

Research Practice & Ethics

COMP9011

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Delivered To

MSc Software Architecture and Design

MSc Artificial Intelligence

MSc Information Design and Development

Week 2

How to Start Research in Computer Science

Writing a Research Proposal

How to Start Research in Computer Science? Computer Networks!

Source: <https://www.cise.ufl.edu/~helmy/cis6930/research-start.html>

Step 1: Pick an Area



- Pick a direction or area of interest based on your background in *computer networking* (e.g., courses you have taken, readings, conferences, talks to Professors, etc.).
- Try to be as specific as possible. For example, do not pick 'multicast' (it is too general), but perhaps 'congestion control for reliable multicast' or 'multicast routing in ad hoc networks'.
- Do not pick 'wireless networks' (too general), but perhaps 'systematic testing of wireless MAC layer' or 'efficient handoff for IP mobility', for instance.
- There could be a list of topics that interest you (related or unrelated).
- I do not recommend a list of more than three topics.

Step 1: Pick an Area



- Select an Area related with your MSc
 - Artificial Intelligence
 - Software Architecture and Design
 - Information Design and Development
- You can also select an area which is inter-disciplinary
 - Artificial Intelligence applied to Software Architecture and Design
 - Artificial Intelligence applied to Information Design and Development
 - Artificial Intelligence applied to Medical Science
 - Artificial Intelligence applied to Blockchain
 - Software architecture and design for Blockchain

Step 1: Pick an Area



- Programming Language Design
- Malware Investigations
- Software Process Engineering
- Software Architecture & Design
- Metaheuristic Optimisation
- Natural Language Processing
- Big Data Processing
- Source Code Analysis
- Fraud & Anomaly Detection
- Malware Reverse Eng

Step 1: Pick an Area



- Scalable Microservices
- Knowledge Representation
- Practical Machine Learning
- Decision Analytics
- Deep Learning
- Machine Vision
- Robotics & Autonomous Systems
- XML in Technical Communication
- Design Thinking for Services
- Multimedia Production
- Information Strategy

Step 2: Compile Set of Keywords



- Compile a set of 'keywords' to start searching for high quality readings for each of the previously selected topics. Good places to start your search are [IEEE library on-line](#) and [ACM library on-line](#).
- Pick one research topic at a time. You can also search on the web (e.g., Google, or Google scholar) but please double check the publication details for quality (there are a lot of papers out there!).

Step 3: Select Research Papers



- Out of the search hits, select around 15-20 papers that you think are most related to what you had in mind and are of the highest quality.
- Do NOT read all these papers yet!
- Check the title, abstract, names of authors, their affiliations, and most importantly the conference or journal.
- Many IEEE and ACM conferences/Journals are of high quality.
- Some, however, are more selective and competitive than others.

How to Read a Research Paper?



- For Quick Overview of Any Research Paper
 - Read the title
 - Read the keywords
 - Read the Abstract
 - Read the Introduction
 - Read the Conclusion
 - Browse the whole paper quickly
 - Give attention to the figures and tables

Step 3: Select Research Papers



- Examples of well-known conferences/journals include, but are not limited to:
- In the general area of Computer Networks:
 - IEEE/ACM Transactions on Networking (ToN),
 - IEEE Journal on Selected Areas in Communications (JSAC),
 - ACM SIGCOMM,
 - IEEE INFOCOM,
 - IEEE ICNP,
 - IEEE SIGMetrics,
 - ACM IMC,
 - Usenix/ACM NSDI,
 - ACM CoNext,
 - Computer Networks Journal (Elsevier) among others.

Step 3: Select Research Papers



- In the more specific areas of wireless networks (including mobile ad hoc networks, sensor networks and cellular-like infrastructure-based networks):
 - ACM MobiCom,
 - ACM MobiSys,
 - ACM MobiHoc,
 - ACM TOSN,
 - ACM MONET Journal,
 - AdHoc Networks Journal (Elsevier), ACM Wireless Networks (WiNet) Journal, ACM SenSys, IEEE/ACM IPSN, ACM HotMobile, ACM HotNets, ACM SigSpatial, ACM MSWiM, IEEE SECON, IEEE WoWMoM, ACM UbiComp, IEEE PerCom, IEEE/ACM DCOSS, ... IEEE WCNC, ACM MC2R, to name a few.

Step 3: Select Research Papers



- Some gathered statistics about conference/workshop acceptance rates can be found through [Kevin Almeroth's website](#). Note, however, that this is only one possible indication of quality.
[Note: try to refine your set of keywords and perform multiple searches to cover most related quality work.]
- Another hint is to use references and citations. Usually the most cited work by high quality papers is also of high quality (there are exceptions, such as some surveys, and citation circles/cartels!).
- If you like a specific paper, then look at the list of references, this will give you a good direction to follow.

Networking Conferences Statistics



This page is an attempt to gather year-over-year statistics for some of the major systems and networking conferences.

For an analysis of this data see [Utkarsh Goel, Clemente Izurieta, Mike P. Wittie. "Understanding Factors Influencing the Citation Count of Networking Conference Papers" in ISCA Software Engineering and Data Engineering \(SEDE\), October 2015.](#)

For FOG and Edge Computing conference stats, see the [Fog and Edge Computing Conferences and Journals Page](#).

For Architecture conference stats (ISCA, Micro, HPCA, ASPLOS), see the [Prichard, Scopel, Hill, Sohi, and Wood Excel File](#).

For Database conference stats, see [Peter Aper's Stats Page](#).

For Computer Security conference stats, see [Guofei Gu's Computer Security Conference Ranking and Statistics Page](#).

For Theory (and some Computational Biology) conference stats, see [Florian Sikora's TCS page](#).

[ACNS](#), [AIMS](#), [ANCS](#), [APCC](#), [CAMAD](#), [CCS](#), [CCGrid](#), [CCNC](#), [CloudCom](#), [CloudNet](#), [Cluster](#), [CNS](#), [CNSM](#), [CNSR](#), [COMSNETS](#), [CoNext](#), [CrossCloud](#), [DAIS](#), [DEBS](#), [DRCN](#), [DSN](#), [DSOM](#), [ECRTS](#), [EDOC](#), [EPEW](#), [eScience](#), [ESOCC](#), [EuCNC](#), [Euro-Par](#), [EUNICE](#), [EuroSys](#), [EWSN](#), [FMN](#), [FMOODS](#), [FMOODS/FORTE](#), [FORTE](#), [FORTE/PSTV](#), [Global Internet](#), [Globecom](#), [Grid](#), [HiPC](#), [HotPlanet](#), [HPCC](#), [HPDC](#), [HPSR](#), [I3E](#), [ICASSP](#), [ICC](#), [ICCC](#), [ICCCN](#), [ICCPs](#), [ICDCS](#), [ICDIM](#), [ICIN](#), [ICODP](#), [ICNC](#), [ICNP](#), [ICPADS](#), [ICPP](#), [ICQT](#), [ICS](#), [ICUFN](#), [IM](#), [IMC](#), [Infocom](#), [IPCCC](#), [IPDPS](#), [IPOM](#), [IPS-MoMe](#), [IPSN](#), [IPTPS](#), [ISCC](#), [ISPDC](#), [ITC](#), [IWAN](#), [IWCMC](#), [IWPTS](#), [IWTCS](#), [IWQoS](#), [LANC](#), [LANMAN](#), [LANOMS](#), [LCN](#), [MASCOTS](#), [MASS](#), [MedHocNet](#), [MELT](#), [Middleware](#), [MMCN](#), [MMNS](#), [Mobiarch](#), [Mobicom](#), [Mobihoc](#), [MobiOpp](#), [Mobiquitous](#), [Mobisys](#), [Mobiwac](#), [MSN](#), [MSWiM](#), [Multimedia](#), [NCA](#), [NESEA](#), [NetGames](#), [NetSoft](#), [Networking](#), [NEW2AN](#), [NIME](#), [NDSS](#), [NGC](#), [NGMAST](#), [NOF](#), [NOMS](#), [NOSSDAV](#), [NPC](#), [NSDI](#), [NTMS](#), [OPENARCH](#), [OOPSLA](#), [OSDI](#), [P2P](#), [PAM](#), [PerCom](#), [Performance](#), [PEMWN](#), [PIMRC](#), [PSTV](#), [PVM/MPI](#), [PWC](#), [Q2SWinet](#), [QofIS](#), [RTAS](#), [RTSS](#), [SAINT](#), [SASO](#), [SAWN](#), [SBAC-PAD](#), [SCNS](#), [SECON](#), [Security](#), [Security & Privacy](#), [SenSys](#), [Sigcomm](#), [Sigmetrics](#), [SmartGridComm](#), [SOSP](#), [SOSR](#), [Supercomputing](#), [SUSTAINIT](#), [TechSym](#), [Testcom](#), [Testcom/Fates](#), [TMA \(workshop\)](#), [TMA](#), [UBICOMM](#), [USENIX](#), [USITS](#), [VANET](#), [VTC](#), [WiOpt](#), [WiSec](#), [WCITD](#), [WCNC](#), [WCW](#), [WD](#), [WICON](#), [WiMob](#), [WMASH](#), [WMI](#), [WMNC](#), [WONS](#), [WoWMoM](#), [WORM](#), [WPMC](#), [WQoS](#), [WWIC](#), and [WWW](#).

- Papers Submitted Papers
- Accepted Acceptance Ratio
- Number of Parallel Tracks, and
- Number of Attendee

Source: <https://sites.cs.ucsb.edu/~almeroth/conf/stats/>

How to Find Research Paper?



- IEEE Xplore

<https://ieeexplore.ieee.org/Xplore/home.jsp>

- Science Direct

<https://www.sciencedirect.com/>

- Google Scholar

<https://scholar.google.com/>

- ACM digital library

<https://dl.acm.org/>

- Web pages of researchers

- Repositories

- Arxiv
 - Research Gate

Step 4: Reading Shortlisted Papers



- For the selected 15-20 papers read only the abstract, introduction and conclusion in detail (you may skim the rest of the paper for a general idea). Identify the emphasis of each paper:
 - Which problem it addresses,
 - What solution it proposes,
 - How the solution differs from previous solutions, and
 - What are the main contributions and conclusions.
- Out of these 15-20 papers, and based on your reading and understanding, pick a list of 4-6 papers that you think are the highest quality and that address your research interests and the challenges in the field most appropriately.

How to Read a Research Paper?



- For Detailed Reading of Any Research Paper
 - What are the main problems in this area?
 - What are the pitfalls of the earlier work?
 - Why do you think this topic is important?
 - What earlier researchers have proposed to address this problem?
 - What are the main results and conclusions and Author's contribution?
 - Why do you think you still need to work on this area?
 - What do you propose that is different from earlier work?
 - What do you propose that is similar to earlier work?
 - Clarify how your ideas address the shortcomings of earlier work?
 - Why do you think your proposal is important for the topic?

Step 5: Read in More Depth



- Read those 4-6 papers from beginning to end, identifying in detail:
 - The main approaches,
 - Methods of analysis:
 - (a) metrics,
 - (b) evaluation tools, and
 - (c) analysis and interpretation of resulting simulation or measured data, and
 - Conclusions.

Step 5: Read in More Depth



- At the same time, try to keep a list of what you think the authors may have missed in the paper/study, gaps or limitations that could be improved upon and any ideas on how to accomplish these improvements.

Step 5: Read in More Depth



- Some questions to ask include:
 - Did all/some papers use similar approaches?
 - Have they used the same evaluation criteria, or method of analysis?
 - If not, then what are the strengths/weaknesses of each method?
 - Also, keep a list of ideas that you want to explore further, or background material you want to brush upon.
 - This will create another list of readings for you in later stages.

Step 6: Write Two Page Research Proposal



- Write a two page proposal defining, as clearly as possible, the following items:
 - Motivation
 - Research challenges
 - Overview of existing work
 - Limitations of existing work
 - Potential directions and ideas for improvement
 - Expected results and impact on the field.
- If/when you think it is clear, then discuss the proposal with your research advisor. If you do not think it is clear, go back and re-write. If you think you have missed some other work, then go back to the 15-20 list and pick another 3-5 good papers to read in detail, and re-write parts of your proposal.

Step 6: Write Two Page Research Proposal



- Try to focus... it is hard, and there are a lot of good ideas out there, and the more you read, the more you want to read (which is good), but you have to focus and write those 2 pages.
- Remember that having a strategy is sometimes more important than dispersed ideas.
- More readings will come at a later phase.
- It is more important to focus at this point and not get confused, so be very selective in your readings.

Structure of 2 Page Research Proposal



- Title
 - Think about four to five titles for your proposal
- Motivation
 - Why you think this topic is important?
 - Why is this a significant area of research?
 - What are the main problems in this area? and
 - Why do you think your proposal is important for the topic?
- Related Work
- Proposal Body
- References
 - Add few references of high quality venues

Structure of 2 Page Research Proposal



■ Related Work

- What other researchers have proposed earlier to address the above problems?
- What were their results and conclusions?
- Why you think you still need to do work in this area (i.e., what are the shortcomings/pitfalls of earlier work?)
- What do you propose that is different from related work? and
- What do you propose that is similar?
- Clarify how your ideas address the shortcomings of earlier work.
- Provide adequate and proper citations of related work.

Structure of 2 Page Research Proposal



■ Proposal Body

- *Problem statement*: State very clearly and very specifically the question(s) that you attempt to answer (Be as clear and as specific as you can). You can list the questions but add an introduction sentence to link the questions and tell the whole story.
- *Evaluation metrics*: Mention very clearly and as specific as possible the evaluation criteria and metrics you intend to use to evaluate your approach and ideas. Examples of evaluation metric may include 'overhead' (need to clarify what overhead is and how is it measured), response delay (how to measure it), etc.
- *Investigated Parameter Space*: Mention the design space investigated in the study. For example, a popularity threshold of 5-50 with steps of 5 could be a design space investigated for the SDS promotion scheme. Another example may be random selection of contacts, selection based on stability measures (need to define what stability is and what are the limits investigated).

Structure of 2 Page Research Proposal



■ Proposal Body

- *Methodology*: Graph theory, finite state machines, queueing theory, network simulation, mathematical modeling or experimentation are some examples of the methodology. Mention which of the methodologies will be used and why. Elaborate on the tool used, if any. For example, network simulator (NS-2) or GlomoSim may be used as network simulators. Also, elaborate on the existing capabilities of the tools and what needs to be modified or augmented to suit your analysis.
- *Scenarios*: Include topologies (network size, connectivity, etc.), traffic and multicast membership patterns (if any), network failures, packet loss patterns, mobility models/degrees that will be used to evaluate the protocol. Explain your choice of the above parameters.
- *Expected results*: Show what change in performance/evaluation you would gain by using your approach (as opposed to previous work). At this stage, show only expected/anticipated results or trends and justify your prediction. (It would also help to provide graphs with explanation of the x and y (and other!) axes).

Step 7: Write Detailed Research Proposal



- If you have done a good job at the above, I think you are at a good 'starting' point to pursue research!
- Good luck with the rest...
- The next step is to write a 10 page proposal elaborating on the 2 pages above, adding your own twist on the problem, outlining your initial thoughts, results and findings, and outlining a clear plan to continue the work.

Structure of Detailed Research Proposal



- Title
 - Think about four to five titles for your proposal
- Abstract
 - Around half page (or less) outlining the work, its scope, what is the problem statement in brief, how is the approach different than main previous approaches to this problem and what are the main observations/results?
- Motivation
 - Why you think this topic is important?
 - Why is this a significant area of research?
 - What are the main problems in this area? and
 - Why do you think your proposal is important for the topic?
- Related Work
- Proposal Body
- Result and Analysis
- References
 - Add few references of high quality venues

Structure of Detailed Research Proposal



- Result and Analysis (*Most Important Section*)
- Describe the specific settings of the evaluation scenarios and outline the experiment(s).
- Show the result graphs and explain them very clearly (using self-explanatory graph labelling, graph captions and explanation in the text).
- Focus on the main points of the results and start extracting useful observation that may help in drawing conclusions.
- Analyze these main points, explaining why they occurred? was this result expected? (if yes, was it the same reason initially thought or a different one? if no, why not? was the flaw in the initial thinking?)