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Research Methodology

Computer Science as Experimental Science

Lecture, 5. October, 2007

Research in Computer Science

1. **Pick a relevant research question**
2. **Work on it and make some progress**
3. **Make sure your work is solid and well supported**
4. Write scientific paper about work
5. Submit paper to conference, workshop, journal,...
6. If paper is accepted
   - Update CV, Present Paper, goto Step 1 or 2
7. Else Go To Step 1, 2, 3, 4 or 5

Shared experiment data

- Challenge problems
  - E.g. DIMACS
- Competitions
  - E.g., DARPA Grand Challenge
- Problem sets within field
  - E.g., large sets of SAT problems
- Randomly generated data

DIMACS Challenge - SAT

- Part of Second DIMACS challenge
- Problem sets
  - Generated by experts
  - Designed to push technology
- Tremendous impact
  - Kicked off massive technology leap
- Tricky to stay “real”
  - In this case, okay, as SAT is everywhere

Challenge problem – DARPA

- First attempt 2004
  - Drive from LA to Las Vegas (sort of)
  - Result: All vehicles failed within 1km
- Second attempt 2005

Real world challenge problems

- Real data from “industry”
  - Hard to come by
  - Very useful
- Example:
  - Aircraft assembly problem
  - Sanitized (but was really MD11)
  - Kicked off major improvements in scheduling technology

Key issues in methodology

- Sources of data – especially random
- Implementation differences
- Quality vs speed comparisons
- Variance in results
- Statistical analysis
- Usability and subjective analysis
- CS does not follow standard methods

The silver lining

- Most CS experiments work well
  - Can be repeated fairly easily
    - Or at least should be
  - Observation rarely impacts outcome
- Moving in the right direction
  - More rigorous methods appearing
  - More standardized approaches being used

Push-pull research