Week 6

Algorithms on Graphs

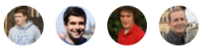
Week 6

Discuss this week's modules here.

Go to forum

86 threads · Last post 10 days ago

Advanced Shortest Paths Project (Optional)



In this module, you will learn Advanced Shortest Paths algorithms that work in practice 1000s (up to 25000) of times faster than the classical Dijkstra's algorithm on real-world road networks and social networks graphs. You will work on a Programming Project based on these algorithms. You will find the shortest paths on the real maps of parts of US and the shortest paths connecting people in the social networks. We encourage you not only to use the ideas from this module's lectures in your implementations, but also to come up with your own ideas for speeding up the algorithm! We encourage you to compete on the forums to see whose implementation is the fastest one :)

Less

Learning Objectives

- Develop an algorithm to find distances in the graphs of social networks such as Facebook and internet graphs much faster than with the classical approaches
- Develop an algorithm to find distances in the real road networks faster
- Develop Bidirectional Dijkstra, A* (A-star) and Contraction Hierarchies algorithms
- Develop a solution of the central problem of delivery companies - delivery truck route optimization on real-world road network
- Develop an algorithm to find distances in the real-world road networks thousands of times faster than with the classical approaches

Less

Bidirectional Dijkstra

Video: Programming Project: Introduction 1 min — Resume

Video: Bidirectional Search 10 min

Video: Six Handshakes 6 min

Video: Bidirectional Dijkstra 5 min

Video: Finding Shortest Path after Meeting in the Middle 9 min

Video: Computing the Distance 2 min

Reading: Slides and External References 10 min

A-star Algorithm (A*)

Video: A* Algorithm 11 min

Video: Performance of A* 2 min

Video: Bidirectional A* 6 min

Video: Potential Functions and Lower Bounds 5 min

Video: Landmarks (Optional) 10 min

Reading: Slides and External References 10 min

Contraction Hierarchies

Video: Highway Hierarchies and Node Importance 7 min

Video: Preprocessing 7 min

Video: Witness Search 10 min

Video: Query 8 min

Video: Proof of Correctness 9 min

Video: Node Ordering 14 min

Reading: Slides and External Refernces 10 min

Practice Quiz: Bidirectional Dijkstra, A* and Contraction Hierarchies 10 questions

Programming Project

Practice Programming Assignment: Advanced Shortest Paths 30h

Research on additional online learning practices for learners' engagement

Research on additional online learning practices for learners' engagement 2 min