Welcome New Members Meeting &
Introduction to Research in Ubicomp Lab

Hao Chu
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Agenda

• Welcome new members
• Intro to research method (20 min)
• Intro to research projects (20 min each)
  – SpinTrack (Ben)
  – MugForest (Joe)
  – Metro WiFi Localization (Arvin)
  – UbiBike (Jones)
• Decide on a common weekly meeting time
• People-project assignment
Intro Research Method

- What is research?
- How to effectively use your advisor?
- How to start research?
What is research work?

• How is it different from any other work?
• Answer the following two questions:
  – What is new?
    • Differentiation – Related Work Survey
    • Implementation vs. Research innovations
  – Why is it important?
    • Why would people care about your innovations?
• Example :: SpinLoc
  – High-precision, low-cost indoor localization vs.
    • High-precision outdoor localization
    • High precision/cost indoor localization
A General Research Lifecycle

(1) Scenario
(2) Problem definition
(3) Related work survey
(4) Design
(5) Implementation
(6) Evaluation

(6.1) Write workshop paper [receive feedbacks]
(6.2) Shoot a video
(7) Redo 4-6
(8) Write a conference paper
(9) Write a journal paper
(1) Scenario

- Illustrate your idea by telling a story
  - How to apply your idea to solve real world problems (motivation)?
  - Emphasize the part of scenario where it is currently not possible, but with your idea, it becomes possible.

- Can be the “demo” scenario
  - How to present your idea?

- Examples:
  - Nutrition-aware Kitchen
    - Lab course after nutritional education class
(2) Derive Problem(s)

• Challenges / requirements
  – Problems you want to solve
  – Specify measurement **metrics** (how to measure if a solution successfully solves a problem?)

• Assumptions
  – Problems you don’t want to solve

• Implementation vs. research problems
  – Implementation problem
    • Java vs. C++ implementation
  – Research problem
    • A new algorithm
Come back to (3) Related Work
(4) Design

- Design solution(s) to solve technical problems
  - Thoughtful design before implementation
- Does your solution meet your requirements?
- Is the design solution sufficient for the demo scenario?
- Is your solution different from related work?
- Write a good design document
  - HW/SW Component Diagram
  - Flow chart
(5) Implementation

- Proof-of-concept vs. full implementation
- Good design document -> easy implementation
- Documentation
(6) Evaluation

• How well do design & implementation really work?
• What metrics can be evaluated?
  – Performance [Quantitative]
    • Accuracy, energy consumption, compression ratio, bandwidth overhead, latency, processing time, etc.
  – Usability [Subjective]
• Poor evaluation results (normal), then what?
  – Find out causes of failures
  – Redo design and implementation
• Thorough evaluation = High quality work
(3) Related Work Survey

• Why do related work survey?
  – Differentiate your solution from the others
    • What’s new?
  – Discover hot topics (problems)
    • Avoid old/outdated problems

• You need to read/hear a lot of papers (old & new)
  – No need to read lots of paper before starting a project
  – A project – focus – focused reading – accumulate related work knowledge over time
More on Related Work Survey

- A thorough related work survey means identifying the state-of-the-art in
  - Unsolved problems
  - Major approaches & their limitations
  - Active research groups & what they are up to
How to read a research paper?

• For each paper, try to answer the following questions:
  – What is the problem?
  – What was the current state-of-the-art?
  – What is the key make-a-difference (new) method?
  – What are the strengths & weaknesses about this make-a-difference method?
  – What has actually been done?
  – What is the future work?

• Reading vs. understanding.
How to read a research paper?

• Reading paper can be painful at the beginning ...
  – Have confidence that you will overcome the difficulty
• Read the 5th paper -> forgot the first paper
  – Write a small paper summary paragraph
• Index papers by
  – Research groups (time ordered)
  – Approaches
  – Published conferences
Reading in Depth

- Reading papers is very different from reading textbook
  - Must challenge what you read
- Critical reading/thinking (use your common sense)
  - Are assumptions reasonable?
  - Is the method similar to other methods in related work?
  - Is the improvement marginal or significant?
  - Are arguments logically sound?
  - Are evaluation metrics reasonable?
  - Is conclusion drawn logically from measurements?
How to select papers for reading?

- Reading list from UbiComp courses 2004-2008 (http://mll.csie.ntu.edu.tw/courses)
- Conferences
  - Applications: ACM UBICOMP, PERVASIVE, ACM CHI, ACM UIST
  - Systems: ACM SENSYS, ACM MOBISYS
- Online talks (http://mll.csie.ntu.edu.tw/seminars.php)
  - Multi-University Research Seminar Video Microsoft MURL
  - Stanford HCI seminar, Computer Systems Lab Colloquium
- Google-scholar keywords
- Collaborative learning
  - Join (start) a reading group

- No endless reading -> forget to work on a project
(7) Paper Writing

- Reflect what you have really done
  - Don’t really understand what has been done till it is written.
- Weakest part of all students in Taiwan
- Check out Armando's Paper Writing and Presentations Page
HCI Research Methodology

Slightly different from general research method

(1) Understand
(2) Study
(3) Design
(4) Build
(5) Evaluation
Skills to learn

• Research skill (i.e., problem solving)
• Language skill (i.e., presentation & writing)
• People skill
• Interdisciplinary research skill

• Research taste
How to Succeed in Research?

- Success is mostly determined by students (you) primarily.
  - Of course, I can also help a lot, if you are willing to listen
- Learn/Read on your own
  - Really read and understand the papers.
- Teach your advisor
  - I really like this concept, go out and learn about something and then teach the professor.
  - Fast moving field, don’t expect professor to be at forefront everywhere.
  - Professor cannot give you good advise if professors don’t understand the issues.
How to effectively use your advisor?

• Leverage the advisor’s knowledge
  – Bouncing ideas
  – Related work knowledge

• Request resources for projects

• Critique your writing & presentation skills
Questions & Answers