CIS373 - Pervasive Computing Introduction to Research

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Adapted from materials provided by Xiang Cao

What is research?

Different understandings
- Propose a new idea
- Design a new algorithm
- Design a new prototype
- Implement a new system

Essentially, something **NEW**!

Research papers

(Typically), two types of research paper:
- Survey/literature review
- Regular research paper

Types of publication:
- Technical report, peer-reviewed, or invited
- Journal, conference, or poster

Why bother? I'm going to industry!

Is this useless?

No! Being able to read and understand research papers **quickly** and **effectively** is a learned skill

A lot of leaps in industry are founded in academic research
  -   And vice versa

Worst case, you learn how to read a white paper
 -   (or you become an academic and write these for a living...)

First off - how do we find these?

Start with Google Scholar - https://scholar.google.com/
- A lot of authors will put pre-prints on their homepage and the link gets indexed
- Or, ACM/IEEE will publish for free
- Or it will be up on arXiv…

If you can't find it there, get yourself a library card
- Academic library though
- https://www.gvsu.edu/library/
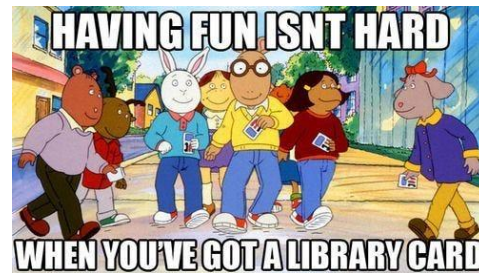
Worst case, email the lead author and see if they don't mind sending you a copy if you can't find it! Paywalls suck for something that should be open/free.

How do we find papers?

Easiest way: https://scholar.google.com

Search for a topic, read the abstracts, pull the PDF

PDFs are *often* uploaded by authors to personal sites (pre-prints)

Sometimes not available - behind paywall
- You may notice this if you are off campus...
- Go to the library to get them!

First, is this a *good paper*?

How to **evaluate** a research paper?
- Venue, i.e., where did this paper published?
  - Journal: ACM/IEEE Transaction, ...
  - Conference: ACM SigComm, ...

Authors/Affiliations
- Are they known in their field (or maybe new and upcoming)?

Impact
- Industry standard
- Patent
- Citation count?

Summary/Literature review

Survey/Literature review is the first step to do research on some topic
- Get familiar with current research area
- Understand what has been done
- Find out what have been **missing** in previous work
- Identify what **problems/challenges** are in related work

Eventually, help us decide what we can do to improve, or propose something new

Usually, survey/literature review is a summary of many (10, or 20, or even more) **existing** research papers

Survey / Literature review

Example:
- As of Feb. 2024, cited **24886** times!

ELSEVIER
N·H

Computer Networks 38 (2002) 393–422

COMPUTER NETWORKS

www.elsevier.com/locate/comnet

Wireless sensor networks: a survey

I.F. Akyildiz, W. Su*, Y. Sankarasubramaniam, E. Cayirci

Broadband and Wireless Networking Laboratory, School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA 30332, USA

Survey / Literature review

The format of survey/literature review varies!

The following one shows a suggestion:
- Introduction
- Terminology
- Research Challenges
- Classification, slicing and dicing, taxonomy

http://www.cs.ucf.edu/~lboloni/Teaching/EEL6788_2008/slides/SurveyTutorial.pdf

Research paper

Generally, there should be **something innovative**:
- A new idea or algorithm
- A new prototype
- A new system
- A new aspect
- A new application
- ...

Shows there is an improvement or investigates an aspect that was missing in others' work

Sometimes, it is necessary to verify why our innovation is **better**
- Implementation
- Simulation
- Mathematical proof
- ...

Common organization

Some sections below can be mixed, or missing, depending…
- Title/Authors/affiliations
- Abstract/Keywords
- Introduction   - there is a formula! (https://efredericks.github.io/students.html)
- Background
- Motivation
- Problem Statement
- Proposed Solution
- Performance Evaluation
- Related Work
- Conclusion and Future work
- Reference
- Acknowledgments

Example: WSN Leach protocol

Cited 21811 times as of Feb 2024!

Energy-Efficient Communication Protocol for Wireless Microsensor Networks

Wendi Rabiner Heinzelman, Anantha Chandrakasan, and Hari Balakrishnan

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How do we read it?

Multiple times!

- Understand **general idea first**
- What is the theme of this paper?
- What is the motivation of this work?
- What kind of innovation/improvement the authors propose?

Then, look for detail
- What is the algorithm/solution?
- How to verify their innovation?

This is our task for the evening

Your job is going to be to find **three** papers relevant to your proposed project
- Jot down the citation information

Your full task will be to parse out what the paper actually is getting after

Let's do an example, shall we?

I need a paper on run time testing for robotics for some current research I'm doing!
- *What ever shall I do?*