CS167: Readings in Algorithms

Tim Roughgarden
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Outline for today

1. Course goals
2. Plan for course
3. Deliverables
4. Example topics
5. Technical topic: counting triangles via Map-Reduce. (see separate course notes)
Course goal #1

Message: algorithms rule!

• As vibrant and important a research field as ever.
  – New algorithms/data structures didn’t stop in the 70s!
  – New progress on old problems; new problems from new applications; old problems on new architectures
  – All papers from 21st century, if not the last few years

• Example: Symposium on Discrete Algorithms (SODA – top algorithms conference), ≈150 papers/year
  – Also lots of cool algorithms in more applied conferences (machine learning, data mining, etc.)
Course goal #2

Message: research is different/humbling, but cool.

• Not like problem sets, at all.
  – Formulating the right problem often the hardest part.
  – No idea what’s true or false, trivial or impossible.
  – Requires some serious creativity.

• Reading research papers is hard.
  – Often written only for experts, and even then, badly.
  – Will develop “paper reading survival kit”.
  – Even understanding 10% of a paper can be a victory.
Course goal #3

Message: small classes are cool.

• Can easily graduate with a Stanford CS degree without any professor knowing your name.

• I don’t get to know any undergrads.

• This class will be different.
Course goal #4

Message: presentation skills are important.

• In research and otherwise.
• In this class, more means to an end:
  – Best way to make sure you understand this stuff is to explain it (to yourself through writing it up, and to others by telling them about it).
Plan for course

• First 2-3 weeks: instructor lectures on topics of broad interest.
  – Current trends in algorithms research; survival guide for reading papers; tips for speaking and writing; landscape of relevant conferences; etc.

• Next 1-2 weeks: paper reading, group discussions.

• Last 5-6 weeks: student presentations
  – 25-30 minute per student (solo or in pairs)
Deliverables

• Overall grade out of 100 points.
  1. 20 points: attendance.
  2. 20 points: paper responses. (.5-1 page per paper; paper-specific guidelines will be given)
  3. 20 points: paper presentation (25-30 min)
  4. 20 points: practice presentation (1 wk before)
  5. 20 points: write-up to accompany presentation (due 1 week after)
Example Topics

• Bread-and-butter algorithms
  – Traveling Salesman Problem, bipartite matching

• Bread-and-butter data structures
  – E.g., latest development in hashing, heaps

• Algorithms for social networks
  – Triangle counting, de-anonymization, etc.
Example Topics (con’d)

• Algorithms for massive data sets
  – Map-reduce, dimensionality reduction, etc.

• Algorithms in machine learning
  – E.g., topic modeling, feature selection

• Miscellaneous cool stuff
  – Algorithmic LLL, pseudorandom data, etc.