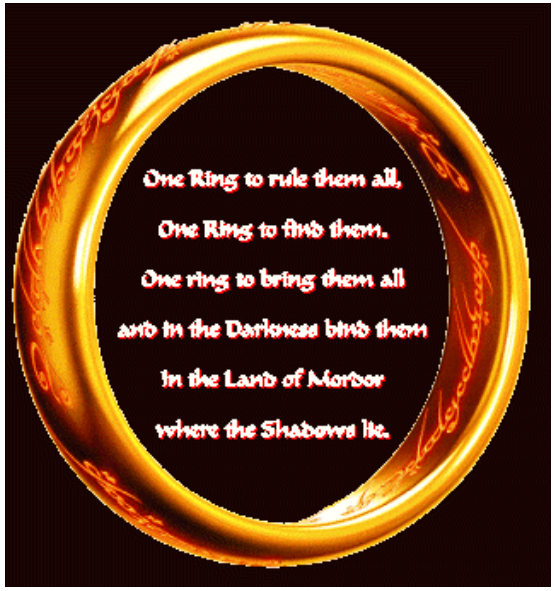
Research as a Graduate Student- beyond a survival guide

Shou-de Lin
Assistant Professor, CSIE/GINM, NTU
sdlin@csie.ntu.edu.tw

Acknowledgement

- Some of the materials and ideas are originated from other people, including:
  - *Marie desJardins*
  - *Kevin Knight*
  - *Ed Hovy*
  - Dianne O'Leary
  - Duane A. Bailey
  - Ronald T. Azuma
  - Possibly others here and there

Lord of the Rings-the Graduate Version



The beginning of the Journey

- 故事從一個叫Frodo的學生說起…
  - Frodo看不起自己那些大學整天蹺課，畢業後就嚷著要開公司賺大錢的同學。
  - Frodo 大學畢業時覺得自己好像甚麼都會，又甚麼都不會，所以決定來念 T大研究所 。
  - Frodo 自尊心強，但也非常敬畏他的指導老師－資深教授Gandalf，所以當Gandalf跟他說：『 我給你一個簡單的project （ 把魔戒帶去Rivendell ） ，你應該可以做吧？ 』時，他找不到拒絕的理由 。

So, Is this Research?

- 在Frodo執行Project 的時候， 他發現事情沒有那麼簡單。 這個問題不如想像的單純， 前方還有很多障礙（ 比如系辦的幽靈部隊常常找麻煩 ，而網路就像風箏一樣）
- 幸好， 他得到了一些朋友師長的幫忙， 尤其是已經到處打游擊當了五年Postdoc 的Aragorn，他在Gandalf不在的時候順理成章的扮演起advisor的角色。

- 終於， 在經過一個學期的努力，這個小小的project完成了， 魔戒送達定位。
- Frodo 心裡想： 原來研究，其實只是一塊蛋糕。

Warning!! Funding is Coming!!

- Gandalf對Frodo 的結果感到滿意， 沒多久他就以這結果爲基礎，對金主Elron 提出了多年期產學計畫。

- Gandalf也開始大肆召集研究團隊成員，包括外籍生Legolas ， 大學專題生Sam ，訪問學者Boromir 。 碩士班學生Pippin。

於是 Gandalf 只剩下一件事要做： 找個未來可以待個三四年的人負責這個計畫。

The Persuasive

- 於是 Gandalf 把Frodo 找來說：「現在有一個千載難求的好計畫， 你願不願意幫我把魔戒送到摩多。接這個四年計畫的好處有：
  - 月薪從5000 跳成15000。
  - 到摩多之後有一群人組成committee在等你， 只要通過他們的試煉， 就可以拿到一頂魔法帽子，戴上去就可以呼風喚雨（看看我現在這樣 ）。
  - 有一群兵士（學弟妹） 供你使喚。
  - 最重要的是， 如果你不接的話... 碩士論文口試那天，可能會出現以下 情形。
- Frodo 二話不說馬上答應接這個計畫。 他說了一句全世界的博班學生都說過的話：”I will take the ring, although I do not know the way”.
- Gandalf 也二話不說把他保送到博士班。

The Pain Starts…

- 很快的，Frodo 發現事情不大對勁。首先， 他發現 Gandalf 失蹤了（到快畢業才出現），一開始他以爲是因爲生病或是被火獸吃了， 後來發現他不過是去找其他的funding。
- 然後， 他發現訪問學者Boromir 背叛他， 把他的Idea 拿去發表，想自己先去摩多。
- 更慘的是， Aragorn找到了在剛鐸的助理教授職位， 把Legolas 等人也帶去了。Frodo 發現原來身邊可以求助的人都走了， 原來博士論文這東西「真的」是要靠他一個人產生。
  - 或許不是一個人， 他身邊還有Sam（大學部專題生把 Frodo 當成神一樣崇拜 ）

The Pain Continues

- 於是Frodo自己一個人慢慢的走向摩多。時間一天一天的過他身上的擔子一天一天的重，愈接近他就愈害怕失敗。
- 而且，縈繞不去的是Gollum（上一個擁有魔戒的人，傳說中念了七年沒有畢業的學長）的陰影。常常在Frodo夢中不時傳來「放棄吧放棄吧」的耳語。

Toward the End

- 終於，Frodo東拼西湊，用著不是很優美的姿勢到達了摩多。He submitted the ring to the file, and waited for the final judgment day.
- 從火裡緩緩的走出了Defense committee，他發現，裡面除了有久未謀面的Gandalf外，還有平常最愛找他麻煩的Saruman教授。

- 經過了一場激戰， 遍體鱗傷的Frodo 終於還是survive 了 ， 接受大家的恭喜。

而他的論文， 就像是掉到火裡的魔戒一般，再也沒有人看過（包括他自己）。

Why Frodo Suffered

- Because he is always forced to do things, he is not in “for himself”.
  - You should be in for yourself, not for your advisor or family.
  - Fail or succeed, it is YOU that should be responsible for it.
  - You should think about passing the test with flying colors, not just surviving it.
- Because nobody has ever come back from Mordor to pass the experience.
  - The goal of this talk is to let you know something that I wish I could have known earlier when I started my graduate life.

How to Become a Successful Graduate Student - General Tips

Graduate school is a different ballgame (comparing with Undergraduate)

- A successful undergraduate student ⇎ A successful graduate student
  - The students who do well in graduate school are the ones who learn this earlier rather than later and make the necessary adjustments.
- Graduate school training is like teaching swimming by tossing students into the deep end of the pool and seeing who makes it to the other end alive and who drowns (we are too kind to do this to the undergraduates)

Three major things to take care of as a graduate student

- Course
- Club
- More

Research

Research

Research

Research is NOT about programming, NOT about learning, it is about finding and solving problems that have not been solved.

Successful Research (Knight)

- Coursework: **no**
- Teaching: **no**
- Dissertation: **yes**
  - **You**: “In my thesis, I showed X.”
  - **Them**: “Really? I can use that in my work!”
  - **Them**: “Really? Huh, my approach isn’t nearly as good.”
  - **Them**: “Really? I’m doing Y. We ought to put X and Y together.”
  - **Them**: “Really? No way. Really?”
  - **Them**: “Really? Are you looking for a job?”

Why Get a PhD (Knight)?

- PhD is a lot of work, requires hard thinking.
- It's a lot harder than undergrad and master.
- Only ½ of you will make it through.
- Why do it?
  - PhD trains you to be a professional researcher
  - Research life is fun
    - You can work on what you want
    - Your ideas will shape the future
    - You don't have commercial pressure
    - You can be a professor
    - Your colleagues are smart and interesting
    - You can discuss research in exotic locations

  (But watch out if:
    - Your family expects you to do it
    - You mainly want to take more classes)

Course

- As you have heard 1000 times in your life, “Grades are not as important than as what you have learned in the class”. Well, this saying FINALLY becomes true now.
- You finally have the freedom to choose the courses (good or bad? core course or research-related course?)
- Taking courses that are relevant to your research, but different from your advisor’s expertise… ***so you might learn something your advisor doesn’t.***
- Attending courses: instructors can perform better or even turn into a humorist when talking about something relevant to his or her research.
- Course project: A chance to enrich your resume and publications.

Getting feedbacks

- To be successful at research, it is essential that you learn to cope with criticism, and even that you actively seek it out.
- Write up what you're working on (even if you're not ready to write a full conference or journal paper) and show it to people.
- Talking to other people will help you realize
  - which aspects of your research are truly different and innovative
  - how your work fits into the current state of your field and where it's going
  - which aspects of your work are harder to sell (and, therefore, which aspects you need to think more about justifying).
- Tell people as much as they're willing to listen to. You should have 30-second, 2-minute, 5-minute and 10-minute summaries of your project ready at a moment's notice.

Choose Research Areas and Research Topics

Potential Research Areas in CS

- Multimedia: graphics, vision, coding, image processing…
- Networking: wireless, VOIP, protocol…
- Theory: algorithm, math, learning theory…
- AI: IR, data mining, agent, natural language processing, neural network, robotics…
- Hardware: embedded system, architecture…
- Software: compiler, software engineering, programming language, automatic control, digital archive
- Others: bioinformatics, human-computer interaction, …(you name it), security

Research Area: Rising or Fading

- Check whether people working on that area are happy.
- Check the trend of the major conference attendance in that area.
- Check what kind of job the graduates find in that area.

Choosing Research Topics

- The first mistake Frodo made is that he never really thinks about what he wants to do (and is capable of doing).
- Don't choose a research topic ONLY because:
  - It is funded.
  - It is your advisor's favorite (believe or not, people's favorite can change very quickly).
  - It is a hot topic (believe or not, market value can change very quickly).
  - Your ____ likes this project a lot.

What Counts as A Good Research Topic

- Something that interests yourself, your advisor, and your research community.
- It is a real problem, not a toy problem (or even worse, not a well-defined problem).
- It has to have certain connection to existing research (If not, you need to make sure people think it is interesting and worth doing.)
- There is a chance for you to have solid theoretical contribution or empirical results (preferably both).
- Significant yet manageable, with extensions and additions that are successively riskier but will make the thesis more exciting (Chapman)

Check list when choosing a research problem

- Can it be enthusiastically pursued by you in the long run?
- Is the problem solvable by you?
- Is it worth doing?
- Will it lead to other potential research problems?
- Is it manageable in size?
- What is the potential for making original contributions to the corresponding research society?
- Can the results/methods be evaluated
- Can you demonstrate independent skills to others by solving it?
- Can the society benefit from somebody solving this problem? (e.g. what's the application)

How Do I Find a Good Research Topic

- Talk to your advisor.
- Taking relevant courses.
- Read some papers.
- Don’t just read papers, do something (join a group, implement a system).

What to do next after choosing a topic?

- Write the followings down (clearly and concisely) and show it to people for comments
  - Why it is important (Research value? Commercial value? Ethic value?)
  - Why it interests me? (so you are sure it is not a short-term fever)
  - Why it is challenging (why it has to be a thesis rather than a course project)
  - Why it is doable? (so I can graduate on this)

Literature Review

Reading

- Try going to the library every week, spending some hours reading recent journals or books (i.e., there are things that cannot be downloaded online).
- Start with a tutorial paper or classic paper, then the journals/books of recent years.
- Summarize every article you read in EndNote or other bibliography format (BibTeX). It will save you a lot of time in thesis writing.
- Take advantage of “ACM Guide to Computing Literature” and “Computing Reviews”.
- Scan the title first, then abstract. If you interest is still there, read the introduction and conclusion first.
- You will NEVER be able to finish all the reading. Start doing research when you feel you have certain background, but don’t stop reading.

Ask yourself when reading a paper (or attending somebody's talk)

- Problems
  - Is the problem clearly defined?
  - Is it a good research problem?
  - Is the problem relevant to your research/interests?
- Solutions
  - Are the solutions sound and reasonable?
  - Is the solution easily implementable ?
  - Is there any better solutions you can think of for this problem?
  - Can we use/modify their solutions to solve our problems?
- Data and Resources
  - Are the data suitable for our problem ? If yes, are they available to us?
  - What kind of resources (e.g. machines, infrastructure) do they use? Do we have similar ones?
- Applications
  - Is there any applications they haven't thought of?
  - How much gap is there between the existing theory and its final application? Is there any research value hidden in such gap?
- Future Work
  - Is it worth doing?
  - Can we do it using a better method?

Doing Research

There's No "Right Way"

- Every thesis is different (Allen Newell):
  - Opens up new area
  - Provides unifying framework
  - Resolves longstanding question
  - Thoroughly explores area
  - Contradicts existing knowledge
  - Experimentally validates theory
  - Produces ambitious system
  - Provides empirical data
  - Derives superior algorithms
  - Develops new methodology
  - Develops new tool
  - Produces negative result

The Evolution of Researchers (knight)

Beginning Researchers	**Expert Researchers**
Can't explain what he/she is doing & why he/she is doing it	Can write hoped-for paper abstract before even starting work
Unwittingly working on a previously solved problem	Knows all related work
Attends directly-related seminars	Goes to seminars, tries to ask a question
Can write about finished work	Can write a proposal
Work goes unnoticed	Causes other researchers to shift gears
Brings pre-conceived solution	Listens carefully to the data at hand
Blocks on non-research problems	Emails to others who "must have faced this problem before"
Works with same basic tools as everyone else	Has a secret weapon (data infrastructure… unsupervised technique… 64-processor cluster…)
Aims too low, or too high (or in a strange direction)	Picks good problems to work on

Building the Foundation

- Algorithm: Dynamic Programming, Graph theory, Clustering, automata, logic, cryptography
- Search methods:
  - *Optimization* (e.g. heuristic search) : adjusting parameters of a system to optimize an explicit or implicit objection function (e.g. Maximum likelihood Estimation)
  - *Learning (classification or* regression*)*: Given a set of input/output pairs, learning tells you how to predict the output given some unseen input. Proposed methods: SVM, NN, ME, DT, GE, EM…
- Math: probability and statistics, information theory, coding theory, queuing theory, linear algebra, discrete math…
- Programming Skills: C++, Java, design related tools, Python, Perl, MPI, database management…
- Background knowledge in other areas: biology, music…

Finding your Own Hammers

- You need to identify your “secret weapon”.
- For example, the hammers in MS lab:
  - Estimation-Maximization Algorithm.
  - Classifiers (e.g. ME, SVM, DT, GA).
  - Bayesian Inference Tools.
  - Reinforcement Learning Packages.
  - Regression Tools.
  - Bayesian Networks Learning Tools.
  - Clustering Tools (e.g. K-means, Hierarchical).
  - Hidden Markov Models.
  - Markov Decision Processes.
  - Social Network Analysis Tools.
  - Clustering Machines.
  - Dealing with GigaWords of data

How Can I Find New and Better Ideas (knight)

- Listen to data (Herb Simon)
- Kick around ideas with senior students and advisor
- Reject mediocre ideas
- Reject complex ideas
- Get animated by a giant goal
  - Narrow immediately – what's the first experiment?
- Learn powerful techniques by implementing them
- Pick problems that will teach you something
- Obsess yourself with the research problem, and wait for the ideas to come.

Writing

Writing is essential

- Keep a research journal
  - Write down what you did in research before going to bed
  - Write down your unpolished ideas
  - Write down other's useful ideas
- Don't start writing a paper only until all your experiments are done. Start writing the introduction section as soon as you know what to do, and the methodology section as soon as you know how to do it.
  - Writing down your method usually can reveal its pitfall.
  - It's difficult to formalize an idea well enough to test and prove it until you've written it up;

Proposal Writing and Presentation

- Circumscribe the problem and argue convincingly that it needs to be solved.
- Convince the committee you have a methodology for solving it.
- Clearly state how you plan to evaluate your system.
- Identify and discuss related work:
  - has this problem been addressed before?
  - What are the shortcomings of existing work in the area, and how will your approach differ from and be an improvement over these methods?
- Be sure that your committee members are as familiar as possible with your work before your oral.
- During the exam, don't panic if you don't know the answer. Simply say, ``I'm not sure'' and then do your best to analyze the question and present possible answers.
- You want to convince the committee that you CAN solve the problem, not you HAVE solved the problem.
- Give a practice talk to other students and faculty members.
- Remember: you know more about your thesis topic than your committee.

Dissertation Writing

Organization:

- Abstract: a mini-version of thesis, write it when you finish the whole thesis
- Introduction: The most important section in your dissertation. Should contain the research statement (goal), motivation (avoid information-less sentences), methodology outline.
- Related works: to show that you have read everything relevant (can be moved to later).
- Methodology: how to solve the problem.
- Experiment (or evaluation): show your method is useful.
- Discussion: deeper analysis about the experiment results.
- Conclusion: say something that becomes clear after reading all the above.

Tips for Dissertation Writing

- Don’t worry about the minor details (e.g. length, position of the figure) until you finish the whole article.
- C^3 : clearness, concise, and consistent.
- Usually it is necessary to rewrite the introduction section after all the other chapters are done.
- Figures and Tables should be self-explainable (use captions)

Ed Hovy's Seven Steps to Thesis

- The idea
  - Is there a claim? Is the claim clear?
  - Is the idea large or small? Is the idea as large as it can be? Can you generalize it, or apply i elsewhere?
- Motivation, Use, or Application
  - Why should we care? How can the claim be used? Are there other applications?
- Details of the Idea
  - What are the basic items/elements /representation units of the idea?
  - What are the rules or types of interrelationships between them?
  - How elaborated are these items and rules/relationships? How much of the phenomena d they cover?
- Data
  - Is there enough data in the study? Is it representative? trustworthy? applicable?
- Discovery Methodology
  - Is the method of investigation clear? Is it appropriate? Does it ignore phenomena that loo relevant?
  - Is it well-reasoned? no biases or mistakes?
- History
  - Is prior work recognized? used?
- Proof
  - Is there an evaluation?
    - If so, is it adequate? Complete enough?
      - Does it speak to the claim? Does it actually prove the claim?
    - If not, why not?
      - Is there a discussion of how one might try to test or prove the claim? Can one make predictions and (easily) tes them?

Defense Committee

- DEFENSE sounds like some war that you have to win, and unfortunately, sometimes it is true.
  - There are 5 powerful enemies on the other side, and on you side there is ….only you.
  - You probably have a ally on their side (if not….good luck!).
  - Try to stay humble but confident, so the rest of the enemies will show you some symphony and respect.
- Choose somebody that is not only knowledgeable but also supportive as a committee member.
- Choose somebody that compensates your advisor's expertise as a committee member.
- Call on them for help if necessary (it's their responsibility to make sure you have a competitive dissertation).

Defense Presentation

- Try to attend at least one before your turn comes.
- Control the talk, and don’t let the talk control you:
  - Control your time (it’s all your fault if you run out of time)
  - Don’t bring up things you are not sure.
- Don't be defensive at your defense
  - No need to fight for everything. Sometimes you can say “Thanks for your ideas. I will be giving it some thinking”
- Reveal the big picture, but ignore the details (leave yourself some materials for Q/A).
- Rehearsal at least three times.
- Remember your advisor is your ally, not your enemy. Discuss with him about possible strategy.

Improving your RQ (Research Quotient)

Unfortunately, IQ ↑ + EQ ↑ ≠ RQ↑

Mentality (1/2)

- **Initiative** : rather aggressive than passive
  - your adviser is NOT going to hold your hands and tell you what to do every step of the way.
  - Your goal is to prove yourself and everybody that you can do high-quality research , not to get a degree.
- **Tenacity:** *"Let me tell you the secret that has led me to my goal. My strength lies solely in my tenacity."* - Louis Pasteur
  - You don't need to be a genius to earn a degree, but very few finishes a dissertation without being tenacious.
  - No one can tell you in advance exactly how long the dissertation will take, so it's hard to see where the "end of the road" lies.
  - It's very easy to become depressed and unmotivated about going on.
- **Discipline:** do research EVERYDAY, instead of when you are in the mood.
- **Flexibility:** taking advantage of opportunities and synergies, working around problems, and being willing to change plans as required
- **Awareness:**
  - paying attention to the rules, news, tips that can benefit you.
  - Have a sense or urgency. It is YOUR future.
- **Selective:** You have only limited amount of time. So don’t spend too much of your time on subordinate things or tasks.

Mentality (2/2)

- Ambitious but practical:
  - Everything is possible, unless you prove it impossible.
  - Don't give up too early.
  - Don't settle for mediocre.
  - Be realistic (there are more research to be done after graduation).
- Breadth:
  - CS is an application science. Interdisciplinary trainings are usually appreciated. Don't constraint yourself on one area.
  - It won't hurt to have more knowledge on math and algorithm
- Get your hands dirty (mind the details):
  - Walk the talk (Talk the talk, walk the walk).
  - Smartness can be learned (Experience counts).
  - Knowing what is critical and what is minor (e.g. the speed is sometimes as important as the quality)
  - The last 10% to perfection typically consumes 80% of the effort. The devil is always in the details (Prof. *Tzi-cker Chiueh)*

Skills

- **Interpersonal skills (Why)**
  - As frustrating as computers can be, they at least behave in a logical manner, while human beings often do not.
  - However, your success in graduate school and beyond depends a great deal upon your ability to build and maintain interpersonal relationships with
    - your adviser
    - Committee members
    - your research and support staffs
    - your fellow classmates.
- **Interpersonal skills (how)**
  - Respect everybody, no matter they are professors or only administrators.
  - Do not offend people you don't like, simply try avoiding them (but try pretending you are not doing it intentionally)
- **Organizational skills**
  - *"Failing to plan is planning to fail".*
- **Communications skills**
  - *"What is written without effort is, in general, read without pleasure."* - Samuel Johnson
  - *"Present to inform, not to impress; if you inform, you will impress. "* - Fred Brooks
  - It can be learned (that's why you take technical writing course)

Time Management (1/2)

- Set up your Goals:
  - You should have daily, weekly, monthly, and yearly goals setup, and check consistently whether you achieve those goals.
  - Be ruthless with time but gracious with people
- Accept the things you can't change (e.g. network broken). Control the controllables. Save the cursing time, it is YOU that should be responsible for how your time are spent.
- When a crisis occurs, don't come unglued.
  - Use your energy to find solutions.
  - Take your time (sometimes time heals).
  - Consider your options (make a list).
  - Rest 5 minutes.
  - Don't start a fire putting out a fire.
  - Turn a crisis into an opportunity.
- Work smart is better than work hard
  - Spending more time on more important tasks (e.g. writing papers instead of preparing exams).
  - Identify your routine, and maintain it.
  - Work hard, if you don’t know how to work smart.

Time Management (2/2)

- Learning how to say “no”.
- Maintain a “to-do list”, and establish your priorities on the tasks.
- Know what times of day are best/worst for you mentally and physically.
- Have and maintain a semester calendar to indicate the due date.
- Simplify your life.
- Have the determination to start working on a touch problem ASAP (Do it NOW!!)

Attending Seminars, Workshop, and Conference

- Attending Seminar (Friday's talk) whenever the topic interests you
  - It does not matter if it is relevant to your research or not.
  - It is good to learn how to deliver a nice (or bad, occasionally) seminar talk.
  - It broads your view and knowledge.
- Workshop and Conference
  - Try to make the most out of it (since you will anyway attend it).
  - Study the schedule and mark the talks you are interested in before you go.
  - Write down a short summary about what you learned everyday.
  - Making connections is as important as building knowledge:
    - Try to talk to people after his talk by asking relevant questions.
    - Introduce yourself in the banquet (don't just stay with your fellow lab-mates).
    - Better aggressive than shy.

There are Other Important Things in Life

- *"Generally speaking, people provide better maintenance for their cars than for their own bodies."* - Scott Adams, *The Dilbert Future*
- Earning a graduate degree (in particular Ph.D.) is like running a marathon. You have to learn to pace yourself and take care of your body if you want to reach the finish line.
- keep in touch with the "real world," to remind yourself that the graduate student population is not representative of humanity in general and to keep your perspective.
- Graduate school isn't worth risking your personal relationships over; be sure that you save time and energy to focus on the people who matter to you.
- Take time for exercise, cultural activities, relationships, and sleep, otherwise, stress will mount and your quality of life will plummet.

Balance for Keeping Motivated

- Don’t just do one thing (or one types of thing), for example:
  - Doing research and taking courses at the same time.
  - Working on two different research problems at the same time (if capable).
  - Writing your dissertation and ….. (maybe this is an exception)

FAQ

Q: Which Advisor Should I Choose?

Ans: pick one

- working in the area you're interested in.
- will be someone you can get along with.
- actively be doing high-quality research and be involved in and respected by the research community.
- are willing and capable of passing the wisdom to you.
- serve as a mentor as well as a source of technical assistance.
- provide (or help you to find) the resources you need (financial, equipment, and psychological support).
- introduce you and promote your work to important people in your field.
- encourage your own interests, rather than promoting their own.
- be available to give you advice on the direction of your thesis and your career.
- help you to find a job when you finish.
- help you to set and achieve long-term and short-term goals.
- enthusiastic about the research and teaching they are doing

Q: Why everyone seems so together except me?

Ans:

- Well, believe or not, it is not true
  - Everybody has papers got rejected (some of mine are still not published yet).
  - Everybody has failed ideas and projects (i.e. the results are not even good enough to write a paper on it)
- Well, people sometimes hide themselves when suffering.
- Well, it really doesn't help too much if you keep comparing yourself with others.

Q: What's so important about publishing?

Ans:

- You'd be amazed how many people read your stuff!
- Your advisor will send you to conferences to present your work (and enjoy a couple day's sightseeing)
- Presenting a coherent, written scientific argument is a learned skill – learn by doing!
- It's a test – if you can't do it…
  - "My great work keeps getting rejected." ……Rare.
  - "My work is too great to even submit for publication." ...Unlikely.
- CS is an application science. However, your work will not be applicable without first letting people know what it is.

Q: I don’t have any secret weapons yet

Ans:

- Well, at least it is a good start to realize this.
- Attending the research-oriented course offered by a faculty member here.
- Asking people (senior students, junior students, postdocs) what are their secret weapons (believe me, they are not THAT secret).
- Check (by reading papers) what kind of skills/methods other famous people in your area usually use.

Q: What the hell am I doing this?

Ans:

- Well, everybody asks himself/herself the same question on the way to the degree (you are not the first, and won't be the last).
- We all lose motivation occasionally. Seek help from your advisor or senior students.
- Sometimes it happens when you stuck :
  - Try something different.
  - Try solving an easier problem (simplified version of the original problem) to regain your confidence.
- Sometimes it happens when you are burned out
  - Take a short break (e.g. a trip to other places).
  - Find the sense of humor you've probably lost. Learn to laugh at yourself and at the situation.
  - Most of all, get in touch with yourself, your values and what you want out of life. Learn to recognize when you are driving yourself too hard.

Final Chapter: The Parable of the Black Belt (Adapted from R.T. Azuma)

So close to graduate....

- A young martial artist kneeling before the Master Sensei in a ceremony to receive a hard-earned black belt.
- After years of relentless training, the student has finally reached a pinnacle of achievement in the discipline.

"Before granting the belt, you must pass one more test," says the Sensei.

One more year…

- "I am ready," responds the student, expecting perhaps one final round of sparring.

- "You must answer the essential question: What is the true meaning of the black belt?“

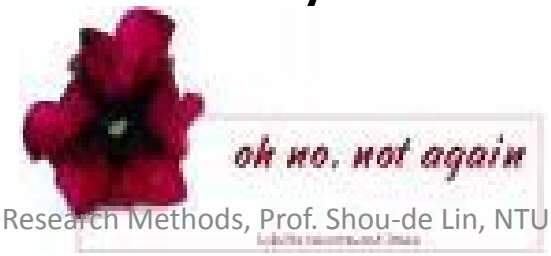
- "The end of my journey," says the student. "A well-deserved reward for all my hard work.“
- The Sensei waits for more. Clearly, he is not satisfied. Finally, the Sensei speaks. "You are not yet ready for the black belt. Return in one year."

Time flies, one year passed…

- The student trained hard for the whole following year, and then kneels again in front of the Sensei.

- "What is the true meaning of the black belt?" asks the Sensei again.

- "A symbol of distinction and the highest achievement in our art," says the student.
- The Sensei says nothing for many minutes, waiting. Clearly, he is not satisfied. Finally, he speaks.
  "You are still not ready for the black belt. Return in one year."



Time flies, again, one more year passed

- A year passed by, the student kneels once again in front of the Sensei, with confidence.
- During the past year, the student didn’t spend anytime on training. Instead, he tries to find people who have earned the black belt before.
- And again the Sensei asks: "What is the true meaning of the black belt?“

- "The black belt represents the beginning - the start of a never-ending journey of discipline, work, and the pursuit of an ever-higher standard," memorized the student.
- "Yes. You are now ready to receive the black belt and begin your work.“, says the Sensei.

What does this story tells us?

- Receiving the degree is just a beginning, not an end. People rarely do their best job in their dissertations. So try to get out sooner than later.
- If you bother to talk to and learn from people who have already gone through this process, you might graduate two years earlier.

And this concludes the talk. Thanks!