CSci 8002: Intro. to Research in Computer Science - II

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Outline

• Research presentation guidelines
• Ph.D. milestones and evaluation at UMN-CSE
• Putting your Ph.D. to work
• Wrap-up
Research Presentation
Schedule

• April 13, 20, 27, and May 4, from 11:15-1:45

• Presentation order posted on class web page

• Everyone is expected to participate

• Your advisor (and other faculty) may attend
Goals of presentation

• Convey *essence* of proposal
• Communicate effectively with a CS-literate, but diverse, audience (us, advisor/other fac.)
• Stimulate audience interest

What’s important and interesting?
*Strike a balance!*
Suggested structure

- **Introduction:** Background, motivation, focus of proposal, potential impact. *Convey Message!*
- **Current status:** Prior work, context for proposed work
- **Proposed work:** Crisp statement of research questions, importance, challenges, potential approaches
- **Timeline:** Task-> subtasks; Expected time
- **Conclusion:** Tie things together, key take-aways, reiterate message
Recent Algorithmic Applications of MapReduce

• Graph algorithms for connected components, cycles, trusses [Cohen, 2009]

• Geometric algorithms for nearest neighbors, convex hulls [Eldawy et al., 2013]

• Social network analysis [Ostrowski, 2014]
2.4 Computational Geometry Operations

As indicated earlier, CG_Hadoop forms the nucleus of a comprehensive MapReduce library of computational geometry operations. Currently, CG_Hadoop includes six fundamental operations, namely, Union, Voronoi Diagram, Skyline, Convex Hull, Farthest pair, and Closest Pair. Below, we give a brief definition of each operation.

Union. The union of a set $S$ of polygons is the set of all such points that lie in at least one of the polygons in $S$, where only the perimeter of all points is kept and inner segments are removed. Fig. 1(a) gives a sample input to the polygon union operation as a set of ZIP code areas, while Fig. 1(b) gives the union result.

Voronoi Diagram. The Voronoi diagram of a set $S$ of points, also called sites, is a tessellation of the space into regions, each associated with a site, such that any point inside each region is closer to the associated site than to any other site. For example, the Voronoi diagram of the sites in Fig. 2(a) is shown in Fig. 2(b).

Skyline. Consider the set $P$ of points in Fig. 2(a). Point $p_i \in P$ dominates point $p_j \in P$ if each of the coordinates of $p_i$ is greater than or equal to the corresponding coordinate of $p_j$, with strict inequality in at least one dimension. The skyline of $P$ consists of those points of $P$ that are not dominated by any other point of $P$ (see Fig. 2(c)). In the computational geometry literature, the skyline points are usually called maximal points [40].

Convex Hull. The convex hull of a set $P$ of points is the smallest convex polygon that contains all the points in $P$, as shown in Fig. 2(d). The output of the convex hull operation is the set of points forming the hull in clockwise order.

Farthest Pair. Given a set $P$ of points, the farthest pair is a pair of points at the largest Euclidean distance from each other. As shown in Fig. 2(d), the two points contributing to the farthest pair have to lie on the convex hull.

Closest Pair. Given a set $P$ of points, the closest pair is a pair of points at the smallest $L_2$-distance from each other (Fig. 2(b)).
Geometric constructs

(a) Input Points (Sites)

(b) Voronoi Diagram

(c) Skyline

(d) Other Operations

Closest Pair

Farthest Pair

Convex Hull
Points to keep in mind

• Use your laptop/tablet
• Time: 12+3 minutes
• 8-10 slides total (with large fonts)

• No cut-paste-read. Pictures >> lots of text.
• Slides should reinforce, not substitute!

• Everyone should attend and participate
Evaluation

• Worth 10% of grade
• Criteria
  – Content of talk
  – Knowledge of topic
  – Organization of talk
  – Clarity of presentation
  – Handling of questions
  – Adherence to time limit
Ph.D. @ UMN-CSE: Milestones and Evaluation
Milestones

• Demonstrate CS&E background knowledge
• Complete Breadth courses
• Pass Preliminary Written and Oral Exam
• Pass Thesis Proposal exam
• Defend Thesis

For details on specific requirements and timelines see https://www.cs.umn.edu/academics/graduate/phd
Evaluation: Process

• Every Ph.D. student evaluated every year by a committee of faculty members
• Student fills out online form (activities, accomplishments, candid self-evaluation)
• Advisor provides input to student and committee
• Committee discusses each case with full faculty
• Student gets committee report (kudos, encouragement, warning!, Warning!!, termination, etc.)
Evaluation: CS&E Grad. Student Skills

• Research and scholarship skills
• Interaction skills
• Goal management skills
• Communication skills
• Career skills and integrity

• Details... (see skills document on class web page)
Putting your Ph.D. to work
What is your post-Ph.D. plan?

Need to start thinking now!
Options

- Faculty (Research univ.)
- Faculty (Teaching college)
- Industry (R&D, Established Co., start-up...)
- Government (National lab.)
- Post-doc/research associate
- Self-employed (entrepreneur)
- Others?

Here/overseas?
My experience in faculty hiring

• 7 years as CS&E Faculty Recruiting Chair (‘98-’05)

• ~2000 resumes reviewed

• ~100 interviews conducted

• 18 faculty members hired
Our dept.’s process (stage 1)

• Get positions from admin. (crucial!)
• Determine target areas (faculty consensus)
• Form FRC (~8 faculty + grad. student rep.)
• Place online and print advts.
• Await applications + recruit proactively

... October through December ...
Process (stage 2)

- Evaluate applications (chair + 2-3 faculty per app)
- Request letters/reject/hold
- Form candidate pool and get approval from Dean’s office
- Conduct phone interviews (WebEx)
- Down-select 15-18 candidates for on-campus interviews

... Jan through mid-Feb...
Process (stage 3)

- Conduct on-campus interview
- Get feedback from faculty, students, others
- Discuss and take all-faculty vote
- Make offer and negotiate (salary, start-up pkg., teaching load, etc.)
- Second visit
- Offer accepted/declined

... Mid-Feb through late-April...
The interview

Opportunity to learn about each other first-hand
• 1 to 1.5 days
• Meet with faculty, grad students, Dean, others
• Research seminar
  – Technical strengths
  – Teaching potential
  – Communication skills
• Socialize, see the Univ., area, etc.
Characteristics of process

• Highly dynamic/fluid
• Decision-making with incomplete info.
• “Optimization” by both sides
• Competition with peer schools
• Special situations, e.g., 2-body problem
• Generally democratic process within dept.
• Need to follow good hiring practices
Selection criteria

• Strong research record! (Quality >> quantity)
• Research statement and vision
• Match with dept. needs
• Quality of ref. letters and reputation of writers
• Evidence of teaching experience/potential
• Performance at interview
• Feedback from faculty (esp. area faculty)
• Tenure-track (junior) vs. tenured (senior)
So, how does one prepare?

• Build a strong research record
• Develop a compelling research story/vision
• Gain teaching experience (instructor, PFF, etc.)
• Serve on FRC as student rep.
• Learn to communicate effectively with a literate, but diverse, audience! (sound familiar? :-)
• Network (but don’t schmooze!). Advisor is key here.
• Put together a compelling dossier (CV, research and teaching statements, references)
• Practice giving various types of research talks, elevator speeches
• Hone interview skills
• Participate in interviews in our dept.

Start now!
Interviewing for other types of jobs

• Teaching faculty
  – Similar, greater emphasis on teaching than research

• Research labs (industry, Natl. Labs.)
  – Exclusively research, focused interviews with 1-2 groups. Problem-solving and coding skills tested. (Internships help a lot)

• R&D (industry)
  – Similar to above, but more product-focused.

• Post-doc
  – More 1-1 and based on advisor connections. Primarily research (and maybe some teaching)
Wrap-up

• Next week
  – Guest talk on “Demystifying the dissertation-writing process” by Noro Andriamanalina (Director, Academic and Professional Development, UMN)

• Questions/discussion?