High Performance GPU Accelerated TSP Solver

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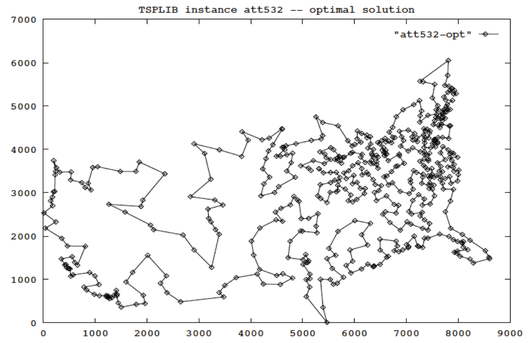
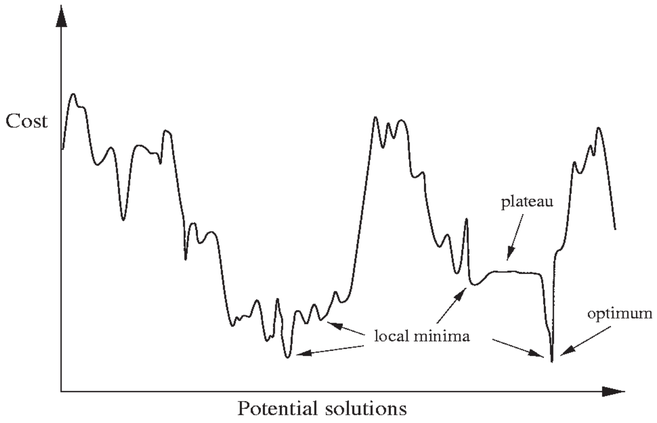
TSP instance: shortest round trip through 532 US cities



- Computer wiring
- Vehicle routing
- Crystallography
- Robot control



LOGO TSP Solver - Open available
LOGO - **LO**cal **G**
CUDA and OpenCL

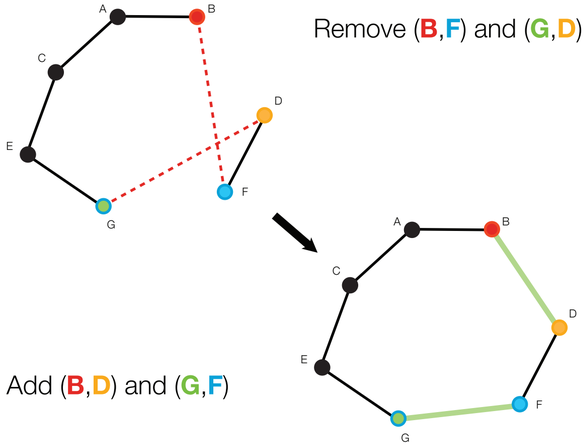
http://olab.is.s.u-tokyo.ac.jp/~kamil.rocki/projects.html

Global Optimization

```
1: procedure ITERATED LOCAL SEARCH
2:     s0 := GenerateInitialSolution()
3:     s* := 2optLocalSearch (s0)
4:     while (termination condition not met)
5:         s' := Perturbation (s*)
6:         s*' := 2optLocalSearch (s')
7:         s* := AcceptanceCriterion (s*, s*')
8:     end while
9: end procedure
```

GPU acceleration

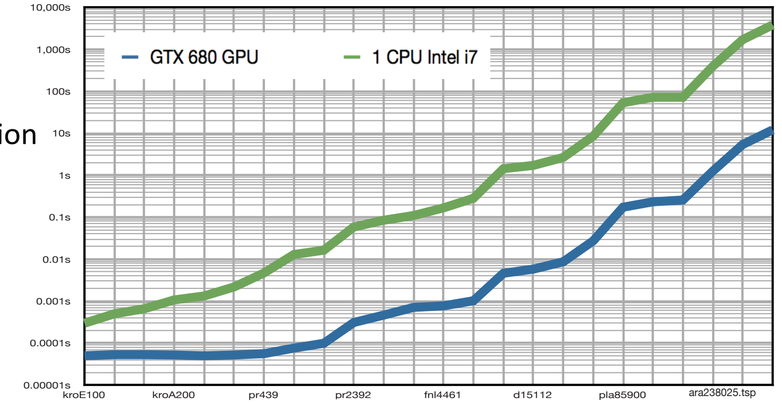
Local Optimization



Each thread has to check:

if (distance(i, i-1) + distance(j+1, j) > distance(i, j+1) + distance(i-1, j)) update best i and j;

2-opt step processing time



For 200,000 cities approximately
25,000,000,000 swaps/second checked on
GTX 680 ~ 700 GFLOPS

The 2-opt algorithm basically removes two edges from the tour, and reconnects the two new sub-tours created. This is often referred to as a 2-opt move. There is only one way to reconnect the two sub-tours so that the tour remains valid. The steps is repeated only as long as the new tour is shorter.

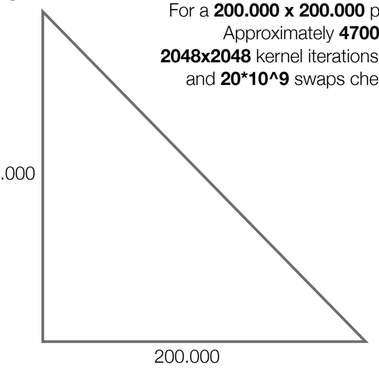
GPU uses this simple function for EUC_2D problems

```
__device__ int calculateDistance2D
(unsigned int i, unsigned int j, city_coords* coords) {

        register float dx, dy;

        dx = coords[i].x - coords[j].x;
        dy = coords[i].y - coords[j].y;

        return (int)(sqrtf(dx * dx + dy * dy) + 0.5f);
}
```



For a **200.000 x 200.000** problem
Approximately **4700**
2048x2048 kernel iterations needed
and **20*10^9** swaps checked