Research Methods
in computer science

Spring 2023

Lecture 1

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Class Introduction

Introduction

    Name

    Research Topic/Group/Advisor

    Year(s) at UH

    Undergrad institution/country/city

Why do a PhD?

Some possible reasons

Like research

Want to get a research/faculty job

Learn how to read and write

Leadership in technology

Acquire analytical and technical skills

Objective

Learn how research is done in computer science

Improve research productivity

PhD Skills?

What skills do we need to do a PhD?

    To become a good researcher

    To become an effective and productive technologist

Topics Covered

Papers: Read, write, evaluate

Presentations: create, perform, evaluate

Other topics

- Research thinking
- Graphs and visualization
- Tools
- Statistics and data analysis
- Experiment design
- Ethics, Intellectual property, and startups

Guest Lectures

Other faculty and experts in research, writing, presentation will come to the class to share their ideas.

Important to understand different views and emphasis. They may be your co-advisor, peers, or thesis committee member.

Who Should Take this Course?

Ph.D. students in early career

MS Thesis/research students

Must have a research topic in mind!

Administrative Information

3 credits

COSC 6321/6110 is a PhD requirement

Meet Mondays/Wednesdays 1-230pm at S 116

Office hours: Mondays 230-330pm

http://www2.cs.uh.edu/~gnawali/courses/cosc6321-s23/

Lectures

Lectures are done in-person

Some guest lectures may be online

Grading

Pass/Fail

To Pass

    Submit all homework

    Each homework graded 0 or 1

    Average grade must be > 0.8

    Participate in activities (conference, etc.)

Logistics

Most HW submission on Teams

We will use specialized platforms for specific exercises

Discussions/messages on Teams

Topics for today

PhD and Research

What skills do we need to be successful?

    Get a PhD.

    Get a job.

The concept of deliberate practice

PhD

Courses?

Research?

Networking and other activities?

Research

Research comprises "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications." It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories.

https://en.wikipedia.org/wiki/Research

Some research is theoretical and involves developing and analyzing new algorithms and techniques and some is more applied and involves experiments, design, implementation, and testing. In every case, research is an enterprise of intellectual exploration that seeks to advance our field.

http://conquer.cra.org/students/what-is-research-in-computer-science

Computer Science Research

It is a little different from what that wikipedia article says

We build new artificats

What are the desirable properties?

How does it perform?

How well does it solve the problem?

Closer to engineering than natural sciences

Practical Process of Getting a CS Ph.D.

Generate papers?

> Need N papers to graduate??

Create new technology that will change the way we do things

> Describe your technology in a paper

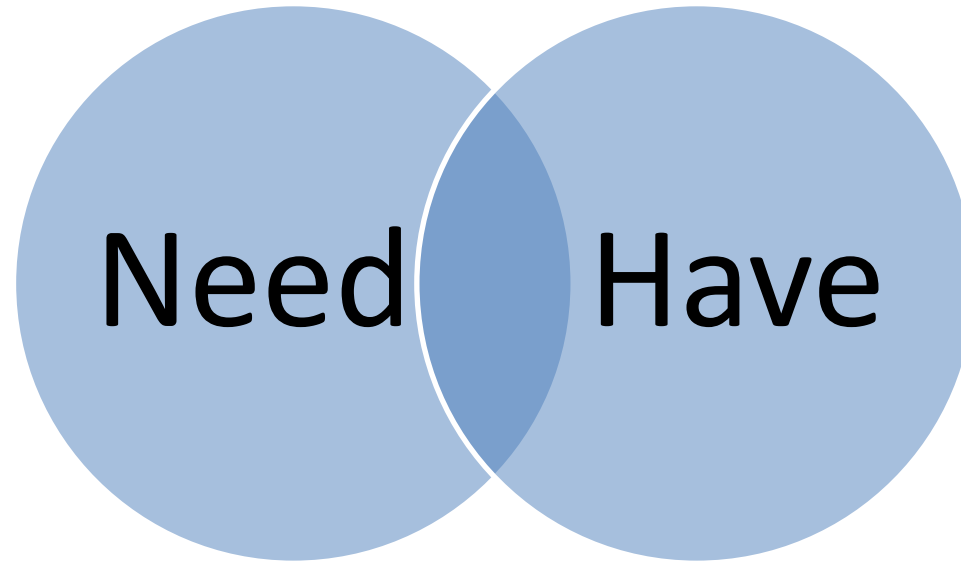> Paper is not the goal. It is a vehicle for communication and dissemination.

Skills

What skills do we need to do research?

How to create knowledge?

(Practical) How to produce output such as:

paper/presentations/software?

Deliberate Practice

Observe

Find good papers and presentations

Study the content and style

Identify Skills

Compare with your habits/skills/outputs

Details (not high level like "writing")

Practice

Drills to challenge and improve

Iterate with feedback

Frequent Practice

You may write just a few papers during your PhD.

    Not enough practice to be a good writer.

You may do just a few conference/external audience presentations during your PhD.

    Not enough practice to be a good presenter.

You may think you have infinite time to write your paper.

    Not a good environment to learn to be productive.

We will try to address these issues in this course.

Assignment 1

Please describe two topics of interest in Computer Science, one in your area of research and one related to the metaverse. Each paragraph must have:

Title

Clear and short explanation of the topic, understandable to a **broader** CS audience.

Reason why the idea is interesting