

Research method in Computer Science

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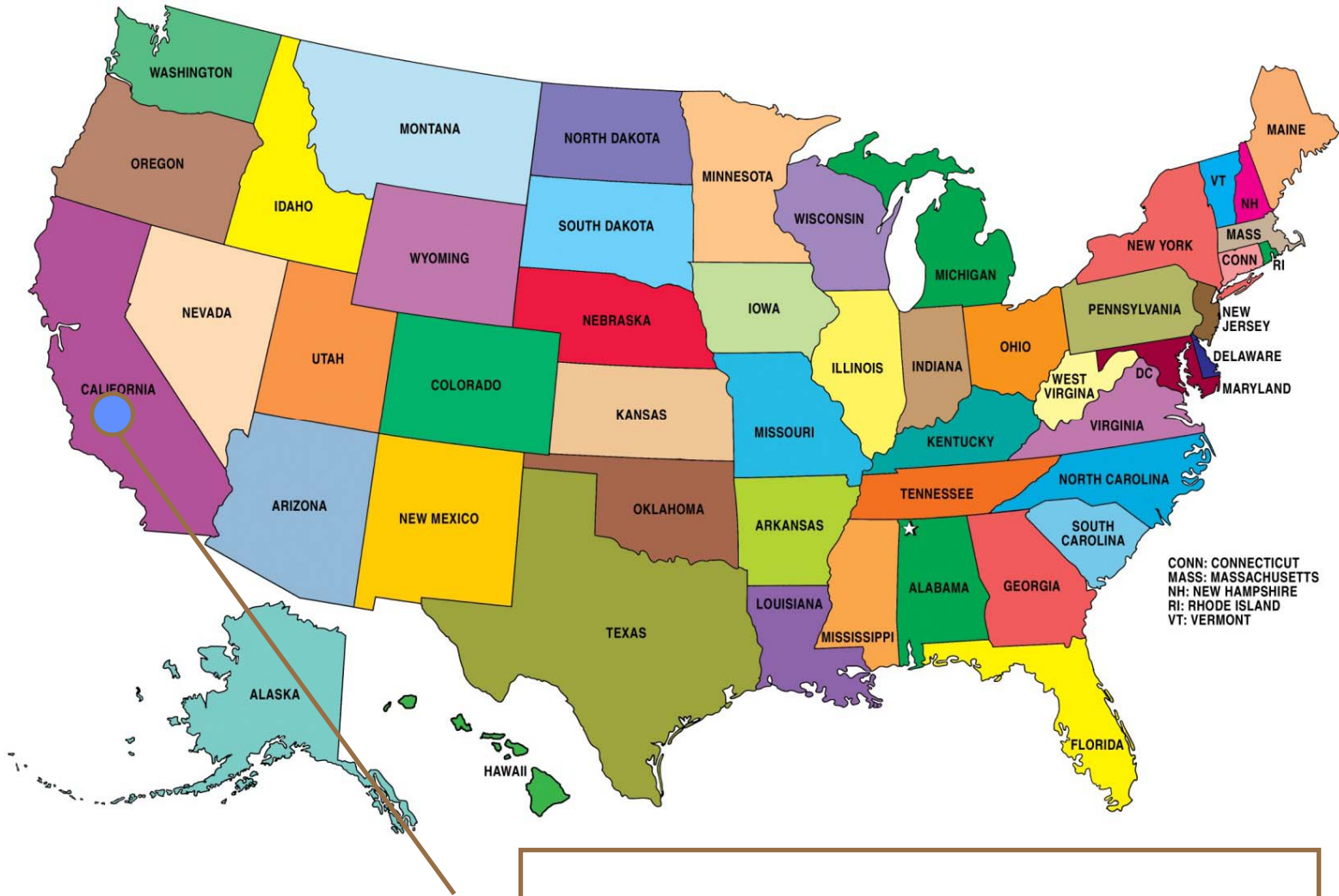
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Academic experience

- **2006.9 ~2008.6 University of California, Irvine,
Postdoc researcher Supervisor: Prof. Chen Li**
- **2002.8 ~2006.8 National University of Singapore,
PhD candidate Supervisor: Prof. Ling Tok
Wang**
- **1998.9 ~ 2001.1 Shanghai Jiao Tong University
Master candidate**



CONN: CONNECTICUT
MASS: MASSACHUSETTS
NH: NEW HAMPSHIRE
RI: RHODE ISLAND
VT: VERMONT

University of California, Irvine

Research in Postdoc



Data integration in medical system
[US patent]



Approximate string search [ICDE08]



PhD research topics

- **XML twig query processing**
[SIGMOD05, VLDB05, CIKM05,04, DEXA05,DASF06]
- **XML keyword search [ICDE09,DASF08]**

Course purpose

- **Teach in English in most time**
- **Introduce graduate students, including Master and PhD students, to the practice of research.**

Course contents

- **Reading technical papers**
- **Selecting research topics**
- **Writing research paper and thesis**
- **Performing experiments**
- **Searching job and interview skills**

Course grading

- **Presentation in English only 40%**
- **Paper in Chinese only 40%**
- **In-class presence and quiz 20%**

Introduction to computer science research

1. Reading
2. Ideas
3. Getting Connected
4. Learning Other Fields
5. Writing
6. Publishing
7. Talks
8. Thesis
9. Emotional Factors

1. Reading

- **Many researchers spend more than half their time reading.**
 - You can learn a lot more quickly from other people's work than from doing your own.
- **Read with a question in mind.**
 - How can I use this? Does this really do what the author claims? What if...?
 - Most of the understanding is in figuring out the motivations, the choices the authors made (many of them implicit),
 - whether the assumptions and formalizations are realistic,
 - what directions the work suggests, the problems lying just over the horizon, the patterns of difficulty that keep coming up in the author's research program, etc.

1. Reading (2)

Three phases to reading a paper:

- **First: see if there's anything of interest**
 - Scan the title, then the abstract, then -- if you haven't completely lost interest already -- glance at the introduction and conclusions.
- **Second: find the part that has the good stuff**
 - Most fifteen page papers could profitably be rewritten as one-page papers; you need to look for the page that has the exciting stuff.
- **Third: go back and read the whole paper through if it seems worthwhile**

2. Ideas

- **Always have some research ideas.**
 - **Start with small; ask advisor and senior students for ideas; and later come up with your own.**
 - **Expose yourself to research:**
 - » **Use libraries and electronic resources**
 - » **Attend research seminars**
 - **Become an active reader and listener**
 - » **Read/listen and critique**
- **Most ideas are dead ends, few endure.**

3. Getting Connected

- **Secret Paper Passing Network**
 - When you read a paper that excites you, make five copies and give them to people you think will be interested in it.
 - Whenever you write something yourself, distribute copies of a draft to interested people.
 - When you finish a paper, send copies to everyone you think might be interested.

- **Conferences**
 - How to meet people? Walk up to someone whose paper you've liked, say “I really liked your paper”, and ask a question.

4. Learning Other Fields

- **Good research requires that you know a lot about several related fields (math, engineering, psychology, philosophy, physics, ... etc.)**
- **To know about a field you don't know much about:**
 - Take a graduate course.
 - Read a textbook.
 - Skim the last few years worth of best journal in the field.

5. Writing

- **Writing down your ideas is the best way to debug them.**
 - Usually you will find that what seemed perfectly clear in your head is in fact an incoherent mess on paper.
- **A basic responsibility of research is to benefit.**
 - If you write well, more people will read your work!
- **Writing seems a distraction from doing the real work.**
 - As you get better at it, it goes faster.

5. Writing (2)

- **Learning to write well requires doing a lot of it, over years.**
- **Read books about how to write.**
- **Reading well-written books makes you absorb the good style.**
- **Writing letters or a diary is a good practice.**
- **Comments on your papers are one of the most important forms of feedback.**

5. Writing (3)

- **Make sure your paper has an idea in it.**
 - Don't just explain how your system is built and what it does, also explain why it works and why it's interesting.
- **Write for people, not machines.**
 - It's not enough that your argument be correct, it has to be easy to follow.
- **Put the hot stuff up front, at all levels of organization from paragraph up to the whole paper.**
 - A much better introductory sentence can be found at the end of the first paragraph or the beginning of the second.
- **Don't “sell” what you've done with big words or claims.**
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6. Publishing

- **Academia runs on “publish or perish”.**
- **A good paper should:**
 - **Have something new.**
 - **Not be broken in some way.**
- **Make sure your paper is readable.**
- **Circulate drafts for a while before sending it in to the journal.**
 - **Resist the temptation to hurry a result into publication.**
- **Papers get rejected -- don't get dejected.**
 - **The reviewing process differs greatly between journals and conferences.**

7. Talks

- **Talks are another form of communication with your colleagues**
- **Some people find that talks are a good way to find the right way to express their ideas, since revising a talk is generally much easier than revising a paper,**
- **Practice, practice, practice**
 - Practice the talk in an empty room or with a mirror, tape, or video recorder.
 - Actually give talks to groups of people.

8. Thesis

- **Master's thesis vs. PhD thesis**
 - **The essential requirement of a Master's thesis is that it literally demonstrate mastery: that you have fully understood the state of the art in your subfield and that you are capable of operating at that level.**
 - **PhD theses are required to extend the state of the art. PhD thesis research should be of publishable quality.**

8. Thesis (2)

- **Choosing a topic is one of the most difficult and important parts of thesis work.**
 - **A good thesis topic will simultaneously express a personal vision and participate in a conversation with the literature.**
 - **An ideal thesis topic has a sort of telescoping organization.**
 - » **It has a central portion you are pretty sure you can finish and that you and your advisor agree will meet the degree requirements.**
 - » **It should have various extensions that are successively riskier and that will make the thesis more exciting if they pan out.**
- **When doing the work, be able to explain simply how each part of your theory and implementation is in service of the goal.**

9. Emotional Factors

- **Research is hard. It is easy to burn out on it.**
- **All research involves risk.**
 - **If your project can't fail, it's development, not research.**
 - **The few people in the field who seem to consistently succeed, turning out papers year after year, in fact fail as often as anyone else.**

10. Emotional Factors (2)

- **Try to have the ability to differentiate between superficially appealing ideas and genuinely important ones.**
- **Regularly set short and medium term goals, weekly and monthly for instance.**
- **When stuck, work on a subproblem to get back into the flow.**
- **Don't doubt your ability to do the work.**
 - **Realize that research ability is a learned skill, not innate genius.**

References

- [How to do research at the MIT AI Lab](#)
- [How to start research in computer networks](#)
- [How to be a good graduate student](#)
- [Basic Research Skills in Computing Science](#)
- [What is Research in Computing Science?](#)
- [Resources on Research, Writing, and Careers in Computer Science](#)

- [Writing Technical Articles](#)
- [The Elements of Style](#)
- [Three Sins of Authors in Computer Science and Math](#)

Thanks!