Course Overview

Research Methodology in Computer Science
CSCI 514

Course Expectations

- Seminar + Hands-on
  - Readings, due each class
    - Method descriptions (theory)
    - Example research papers (practice)
- Typical class
  - Lecture/discussion
  - In-class practice
  - Presentations of example papers
- Roles you will play in this course: researcher, author, reviewer

Guiding Principle: Prioritize Supporting Each Other as Humans

Course Overview

- In-class activities 10%
- Research analysis 10%
- Assignments 30%
- Research project 50%

Pre-Class Survey

In your own words:

1. What is research?
2. Is research important? Why?
3. What are examples of research projects you participated in?
4. What activities have you performed as part of these research projects?
5. Do you like conducting research? Why?

The Craft of Research (C of R)

Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams

Research is ...

- The ”world’s biggest industry”
- “Those who can’t do it well or evaluate that of others will find themselves sidelined ”
- “The source of most of what we believe”
- We “trust research” because we believe “it was done carefully and reported accurately”
- “Without research we will be locked in the opinions of the moment, becoming prisoners of what we alone experience or dupes to whatever we are told”

Role of Research

- Should be about a problem that encourages enthusiasm for you and interest for others
- Is often generated from the though “what we’ve got now isn’t quite right/good enough – we can do better ”
- Consists of work that leads to a meaningful contribution and evaluates that contribution
- Generates a better solution to the problem. It advances the state of the art.
- Needs to be shared and used to have an impact
- Needs to be reviewed

What is Research?

- A combination of investigation of past work and effort in the present that will help others in the future
- A set of opposites
  - Fun and frustration
  - Small steps and large insights
  - Building on others' work and contributing your own work
- Finding or developing something new that impacts the world

What isn’t Research?

- Playing with technology
- Book reports
- Programming project
- Replicating what others have already done

- However, each of these can be done as part of research.

Approaches to CS Research

- Attack a know problem, find/compare tools to solve it
- Formalize a new problem, then attack it

- Methods of Research
  - Quantitative Research
    - Use of mathematical models, numerical analysis to analyze results
    - Main approach: discovery, analysis, causal determination, prediction, generalization of findings.
    - Results: “This solution is N% better”
  - Qualitative Research
    - Use od non-numeric techniques to analyze results
    - Main approach: discovery, analogy, understanding extrapolation to similar circumstances
    - Results: “This is a new problem and here is how to solve it”