

Welcome New Members Meeting
&
Introduction to Research in Ubicomp Lab

Hao Chu
7/3/2008

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
 - http://swig.stanford.edu/~fox/paper_writing.html

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