Combinatorial Optimization Using Electro-Optical Vector by Matrix Multiplication

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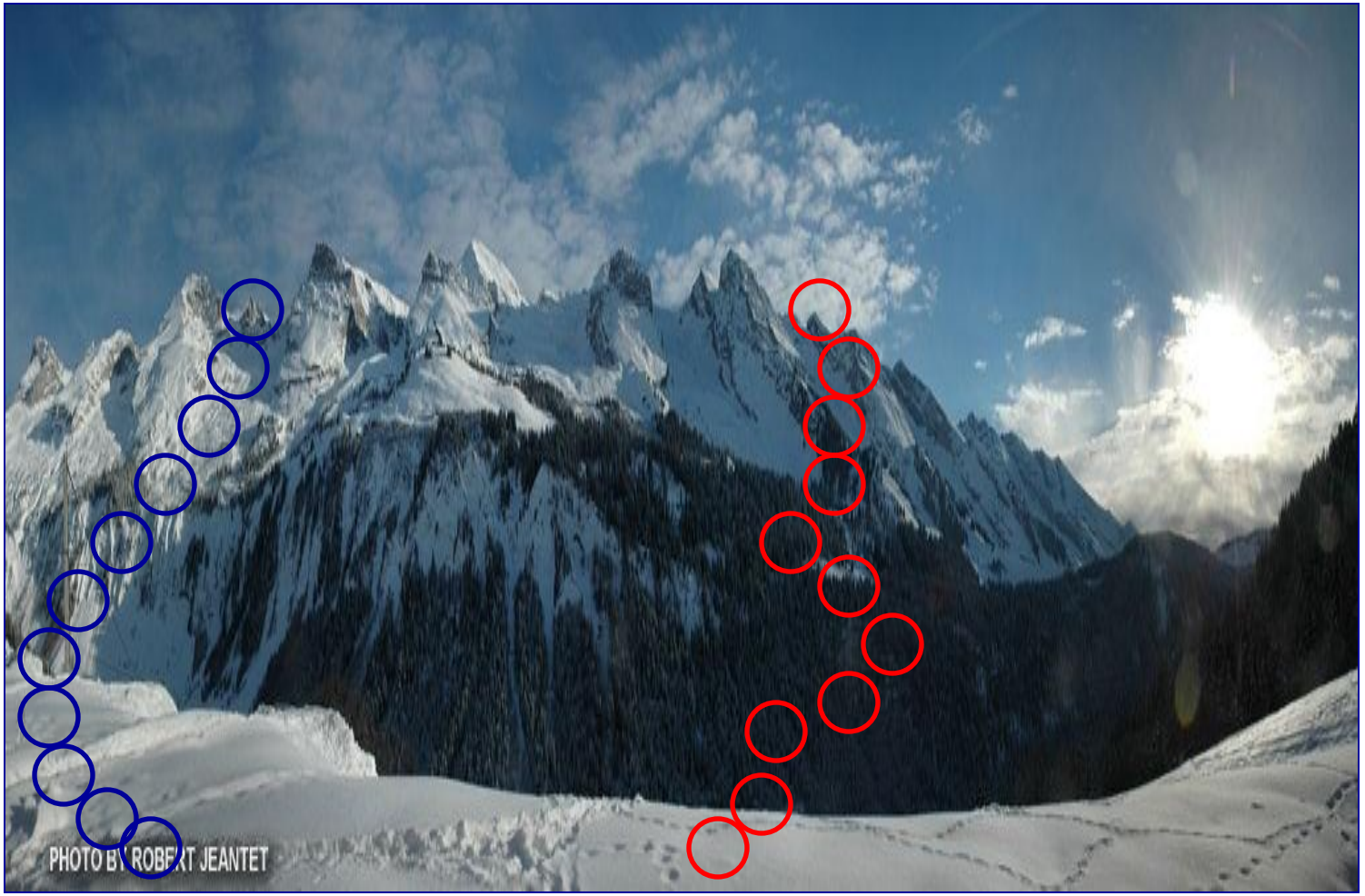
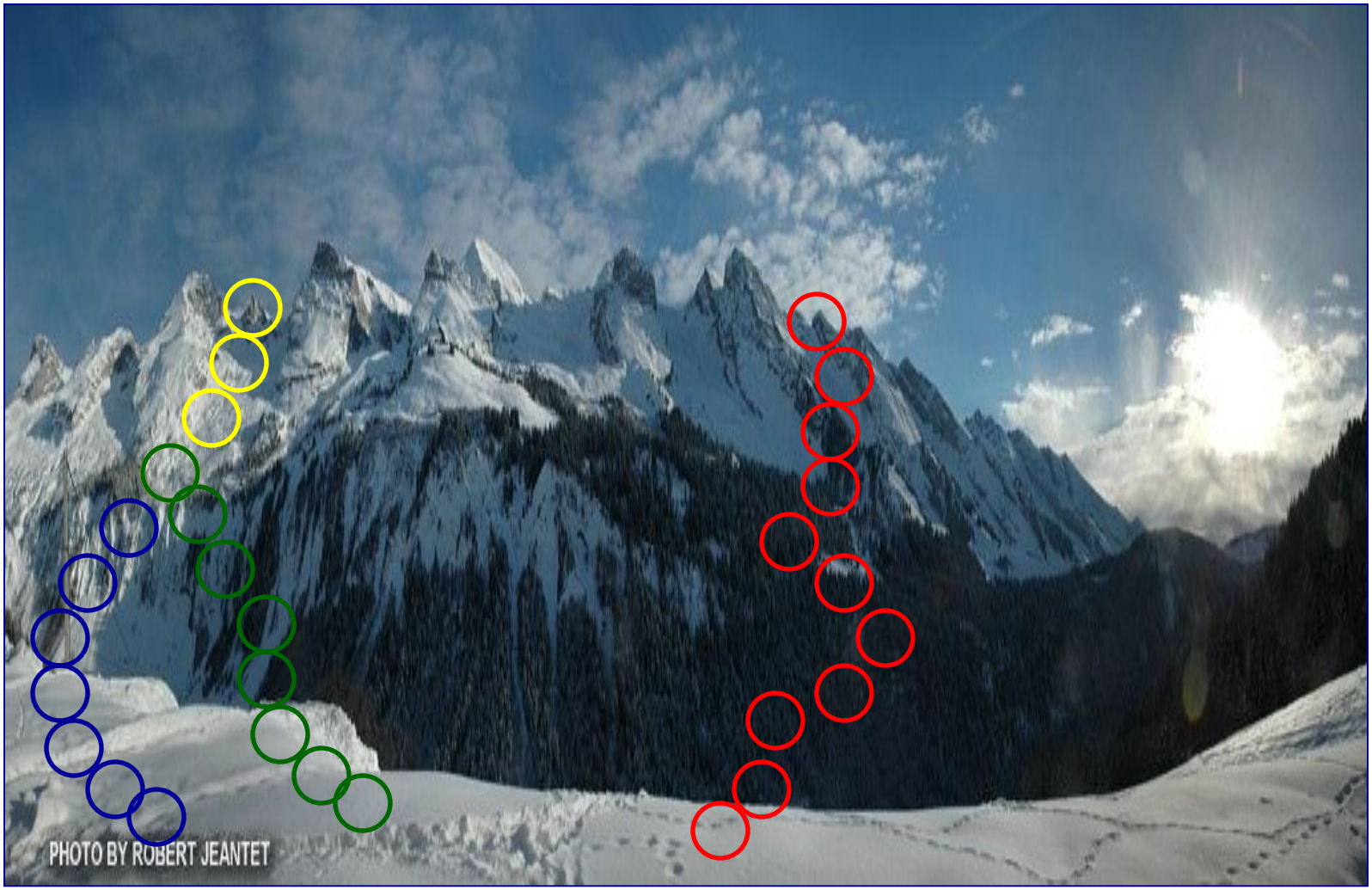
Search Space

Iterative Hill Climbing (ITHC)



Rendezvous



Traveling Salesman Problem (TSP)

Input:

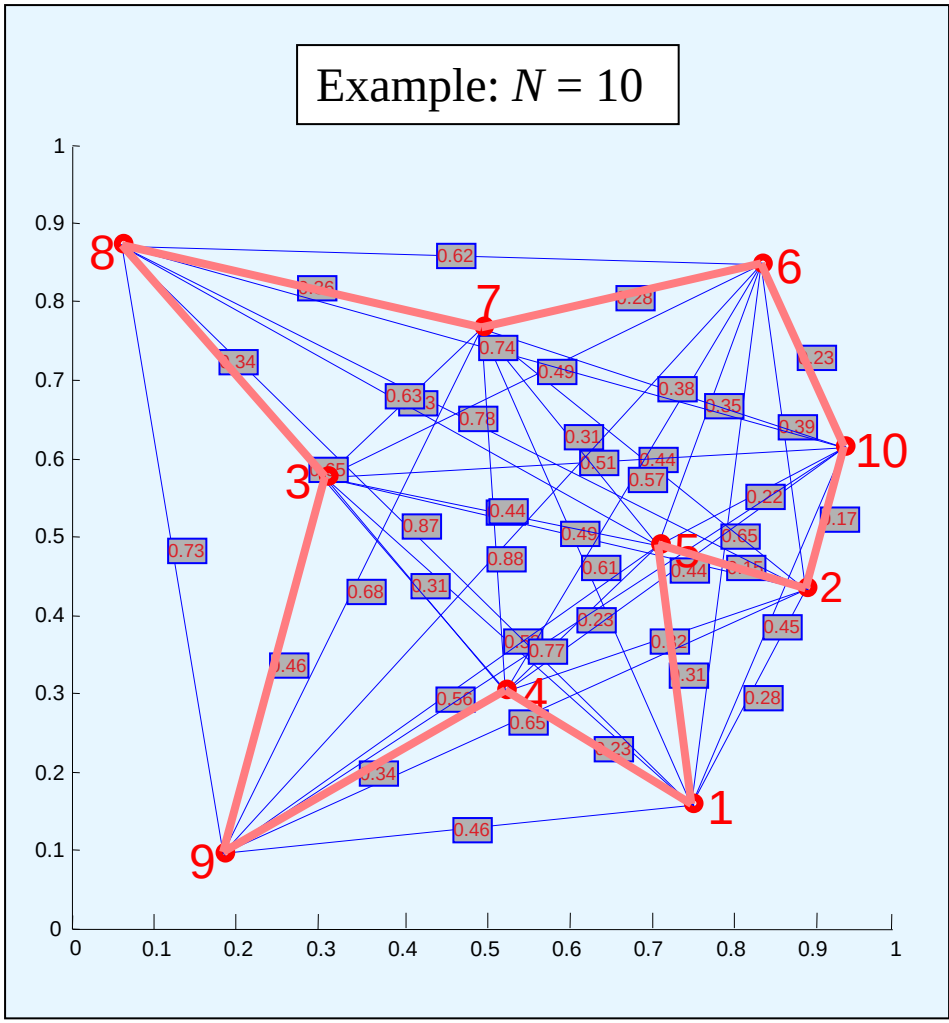
- City map which…
  - contains *N* cities.
  - the distances (weights) between the cities can be calculated from it.

Output:

- Shortest Tour which…
  - visits all cities only once.
  - is a closed loop (starts and ends in the same city).

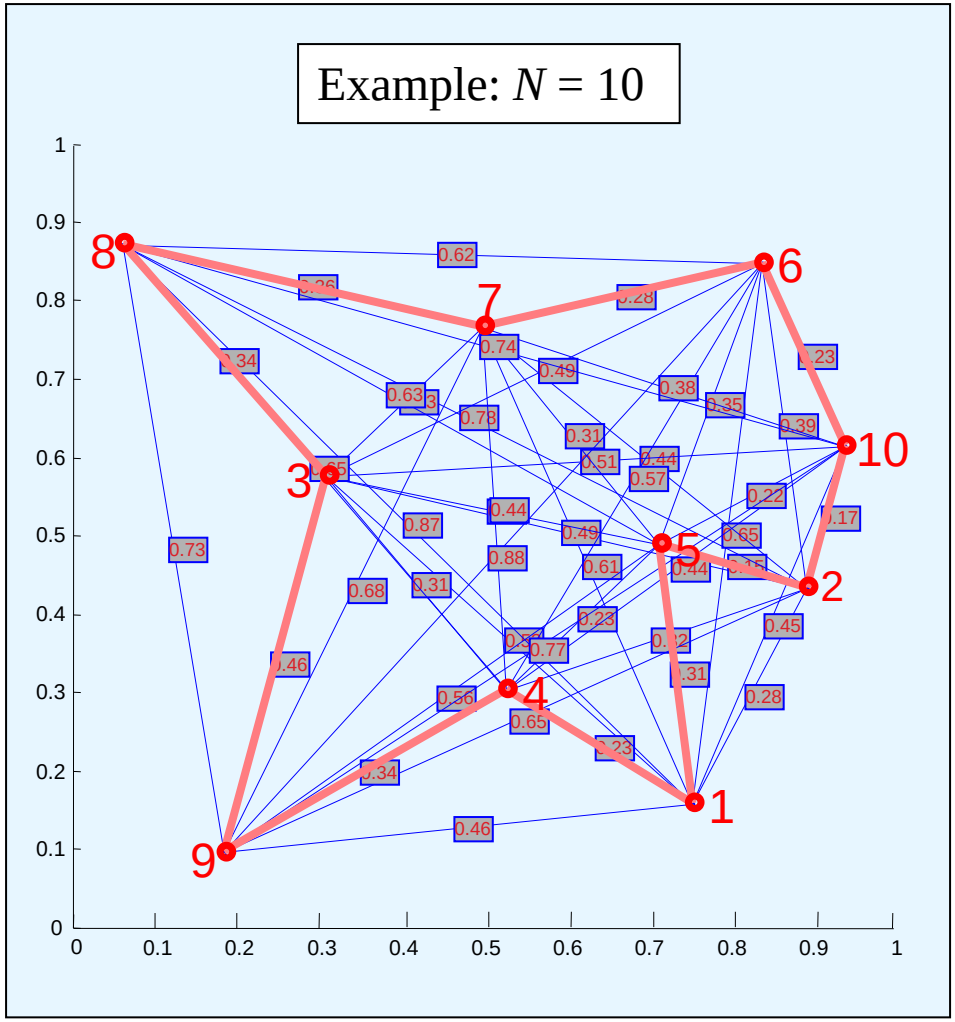
Number of edges (weights): $N(N\text{-}1)/2$

Number of feasible tours: $(N\text{-}1)!/2$



Traveling Salesman Problem (TSP)

N Number of cities	$N(N\text{-}1)/2$ Number of edges	$(N\text{-}1)!/2$ Number of feasible tours
4	6	3
5	10	12
10	45	181440
15	105	4.359×10^{10}
20	190	6.082×10^{16}
100	4950	4.666×10^{155}
150	11175	1.905×10^{260}



An Iterative Hill Climbing TSP

- A “TSP problem”
  - Given a complete weighted graph with N vertices and random weights, find the minimal Hamiltonian cycle
  - E.g., Given the 50 states a TSP wants to go from each Capital city to another without out repeating using the minimum total distance

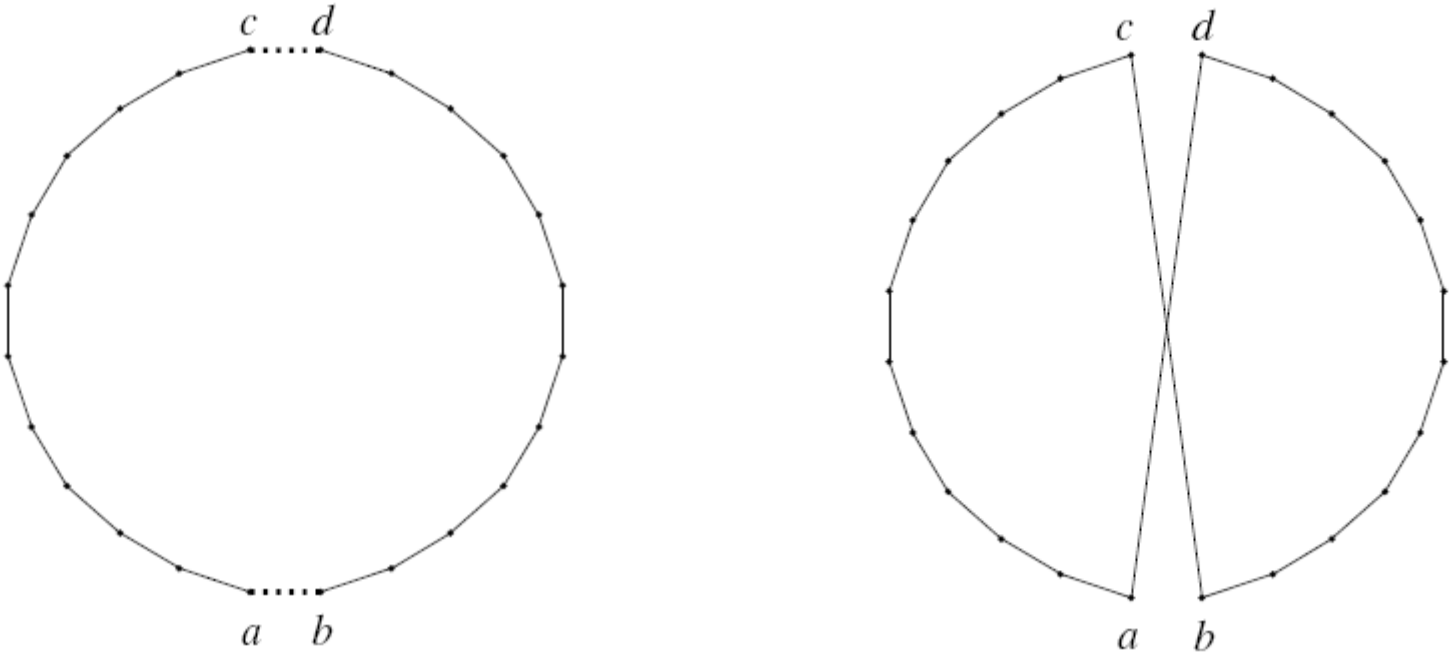
There is a greedy algorithm

The algorithm finds a starting cycle

Local improvements butterfly.

$$O(N^2 \log(N))$$

2-opt – Butterfly



Current version – (a, b) and (c, d) are edges

Experiments

- Seeding
  - Random Restart
  - Greedy Enumeration
- Using Spatial and Temporal Locality to reduce repetitions
- Miss Ratios
- Speed-up