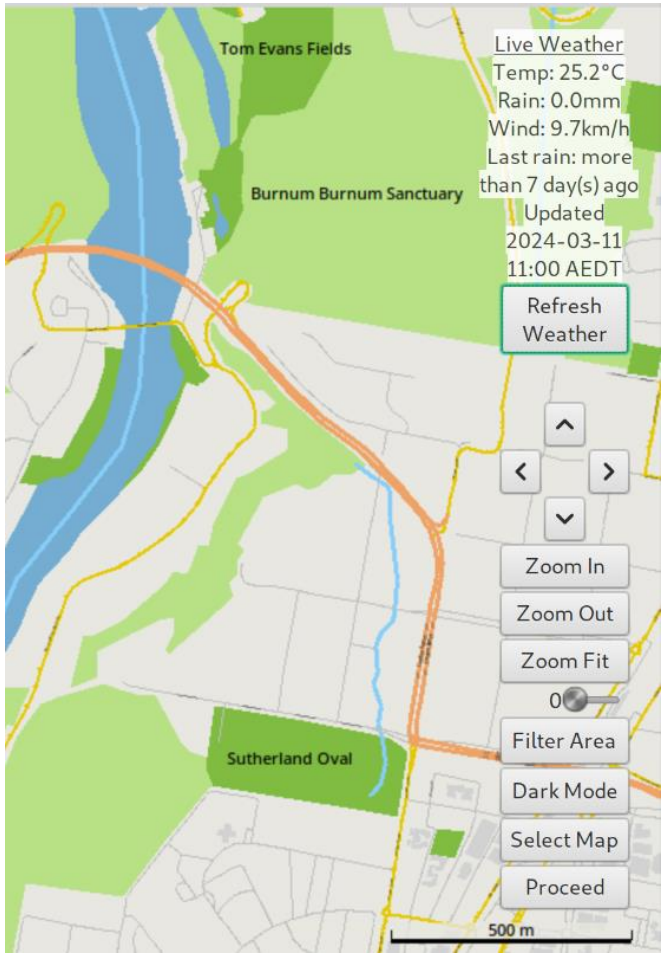
  Green to Greenspaces [1]

FILTERING Finding Without Searching



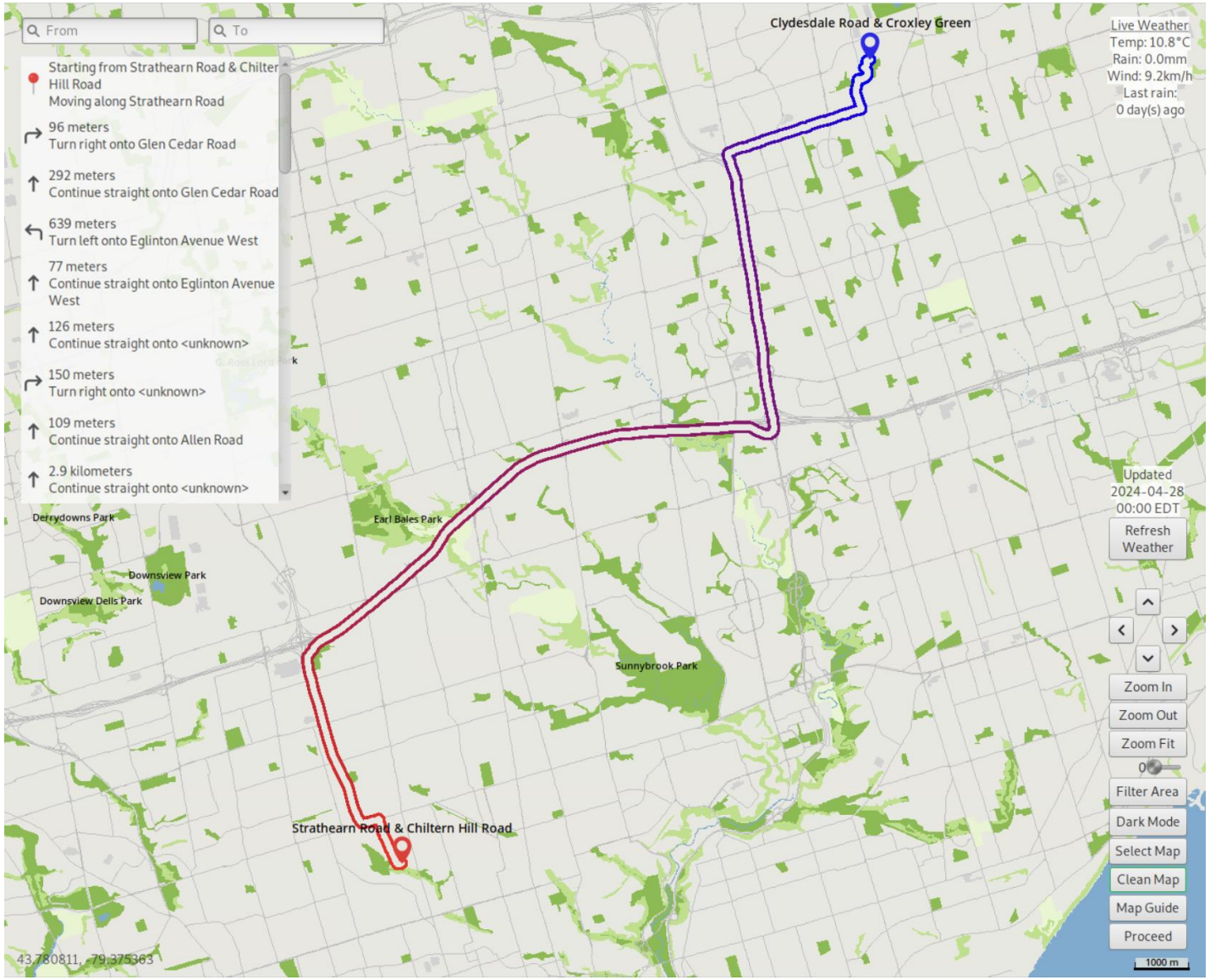
- Visualize Area
- Adjustable Threshold
- Purple stands out [2]

WEATHER Past and Present



- Preparation
- Convenience
- Safety

Path Visualization

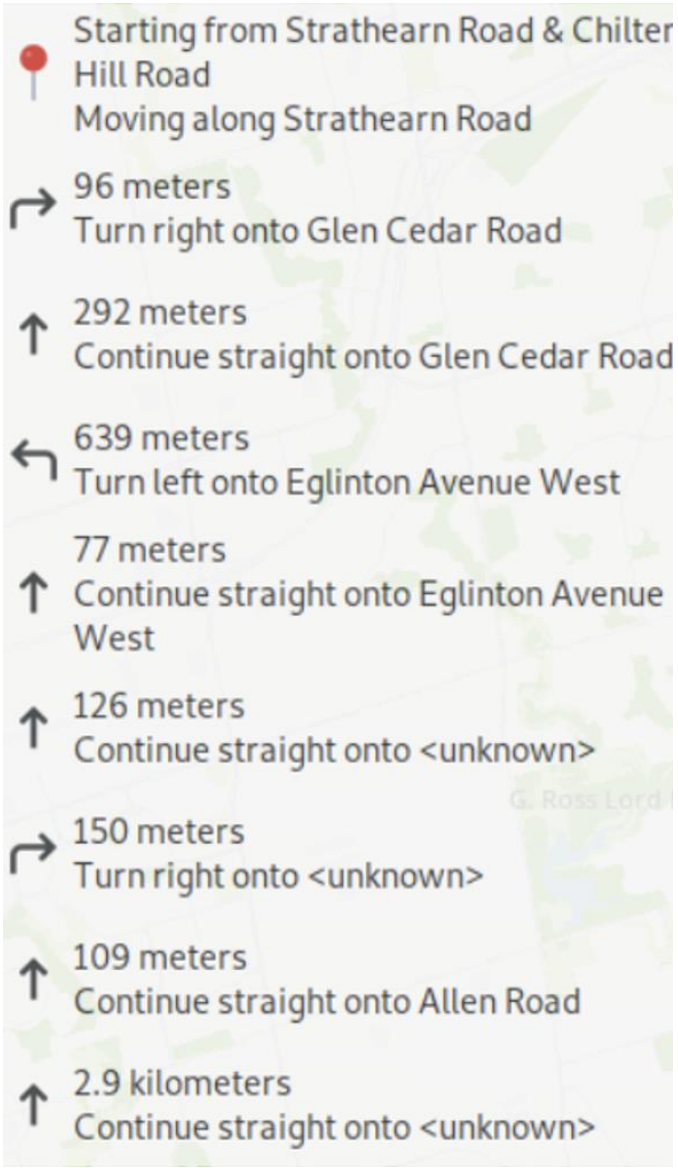


Starting point

Destination

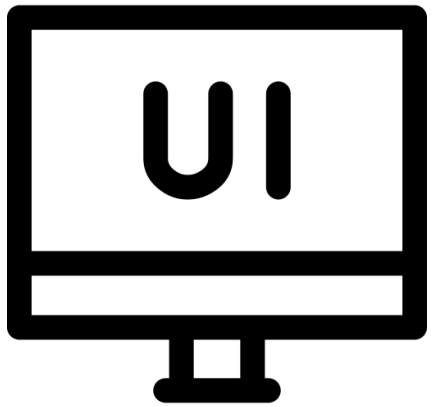
- Path indication (Start to end)
- Informative navigation instruction

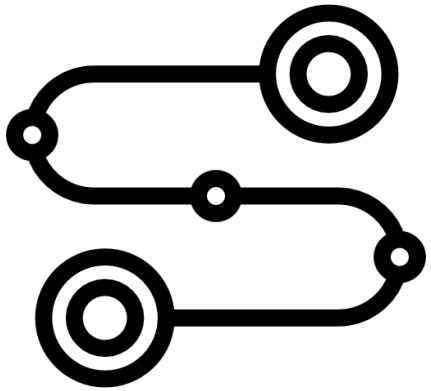
Path Visualization



- Path indication (Start to end)
- Informative navigation instruction

Structure





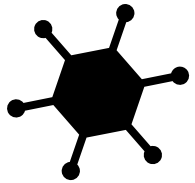
UI Design/ features

Algorithm

Future Pitch

Algorithm

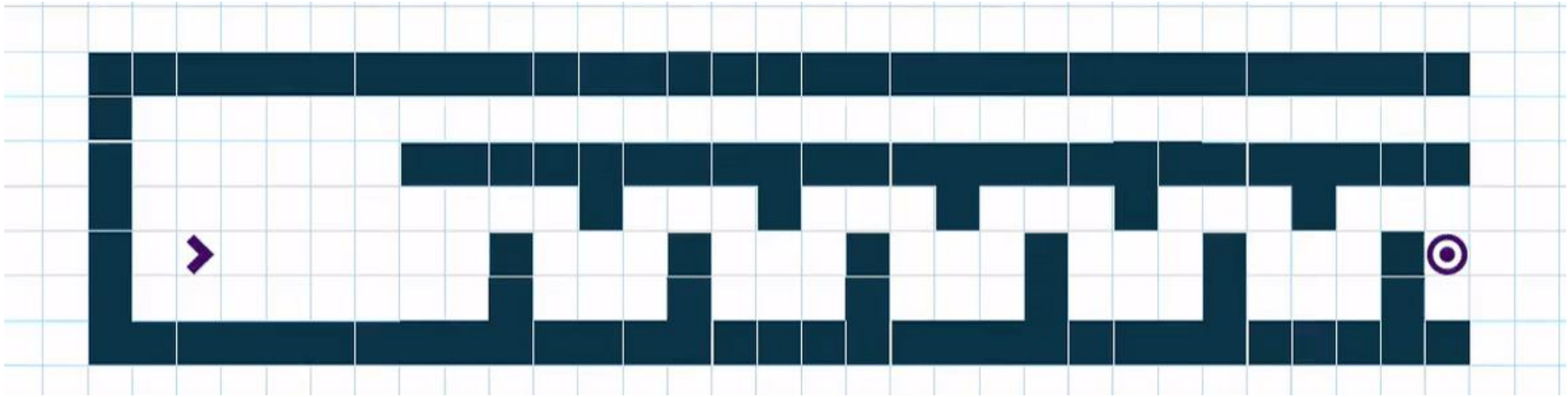
Dijkstra's



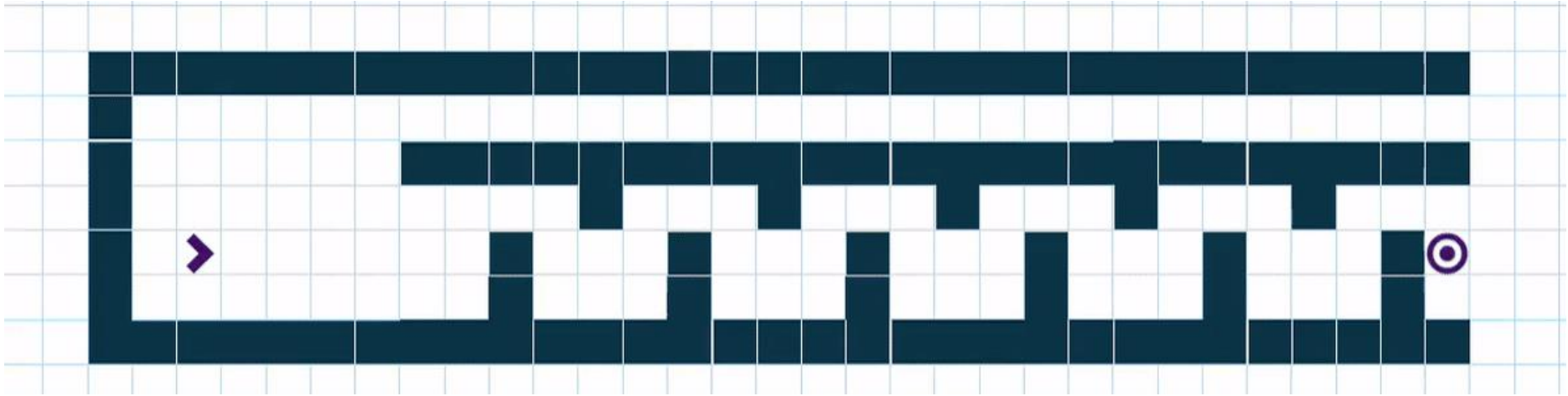
Ant Colony

Simulated Annealing

Pathfinding

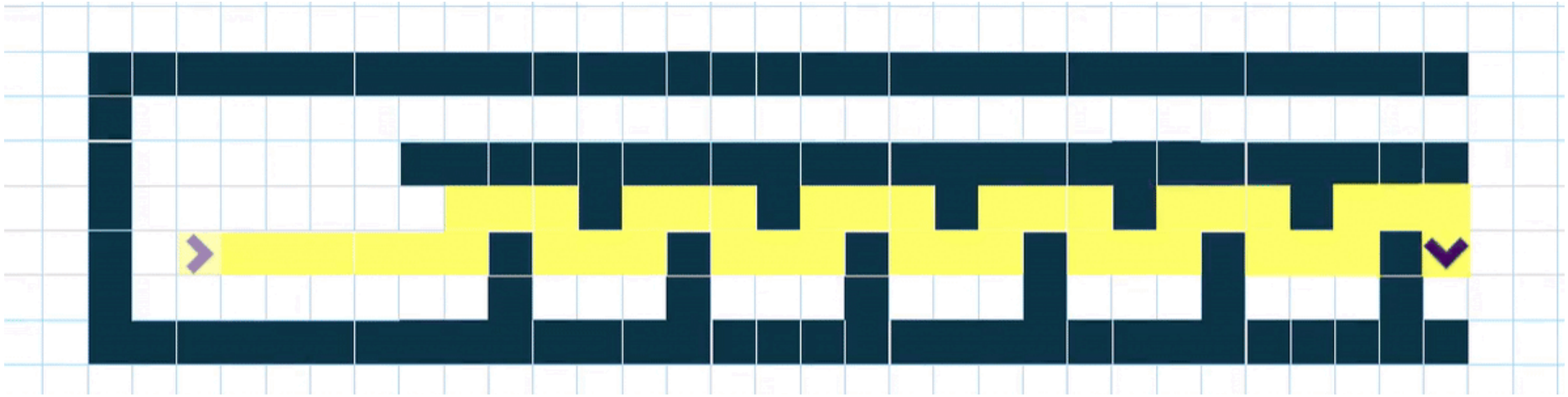


Greedy: “rush towards” destination

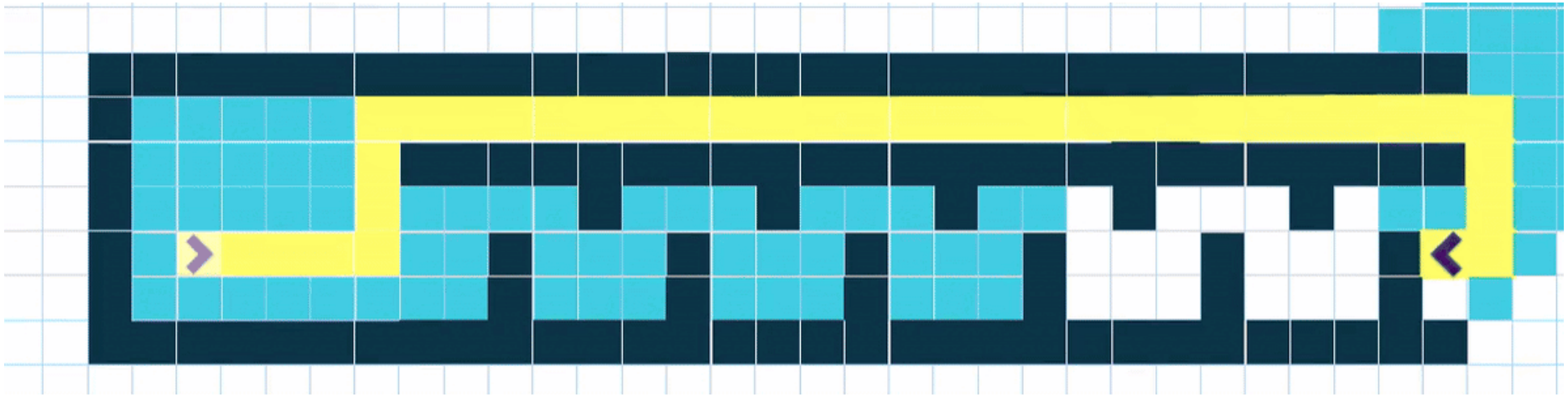


Dijkstra’s: explore all neighboring paths

Pathfinding



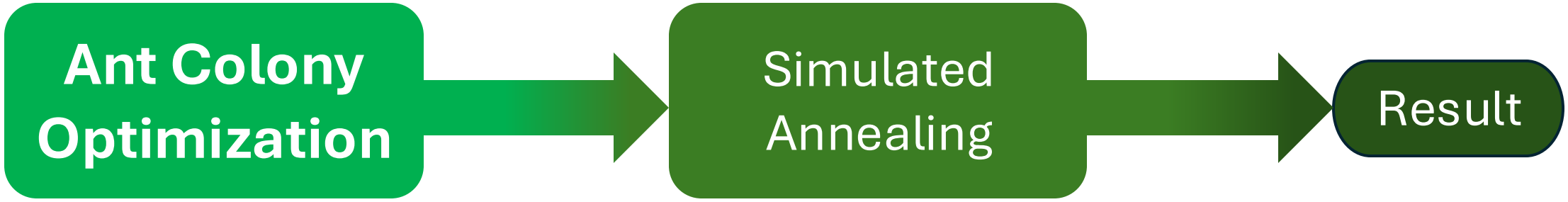
Greedy: 40 grids



Dijkstra's: 36 grids, **guarantees** for shortest

Delivery Route

Combined Approach



Delivery Route Ant Colony Optimization

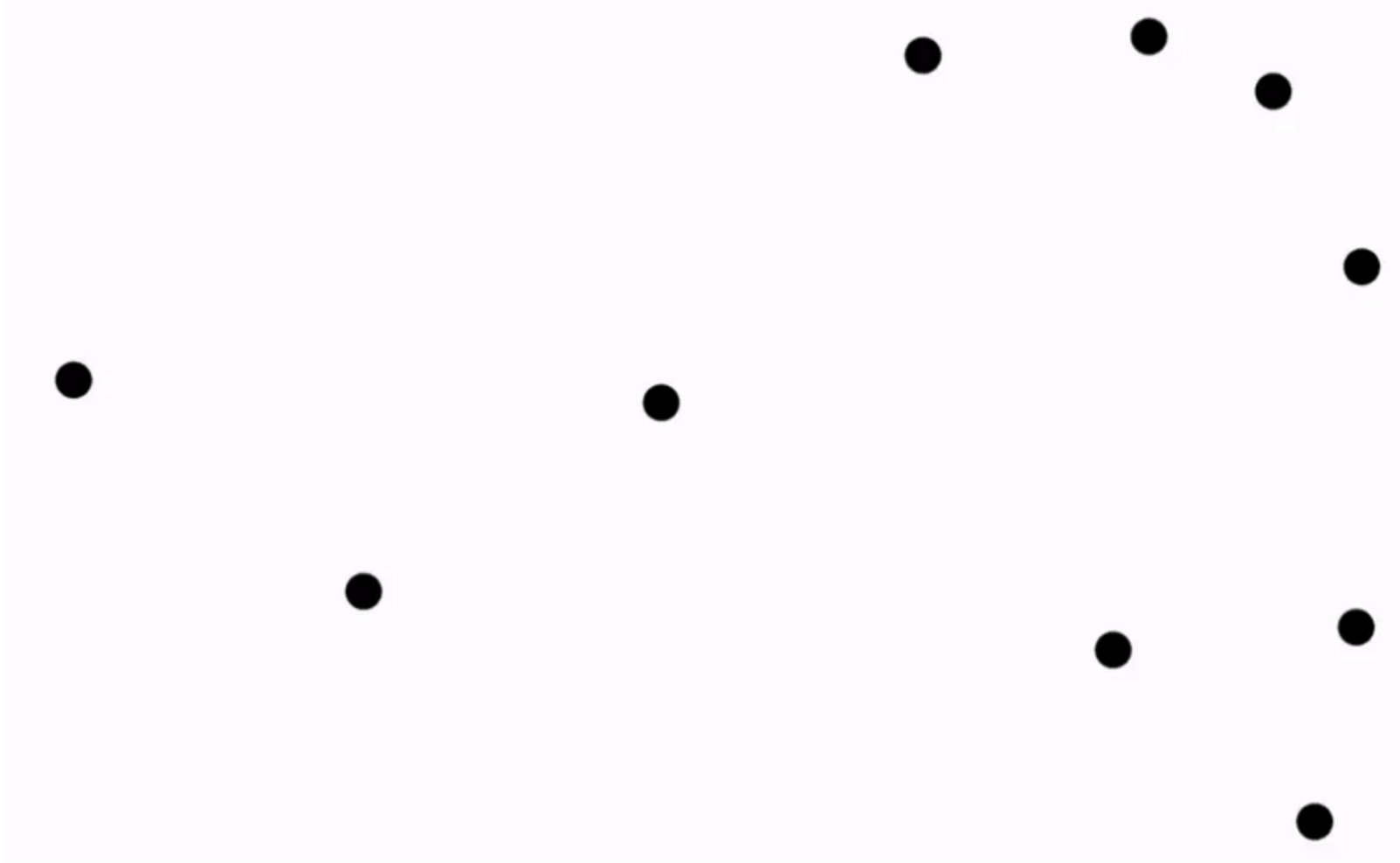
A Group of Ants

- **Initial:** ants wander around **randomly** until they find food
- **Pheromone Trail:** ants leave a trail of scent / **pheromone**
- **Pheromone Amount: shorter** trails has **stronger** pheromone
- **Follow Pheromone:** more likely to **follow** trails with strong pheromone

➔ **Shorter Trails** found with this **collective behavior**

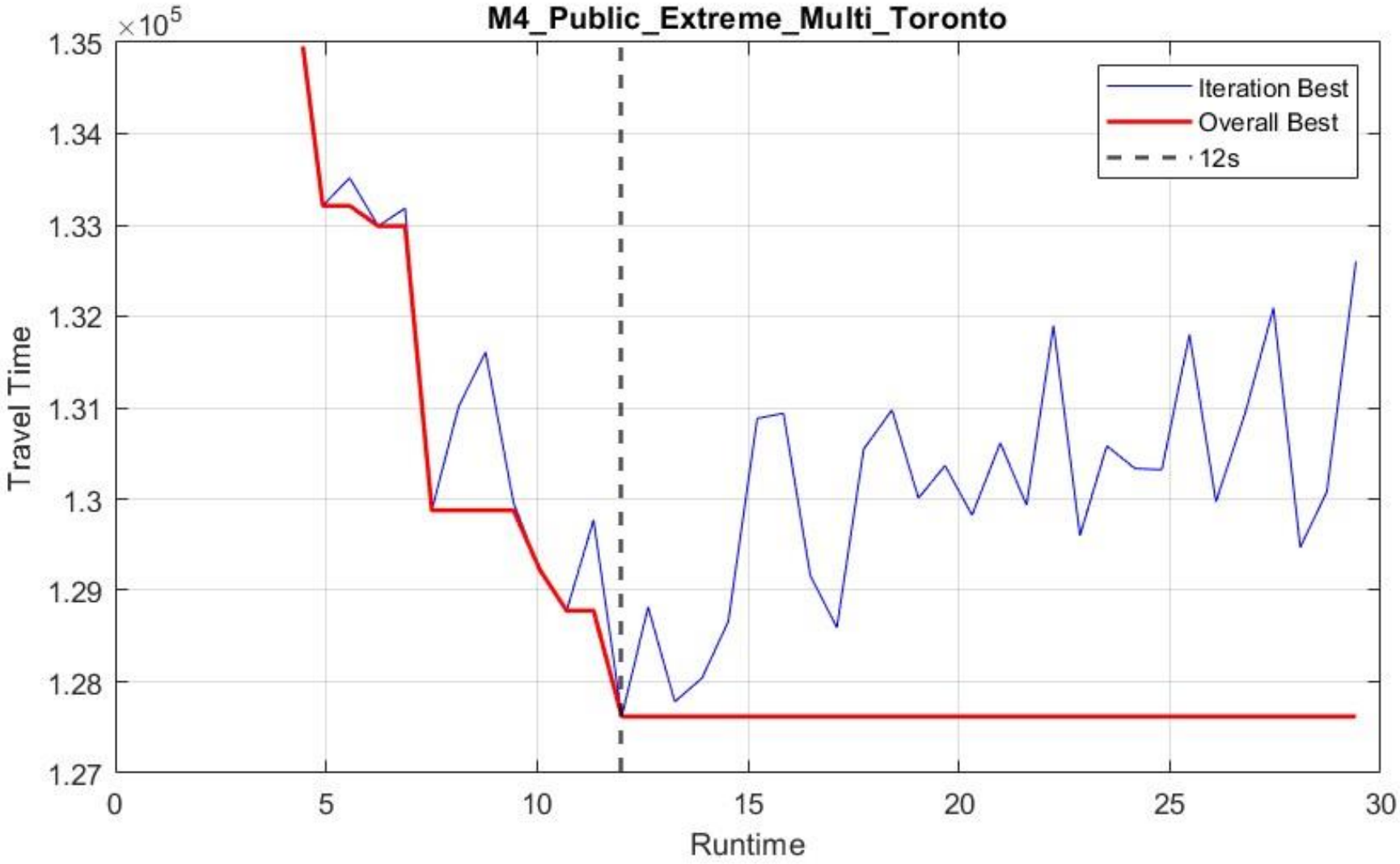
Delivery Route Ant Colony Optimization

Artificial Ants ➔ Ant Colony Optimization



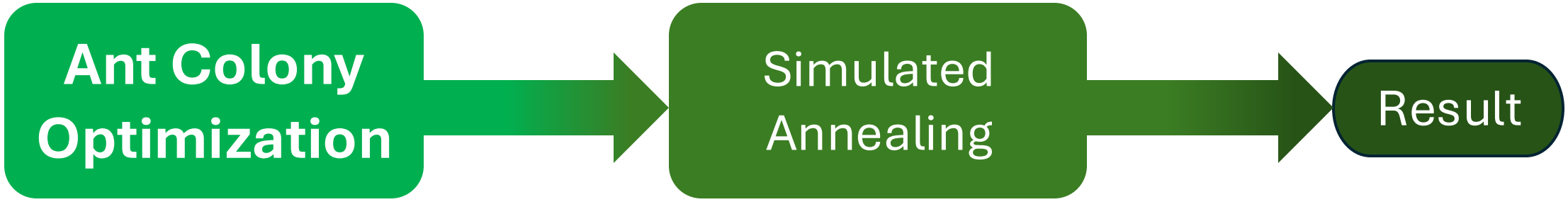
Delivery Route Ant Colony Optimization

Good solution in ~hundred iterations (10s)



Delivery Route

Combined Approach



Delivery Route

Combined Approach

Delivery Route Simulated Annealing

Metal Annealing

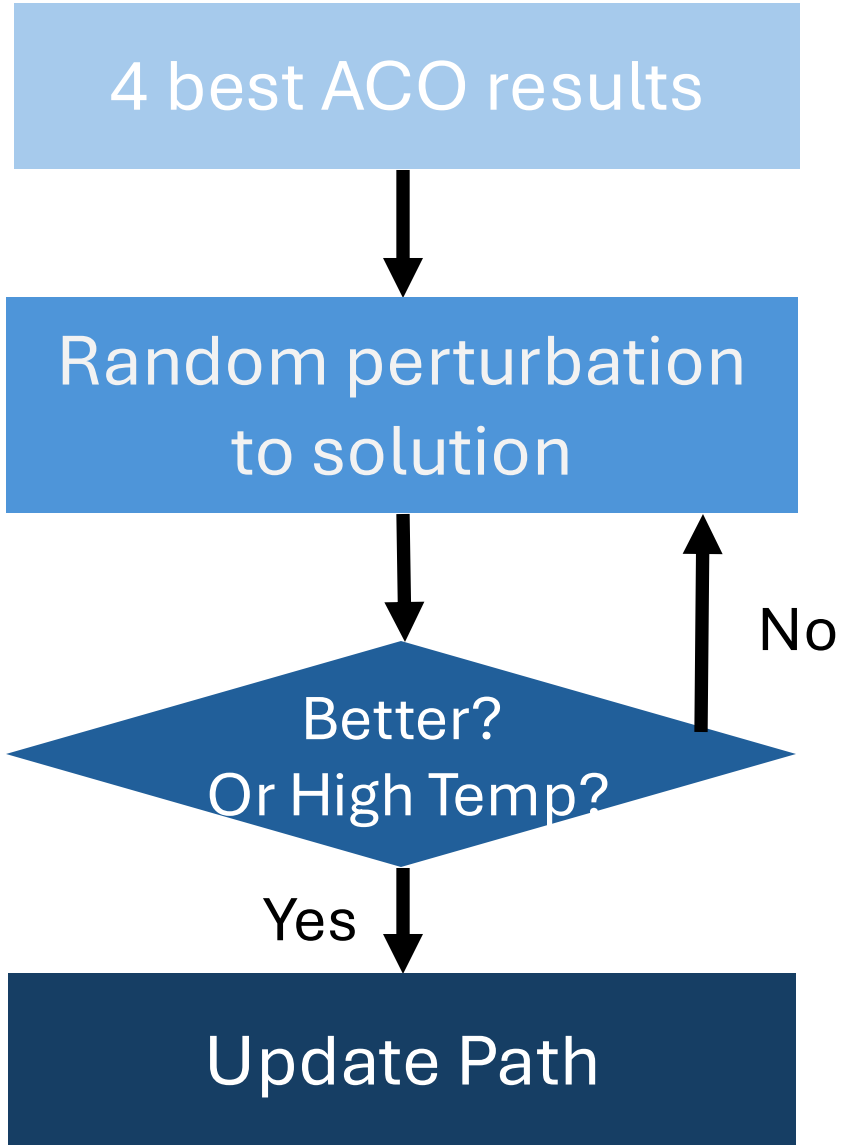
- **Heat metal:** atoms move
- **Cool down:** atoms gradually settle into strong structure

Simulated Annealing

- **High Temperature:** could accept worse solutions
- **Cool down:** accept only better solutions

Delivery Route

Simulated Annealing

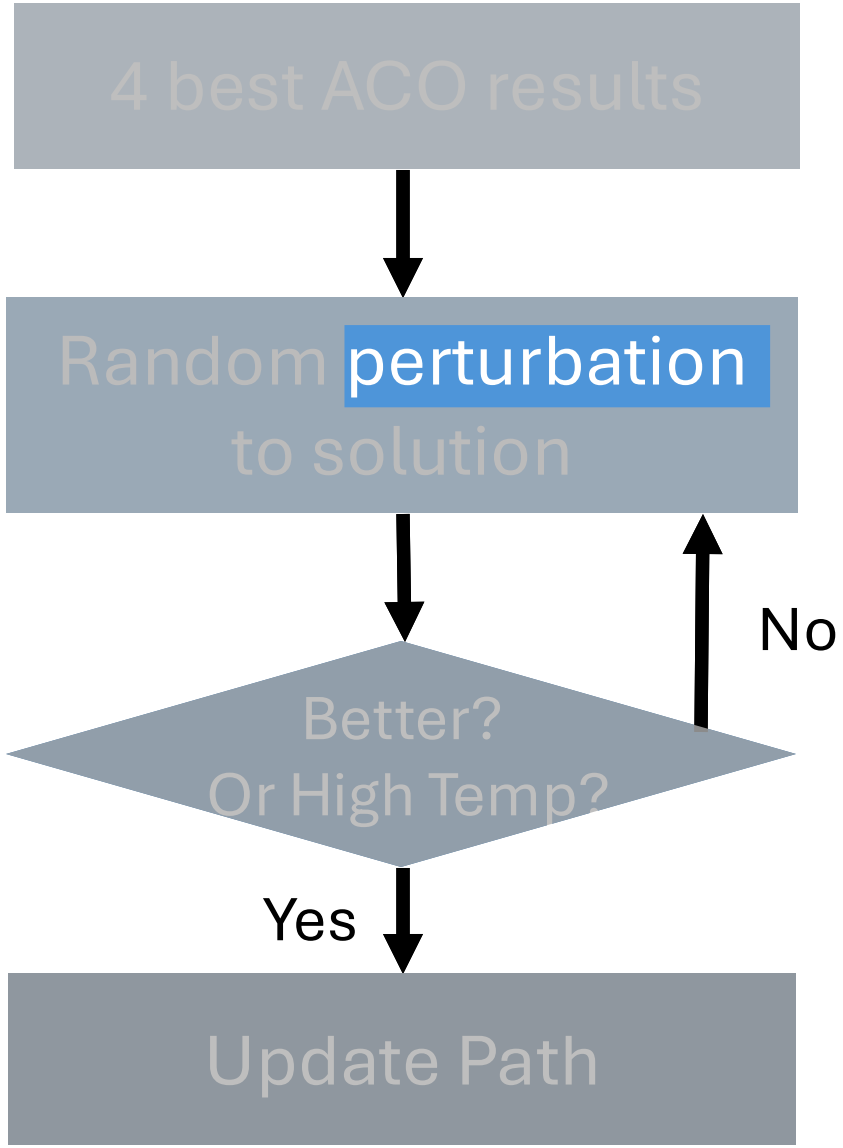


Simulated Annealing

- **High Temperature:** could accept worse solutions
- **Cool down:** accept only better solutions

Delivery Route

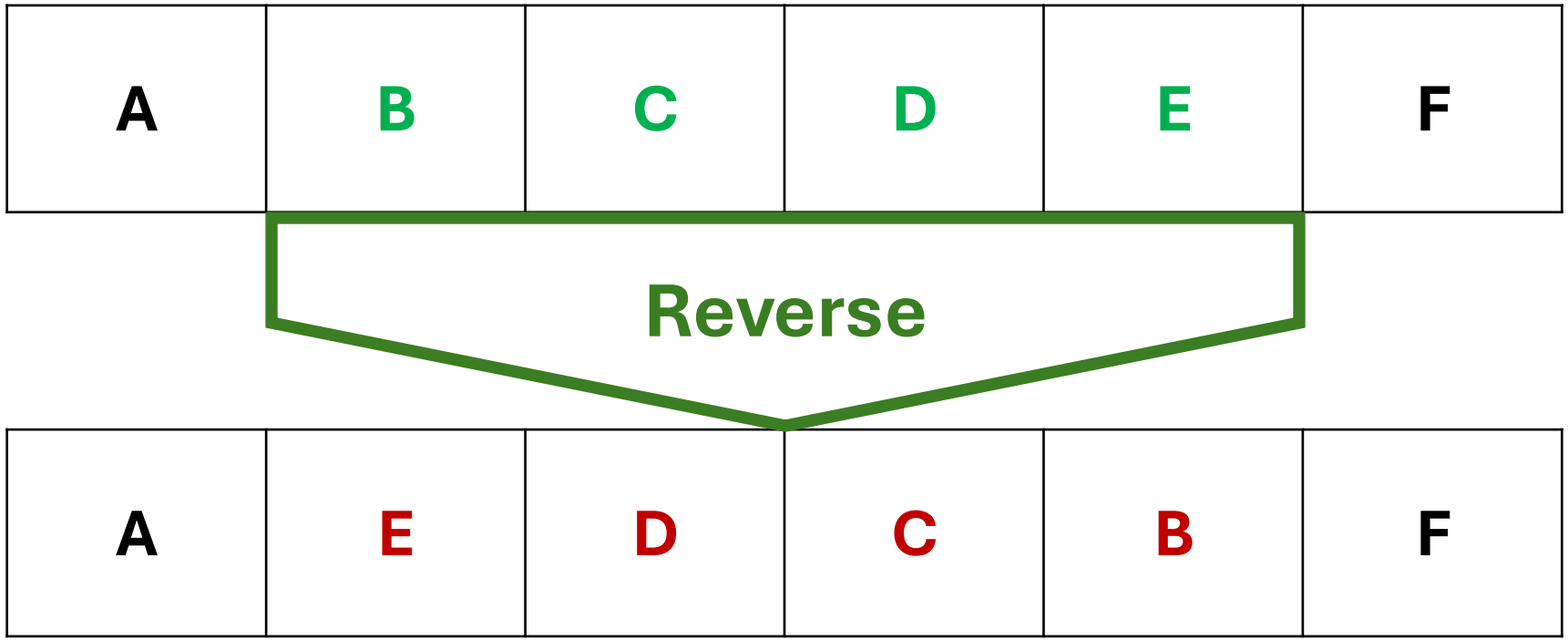
Simulated Annealing



Perturbation Operators[8]:

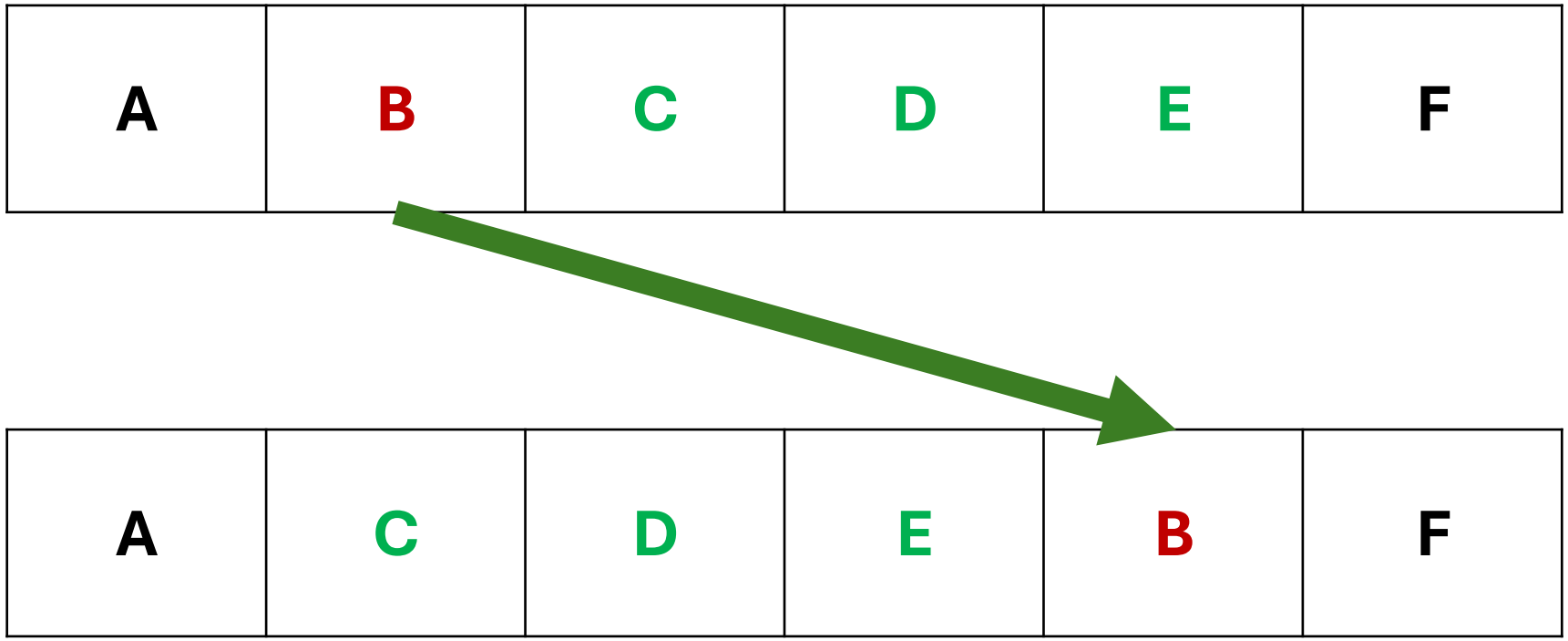
- **Reverse**
- **Insert**

Delivery Route Perturbation Choice



Reverse Operator

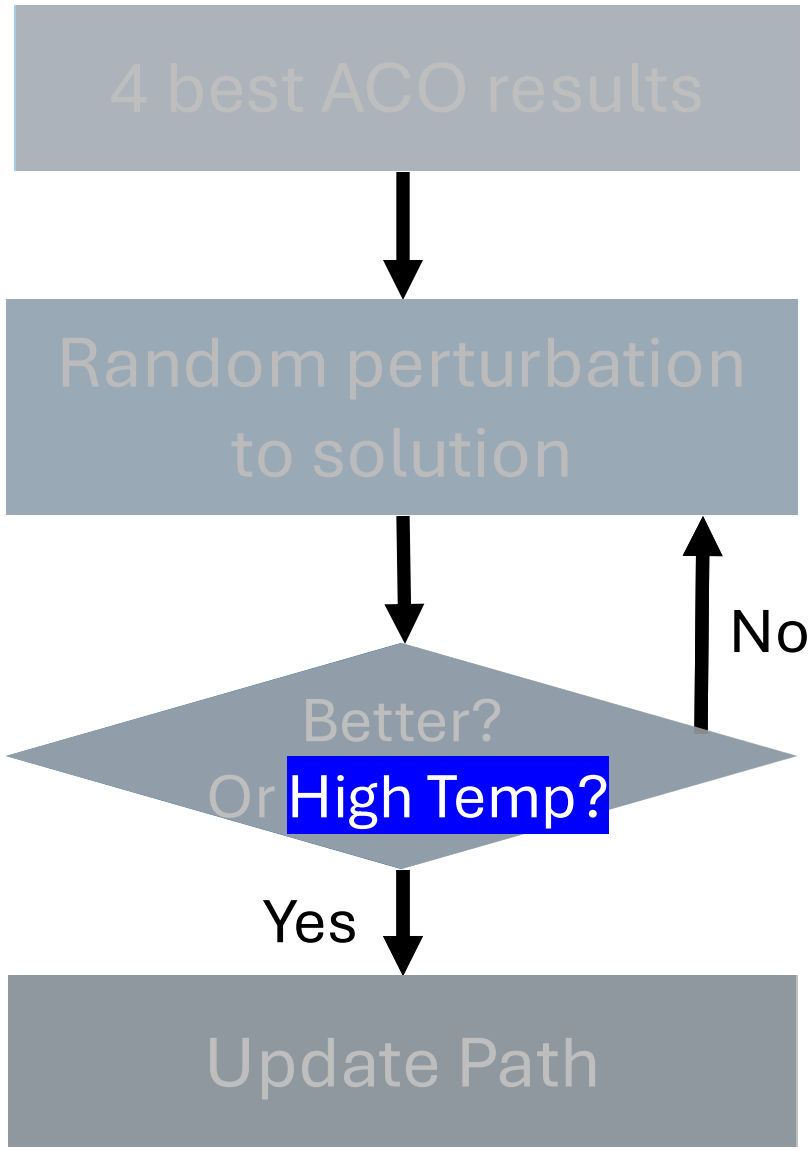
Delivery Route Perturbation Choice



Insert Operator

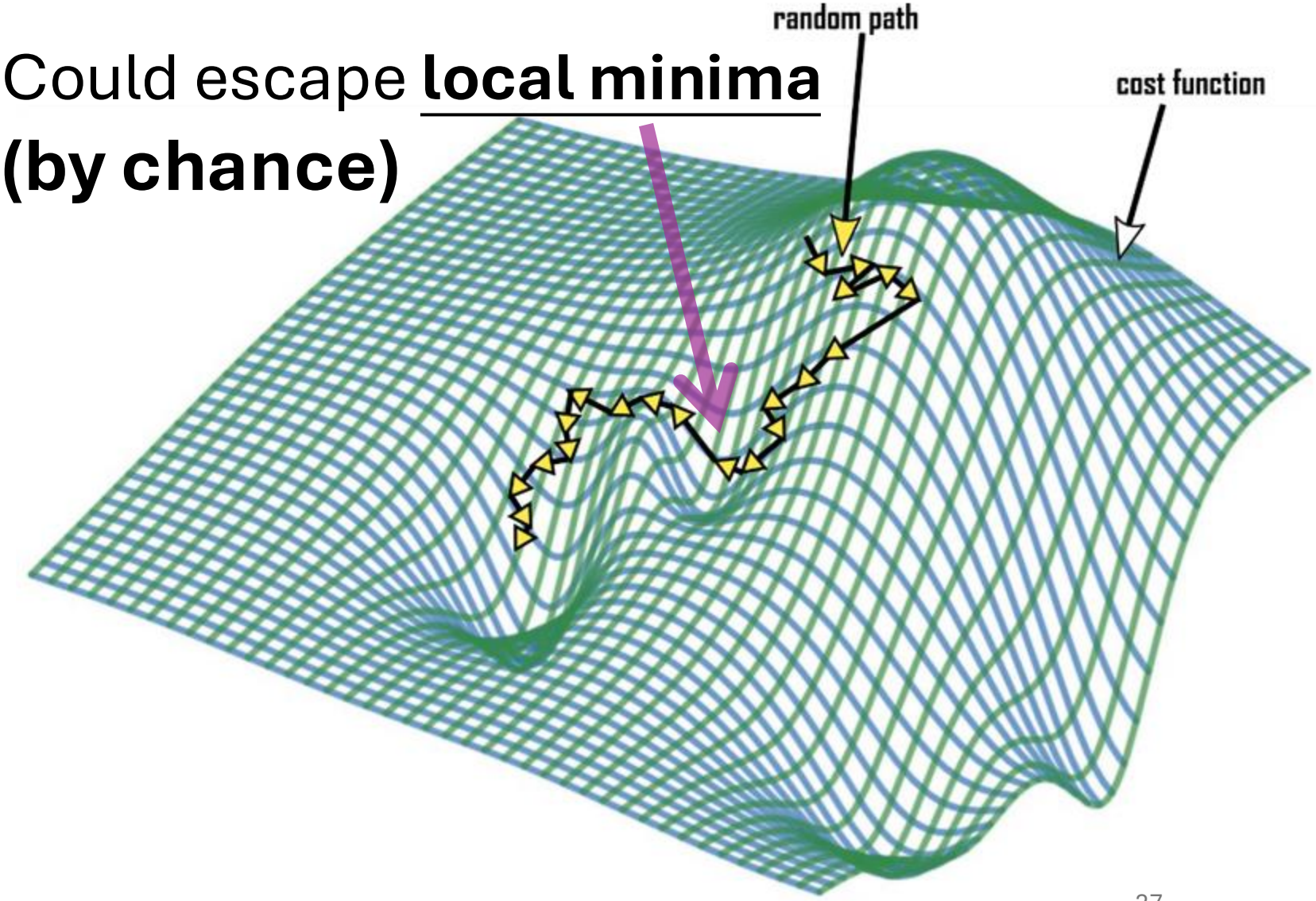
Delivery Route

Simulated Annealing

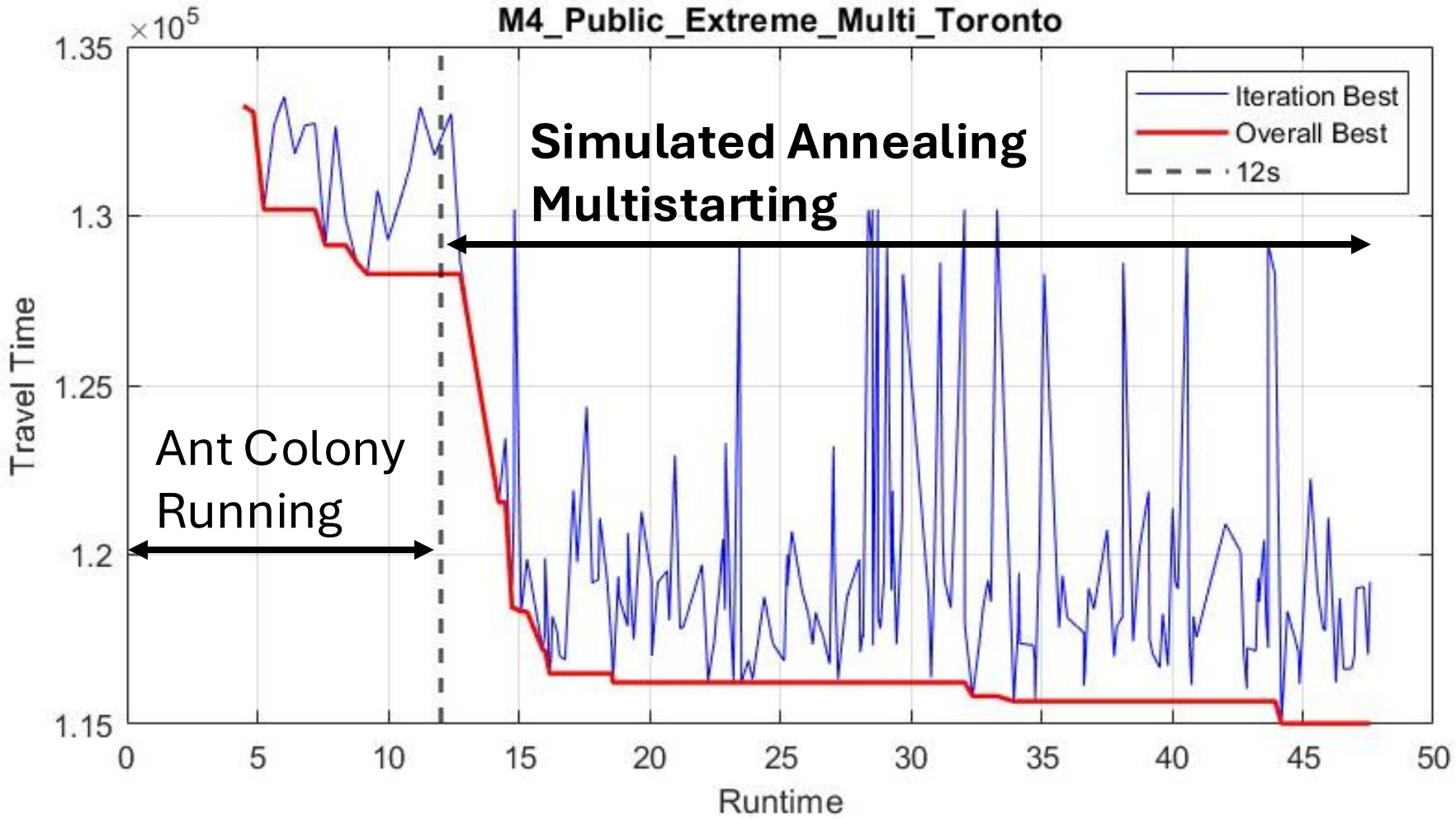


Could escape **local minima**

(by chance)



Delivery Route Simulated Annealing



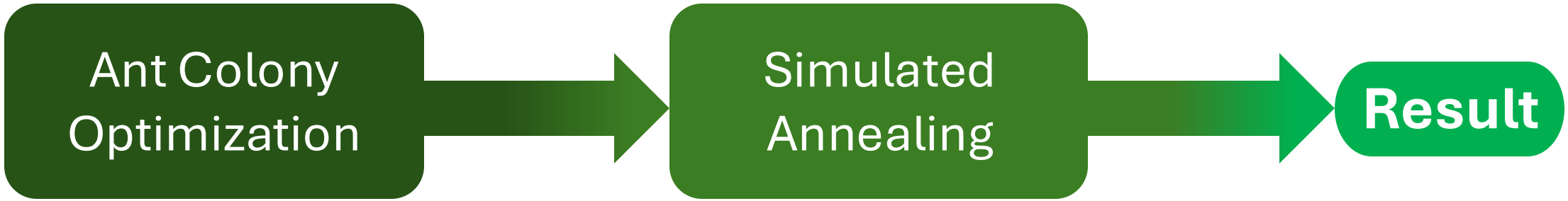
Multistart: escape local minima

Delivery Route

Combined Approach

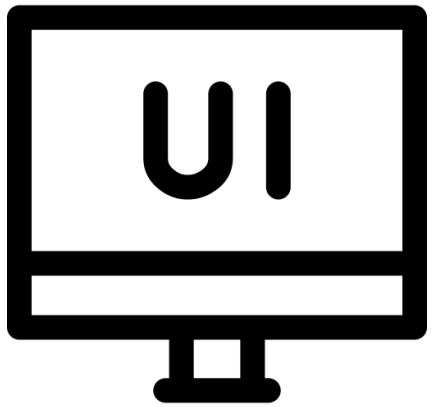
Delivery Route

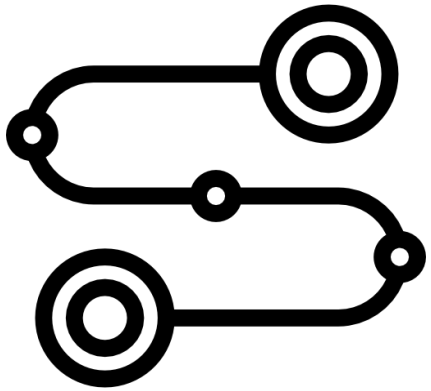
Combined Approach



Our result: **top 3** on leaderboard

Structure





UI Design/ features

Algorithm

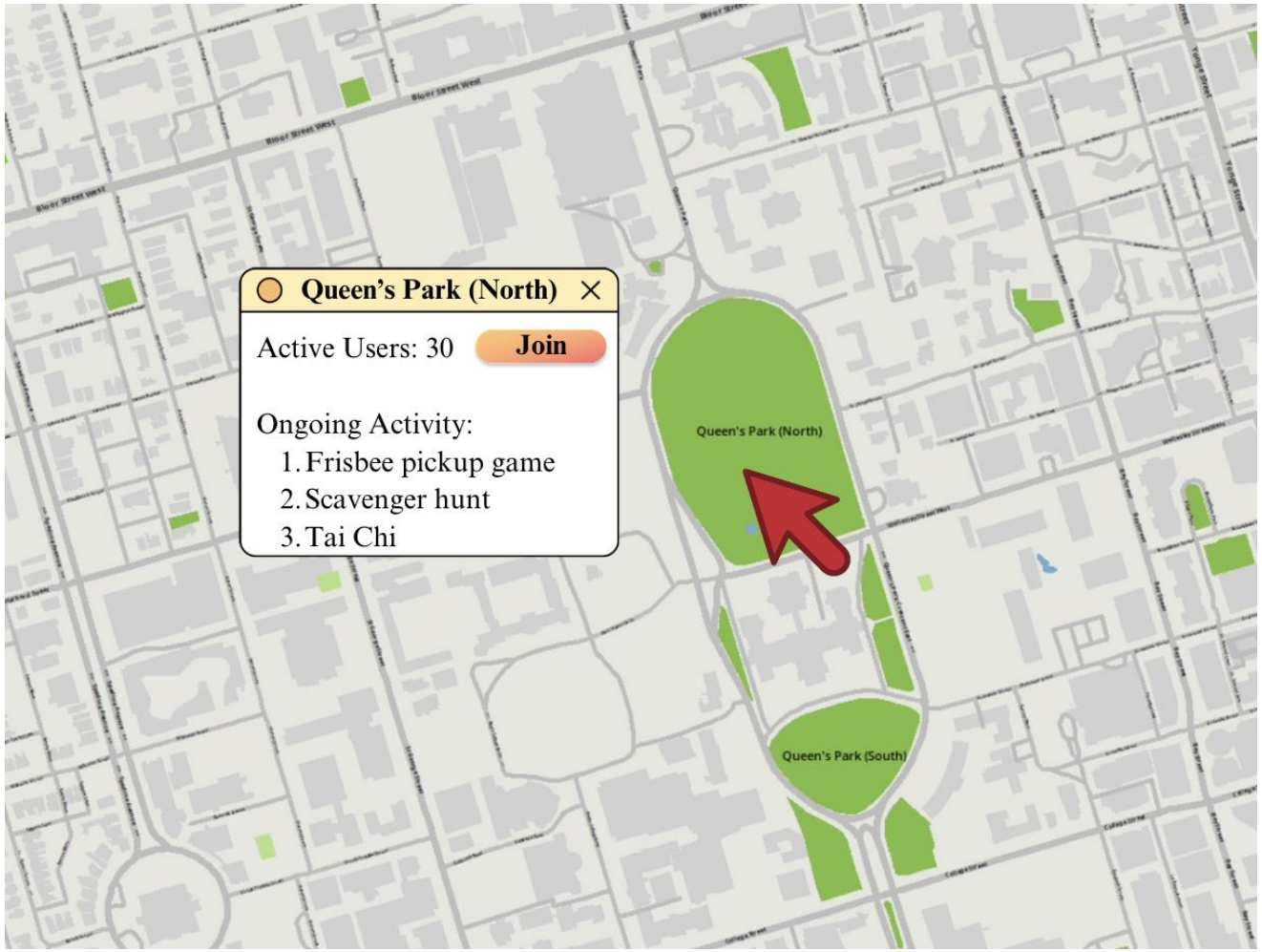
Future Pitch

Future Pitch

Live Status

Alternative Transportation

Live Occupation Status



Everyone can be involved

Clicking on any greenspace:

-shows the number of users

-any events that is happening

-update the status if you are going

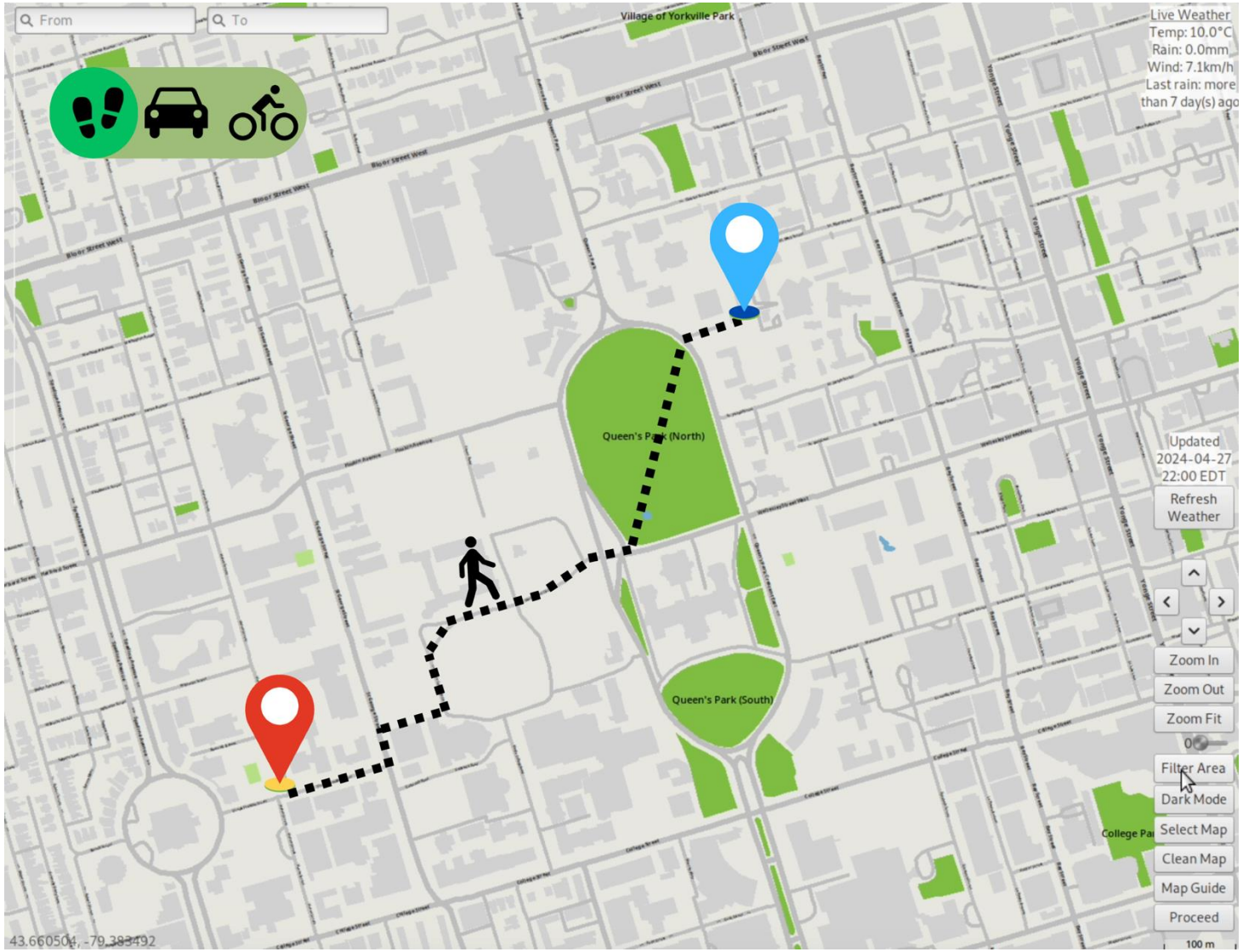
Future Pitch

Live Status

Alternative Transportation

Path Finding for alternative transport

More than just cars



Different best paths:

-bus / subway

-on trails

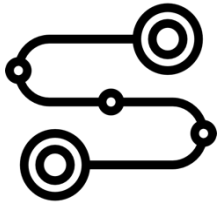
-across greenspace

-see available bicycle sharing system

Summary

UI Design

- Color Scheme
- Filtering
- Weather
- Path Visualization



Algorithm

- Dijkstra's
- Ant Colony
- Simulated Annealing

Future Pitch

- Live Status
- Alternative Transportation

THANK YOU

Questions?

References:

[1] H. J. Park, K. B. Kim, and E. Y. Cha, “AN EFFECTIVE COLOR QUANTIZATION METHOD USING COLOR IMPORTANCE-BASED SELF-ORGANIZING MAPS,” *Neural Network World*, vol. 25, no. 2, pp. 121–137, 2015, doi: 10.14311/NNW.2015.25.006.

[2] A.-M. Nivala, S. Brewster, and T. L. Sarjakoski, “Usability evaluation of web mapping sites,” *The Cartographic Journal*, vol. 45, no. 2, pp. 129–138, May 2008.

[3] Web Content Accessibility Guidelines 2.2, World Wide Web Consortium, 05 Oct., 2023.

[4] L. Vennapu, Rao, V. Mohan, V. Rao, and Mohan, “Impact of weather on sports and sport injuries,” ~ *9 ~ International Journal of Physical Education, Sports and Health*, vol. 8, no. 3, pp. 9–13, 2021, Available: https://www.kheljournal.com/archives/2021/vol8issue3/PartA/8-2-31-646.pdf

[5] R. Mosadeghi, D. Barr, and R. Moller, “The Use of GIS in Major Sport Events Management; the Host City’s Lessons Learned from Gold Coast 2018, Commonwealth Games,” *Applied Spatial Analysis and Policy*, vol. 13, no. 1, pp. 51–67, Jan. 2019, doi: https://doi.org/10.1007/s12061-018-9289-z.

References:

[6] Marcello La Rocca, *Advanced Algorithms and Data Structures*. Manning Publications Co. Llc, 2021.

[7] “Pathfinding Visualizer,” clementmihailescu.github.io. https://clementmihailescu.github.io/Pathfinding-Visualizer/

[8] S. Zhan, J. Lin, Z. Zhang, and Y. Zhong, “List-Based Simulated Annealing Algorithm for Traveling Salesman Problem,” *Computational Intelligence and Neuroscience*, vol. 2016, pp. 1–12, 2016, doi: https://doi.org/10.1155/2016/1712630.

Testing from WD1

Objective	Test Method	Test Goal	Metric Support
Interface is intuitive to use, with clear delivery of information.	Ask new users to perform typical tasks and find important information. Count the number of tasks completed successfully.	Completion rate = completed tasks / total tasks. This rate must be more than 80% and the aim is 100%.	ISO 9241 suggests Effectiveness as a major usability metric. A 80% rate indicates good usability for most users.
UI can deliver information efficiently.	In the test method described above, record the time taken in each task. For benchmarking, measure time usage for tasks with similar nature in Relator.ca and AllTrails.	The average time usage should not exceed the average time in Relator.ca and Alltrails.	ISO 9241 suggests Efficiency as another major usability metric. Since the benchmarked tasks have similar nature, less time usage indicates higher efficiency.
Program response time does not impact user experience.	Time the response of all map operations.	The time must be less than 400ms. If longer, feedback elements (e.g. progress bars) must be used.	Doherty Threshold: If a response appears after the 400 ms threshold, users eventually become disinterested.
Interface is easy to navigate.	Count the numbers of operations (clicks, key presses) needed to use map functionalities.	The number should not exceed 5 for any task.	Miller's Law: The average person can only keep 7±2 items in their working memory. 5 is the lower bound.
Color scheme is accessible for users with visual	Check the contrast ratio between important elements and surrounding background.	In at least one color theme, pins, roads, POIs, and boundaries must have a contrast ratio larger than 3:1.	Web Content Accessibility Guidelines S1.4.1 suggests that contrast ratio > 3 could "provide a redundant visual cue."