

# Notes on Graduate Studies

Alireza Fathi  
College of Computing  
Georgia Institute of Technology  
Atlanta, GA 30332

Here I have written some of my experiences on how to apply and succeed. I applied two times, once from undergrad to masters program, and the second time from masters to PhD. Every time, a year or more after getting admitted, I regretted somethings that I did and also some that I didn't. As a result, I thought it might be useful to write about these, and let other students use some of my experience. These are my points of view, and there is no guarantee if they are correct or not, or if they work for everyone or the will rather harm.

In this text, my goal is NOT to encourage you to apply abroad, or to do a PhD or MSc. Although, if you are planning to do so, these notes are supposed to help. I am a Computer Science student from Iran. So this document is going to be probably more useful to computer science major students, specially the Iranians.

## 1. How to Get Ready

I am not going to prescribe you a diet to follow from five year old. Instead I have a question for you: "Why do you want to apply?". There are many other ways to ask this question: "Why do you want to do a PhD?", "What is a PhD?", "What are the advantages or disadvantages of doing a PhD?".

### 1.1. What is a PhD?

In BSc you learn fundamental and basic things related to a broad field (e.g. electrical engineering). In MSc you either do a project or thesis in a subfield and obtain some experties on that particular domain (e.g. biomedical applications of electrical engineering). PhD is even narrower. You will work for 5 years on average, on a very particular problem, say how to remove the noise from a biomedical device designed to be embedded in brain. After defending your PhD thesis, you will be an expert on that particular thing. You will also learn how to do research and publish papers in general, which will help you to conduct research in different areas in the future. However, the PhD program will lean you toward academia, and will push you to be-

come a researcher rather. Not that there are no PhDs who are CEOs of companies, but probably their only use of their PhD studies were the fact that they have a PhD! Anyways, my assumption is that you want to do a PhD, however, I would suggest you ask a lot of people about it before making this decision.

### 1.2. Study Hard

Probably the most obvious advice I can give you is to study hard while you are in middle school, high school, undergrad, etc. You will regret later why you didn't study hard when you had to, and now you ended up in an average PhD program, while you deserved to be in MIT. Try to get the highest GPA, and be the best rank in your school. I am not suggesting that only study and that's the only thing you are supposed to do. I will describe my opinion about how to stay healthy, and keep a balance while you also work hard in Section 3.1.

## 2. How to Apply

Other than having a high GPA which is probably the most important factor, there are some other factors that are described here.

The way the admissions usually work is that students send their applications to a particular program in a school first. There will be some grad students or secretars who will take a look at applications, and remove the ones who do not meet the qualification criteria (for example, the ones with a TOEFL score less than the minimum required, or the ones with less than three recommendation letters, etc...). In some schools, this stage is even more significant. For example, they ask some graduate students to go through the applications and select the ones that they think are really good.

Then in some big schools, there will be an admission committee, including a few faculty members who will go through the applications and admit the ones that they think are some how among the best. In some other schools, each faculty member decides on whom (s)he wants to take, and asks the department to admit them. As a result, it some-

times helps to send emails to faculty members. However, there are different issues with that: (1) many faculty members are not planning to take students, so they ignore your email, (2) some professors ignore all emails anyway, and they go through application files and admit the ones they think are the best, (3) it is very important what you are going to write in your email. The professor might already have a good opinion about you, but you totally ruin it by sending an email (which might have some grammar mistakes, typos, weird things which show you have no clue about what is going on, etc.). My suggestion is do not send an email, unless someone senior approves you are sending a good one. Also make sure you send at most one email to a professor, otherwise you will annoy them.

Application process is basically a competition. You are competing with people from all around the world. There are Chinese and Indian students with resumes full of honors, with perfect GRE and TOEFL scores, that you are competing with. If you are an MSc student and applying for PhD, there are other MSc students in US who have published more than one paper in the best conferences in your field. You should take all of these into account.

### **2.1. TOEFL**

If you are an international student from a non-English speaking country, you should take the TOEFL test. Each program has its own minimum TOEFL score that you can find somewhere in their website. TOEFL score doesn't really matter much, as far as your score is higher than that minimum. If it is not, you will be in trouble.

### **2.2. GRE**

GRE general is very important, and significantly affects your admission. A good GRE score is not sufficient alone. If you do not have a good GPA, recommendation letters, publications, SOP, etc. a very good GRE score is not much of a help. However, if you have a good resume, having a high GRE score versus a low one, makes a significant change. The top 10 schools, hardly admit someone with a low GRE score, if I don't say they never admit. If you do not have a very impressive resume, as you are from a good school (say from Sharif), but do not have a high GPA, no publications or research experience, a high GRE score will help you get admitted to a rank 40-50 school, while a low GRE might mean no admissions.

### **2.3. GRE Subject**

In computer science, not many of my colleagues took GRE subject. But for example in chemistry it is a requirement for many programs. I think it is helpful if you get a high score (say better than 92-100%) in GRE subject.

### **2.4. Publications**

It is very helpful if you have at least one paper, or there is some evidence that you have been doing research during your undergrad. If you are a MSc student and trying to apply for PhD, I do not recommend to apply unless you have a very good paper. As an undergrad, there is no expectation that you do research, and if you have done some that is very positive. However, if you are a MSc student, but you haven't published yet, it means there is no guarantee that you will publish during your PhD.

### **2.5. Recommendation Letters**

Make sure that the faculty member you are asking for a recommendation letter, will write you a good one. I would suggest that you explicitly ask them: "Will you feel good to write me a strong recommendation letter?". A professor can write you a good recommendation letter, when she/he knows you well enough. It is not enough to just take a course with them and get a good grade. You should have worked with them on a research project for a while. In the best case, you should have published papers together. Then she can write good things about you. Whereas if you got a 100 in a course, she will just write "This student is a good one, since she got a 100 in my course", and that's it! You will need at least one recommendation letter, from a person who you did a lot of work with. It is fine if the other ones are less detailed. An example can be found in Section 4.2.

### **2.6. Statement of Purpose (SOP)**

This one is very tricky. In SOP you are supposed to describe your view about the future. Your different skills can be measured in one page specially your writing, and how motivated you are, and how much you know what are you getting into. In SOP, you have to write about what is your plan in future. You should define a research problem that you are interested in, describe why it is important and useful, and describe how you are planning to solve the problem. Probably the best way is that I append a research statement I wrote a while ago in Section 4.1, which is not perfect, but can give you an idea what I mean.

## **3. How to Succeed**

It is very important to balance your life. You don't want to be a geek that only knows how to study. There are other things to do in life that you need to learn. Grad school is a great opportunity, where you live alone and need to be independent. I learned how to cook different foods, take care of myself, etc. Now I can cook amazing Persian food and desert that even my mom cannot!

### 3.1. Living Healthy

The most important thing that you need to take care of is the food you eat. You should make sure you get enough vitamins, proteins, fiber and carbohydrates. Here are a few tips:

- Early to bed and early to rise, makes a man healthy, wealthy and wise.
- Make sure you eat a heavy breakfast in the morning, that contains fiber, carbohydrates and a lot of water. It is better to drink a lot of water in the morning and during the day, and less at night. Probably juices and milk are the best choices to provide the water your body needs. Do not eat dinner late. Make sure you eat your dinner at least 4-5 hours before you sleep. The reason is that when there is food in your stomach, it produces acid. When you sleep, the acid can reflux from your stomach and harm your throat and cause you serious problems.
- I know cooking is painful, but don't eat contaminated and old food. It can infect you with harmful bacteria and cause serious problems. Don't keep meat in the fridge for more than 48 hours. Make sure your freezer has a low enough temperature and freezes the meat. Don't keep the cooked food in the fridge for more than 24-48 hours.
- Make sure you receive all the vitamins. Some vitamins are found in nuts, some in carrots and dark green vegetables. Make sure you eat a lot of fruits and vegetables. They will also provide you with fiber. Have at least 5 fiber meals (a glass of orange juice, or a small lettuce salad will count as a fiber meal) per day.
- Exercise at least three times a week. Make sure you run, do aerobics, swim or do something that increases your heart rate for at least 20-30 minutes every time. It helps your body produce endorphins and you will feel great.
- Socialize with people. It keeps you happy. Don't study all the time. You are supposed to have fun at least on Sundays.
- Since your climate has changed, it is very common to produce allergies. Go see a doctor if you sneeze a lot or have a congested nose, etc.
- regularly clean your living place. Don't let the dishes stay dirty for long. These things will make you sick!

### 3.2. Review Previous Decisions

At the end, I want to mention that you made the decision to pursue a PhD when you were 22. Feel free to revise your decision later. Don't be scared. Always do what you think is the right thing to do.

## 4. Appendix

### 4.1. SOP Example

I propose to extend and integrate methods for unsupervised event categorization in videos. In computer vision there is a huge literature in action categorization (which is considered a special case of event categorization). Actions are events in which an agent acts. Most of the existing approaches are supervised, requiring hand-labeled exemplars, and deal with only very simple action categories (e.g. walk left, walk right, run left, run right, etc.) in controlled-condition datasets. However, recently people have started working on more realistic datasets from movies or the web and have tried to classify more complicated actions (e.g. open the door, drink, smoke, etc.) [Marszalek09cvpr, Liu09cvpr]. In our lab, Ping et al. [Ping09iccv] use an unsupervised learning method based on repetitiveness of actions to extract social games from long videos. The research contribution of this proposal is to extend prior work in three aspects:

1. I will collect a diverse dataset of events. Recent works in computer vision have shown that many hard problems such as object recognition are solvable with very basic approaches if an enormous and diverse dataset [Torralba08pami] is collected. In the previous event or action recognition works there hasn't been an attempt to collect such a huge dataset until now.
2. In unsupervised learning of events, a challenging task is to determine the temporal boundaries of an event. Ping et al. use repetitiveness of actions, such as social games to segment the video into similar pieces. However, this approach fails for events that happen only once or twice in the sequence. I propose to use surprise as another cue for segmenting events. Researchers in psychology believe event segmentation is the spontaneous outcome of ongoing perception and arises when predictions begin to fail or change. I will extend the Bayesian Surprise concept introduced in [Itti05cvpr] to find the frames which are not predictable considering their previous frames. These frames are where events start or finish, for example, in a classroom, there is no movement, and our brain expects it to stay still, but all of a sudden an event gets started when a student raises his hand to ask a question.
3. I will enhance the feature selection method used by

Ping et al. in the following way. I will extract the dense optical flow for each frame and segment it to a few motion channels. To do the segmentation I will find the regions of optical flow that follow the same affine transformation. Then I will present each frame with a constellation model that describes the transformation matrix of its flow segments and their relative location to each other. For instance I expect the motion caused by opening a bottle top to create a segment with a rotational affine transformation on top, and a segment with a translational transformation around the hand at the bottom.

I believe the excellent learning environment and strong research centers in the College of Computing in Georgia Tech, as well as my desire for research along with my strong work ethics and my academic background, and previous experiences in the field will help me succeed in pursuing my goals. I have published related papers in ICCV [Fathi07iccv] and CVPR [Fathi08cvpr] during my MSc studies. In [Fathi07iccv], I used the motion patterns created by movements of people to track them. I used approximate inference on a complex graphical model on top of an exemplar based approach for finding the motion likelihoods. I extended this work to handle multiple views and scale changes and published it as my MSc thesis. [Fathi08cvpr] is currently giving one of the state of the art results in action recognition. [Fathi08cvpr] uses a two level Adaboost classifier which extracts spatio-temporal shapelets from optical flow channels in the first stage, and classifies the actions based on the local movements in the second run.

## 4.2. Recommendation Letter Example

This could be written much better, but it is written in Iran, when I was an undergrad:

To whom it may concern,

Recommending Mr. Alireza Fathi, a student of mine for more than 2 years is really a great pleasure. He has been my student in Software Engineering course. He received the third highest grade, 18 out of 20, among about 40. Software Engineering course is a fundamental course in Software Major and the syllabus of course is usually very extensive and rich. In this course Alireza posed his excellent capabilities in Design and Finishing facing complicated software projects.

He has worked with me as my undergraduate Research Assistant in AI and Robotics Lab for more than one year. His research was focused on Multi-Agent Systems and robotics. He was a member of Impossible Rescue Simulation Team in which he was working specifically on developing agents for Robocup Rescue Simulation under my supervision. They strongly worked on the problem for more than one year. As a result of qualification in Robocup rescue Simulation Competition, Osaka, Japan, 2005 they were

dispatched to Japan for this competition. Although I did not expect them to have good results as their first year of participation in the games; however, they won the champion only as a result of their great will, friendship, motivation, excellent group-work and the most important their hard work. They used to stay up to midnight in the lab for more than half a year. Alireza has cooperated on implementation of Fire Brigade Agents and Communication part of the code.

As a result, Alireza was awarded as outstanding student by the university president in 2006 academic year. Every year 100 nominees are selected among all undergraduate and graduate students from different departments in the university. Every year students with best ranking in nation-wide university entrance exam enter Sharif University which makes such an honor a great success.

In Tehran, I have organized a robotics program for high school students affiliated by Ministry of Education. Every year we select students from all high schools in the city based on an entrance exam. Afterward these students participate in preparation classes to get more expertise. Alireza has worked with us as an Algorithm and C++ teacher for a year and he has been able to produce good results. As far as I know he has had other successful teaching experiences too that gives him all the abilities a good graduate student should have.

Alireza has good background in mathematics and computing and during his study in our department he has shown impressive appetite for research and learning. He is a highly motivated student and I feel that his academic proficiency and potential for research makes him one of the truly outstanding candidates I have come across and I strongly recommend him for graduate studies and fitting financial assistance.