Lessons I learned while looking for an academic job.

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According to Bill Goodwine, getting a job is a three step process: send out resumes until someone bites, go on an interview, and impress them. The job search is a long arduous process. Even if you go to a school as good as Caltech, you are going to receive many rejections. Do not get discouraged. It only takes one job offer to make the search process a success.

1 Where to look

The best advice I can offer is to cast as wide a net as possible. That is, apply for any job advertisement that is at least remotely interesting to you. For example, if a department asking for a particular background different from yours, apply there if you like the department. Typically, the preferences stated in the advertisement are quite flexible. Furthermore, a lot of departments are always looking for a super star candidate and would be willing to start a new research direction if the candidate were well suited.

> *Sometimes department politics may help you. For example, a job advertisement may request that fluids, solids, or heat transfer people apply. The fluid applicants are the fluid faculty's first choice, the solid applicants are the solid faculty's first choice, and the heat transfer applicants are the heat transfer faculties' first choice. However, a robotics professor may be* everyone's *second choice and thus an agreeable candidate to hire.*

1.1 Journals

The best place to look for job advertisements is in journals associated with your field. If your field is multi-disciplinary, then look at journals associated with each discipline. Typically, the journals are flooded with advertisements in the fall, but new advertisements continue to be posted well into the summer.

> *Since robotics is a multi-disciplinary field, I was able to look at Computer Science (ACM's Computing Journal), Electrical Engineering (IEEE Spectrum) and Mechanical Engineering (ASME's journal).*

1.2 Web

The web is another source of job advertisements. The web page,

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<A HREF="http://robby.caltech.edu/~choset/jobs.html"> Howie's Job List </A>
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contains the following links:

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<LI> <A HREF="http://chronicle.merit.edu/"> Chronicle </A> of Higher
Education's <A HREF="http://chronicle.merit.edu/.ads/.links.html">
jobs in  academia </a>

<LI> <A HREF="gopher://wcni.cis.umn.edu:11111/1"> Academic Position Network </A>

<LI> <A HREF="http://cra.org/jobs/"> Index of Jobs in Computer Science </A>

<LI> <A HREF="gopher://gopher.ieee.org"> IEEE </A> General:
<A HREF="gopher://gopher.ieee.org/11/info/usab">IEEE</A> listings by
geogrphical location

<LI> <A HREF="http://www.engineering.ucsb.edu/infoweb/positions.html">
UCSB Job Links </A>

<LI> <A HREF="http://www.wpi.edu/~mfriley/jobguide.html"> Employment
Opportunities and job resources on the internet </A>

<LI> <A HREF="http://www.occ.com/occ/> Online Career Center </A>

<LI> <A HREF="http://www.onramp.net/ron/"> Recruiters Online Network </A>

<LI> <A HREF="gopher://gopher.siam.org/11/siamnews/profops">SIAM</A>.

<LI> <A HREF="http://www.qualinet.com/jobs.htm"> Michael Shannon's
</A> Job list (nope, I do not know him)
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<LI> <A HREF="http://www.cs.cmu.edu/afs/cs.cmu.edu/user/burks/www/faculty.html">
CMU CS Job list </A>
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1.3 People

Your advisor can be an invaluable source for job-searching information. Typically, one of his friends at another university mentions the availability of a job opening.

Conferences are another good way to meet people who might know of job openings. Also, there are many people at conferences who are looking for new job candidates, so always keep in mind that the person with whom you are speaking may hire you someday.

> *At my last conference I met a lot of people and mentioned to them how hard it has been for me to find a job. As a result of my actions, a handful of these people sent me job advertisements of which I was not aware.*

Email is another source of information. I found that sending email to faculty in other departments to be quite useful. However, you may want the tone of the email to be more of a fact finding mission, than a selling-yourself mission. Ask about their resources, teaching needs, etc., but be careful not to sell yourself right away. Of course, you can play yourself up a bit, but it should be written as if you are looking for information. For example, instead of stating that you are a multi-disciplinary guy, you can say that you are interested in knowing of the existence of a teaching assignment that draws from many disciplines because you have a multi-disciplinary background.

Lastly, former graduate students from your department might have useful job information or might be in a position to help you get a job.

2 The Application

It all begins with the application. The application typically includes a cover letter, research statement, resume and list of references. Remember to use a spelling checker and to enlist the help of a good proof-reader who is a good speller.

2.1 Research Statement

This is an iterative never-ending process. I am not a good writer, so should not be giving any writing tips. However, what follows are some lessons I learned while writing my research statement. I strongly suggest you let others proof-read your research statement. Also, if you can find someone who enjoys writing and is good at it, he will help you clearly put your thoughts down on paper. Be prepared to spend a block of time updating your statement, a block of time not looking at it, another block of time updating it, another block taking a break, etc. Writing is a learnable, but arduous, process.

In one page you must concisely state your current research and how it will evolve in the future. You must also include other research directions which are different from your current work. Finally, you have to impress upon the reader that you are unique, intelligent and the right match for this department.

Be concise. There is no need to go into detail about your research. One or two paragraphs is enough. One way to cut out unnecessary text is to eliminate all technical terms.

Make sure you have a clear outline of what you want to say. This outline may change as you are writing the statement, but it should be clear from reading the statement what it is. This will help you organize your thoughts and it makes your document more readable

Tailor the statement a bit for the particular university or type of department to which you are applying. Again, you want to give the impression that you are a good match for this particular department.

Do not preach to your reading audience. Do not state anything that is obvious or completely unfounded. Sometimes it is appropriate to use the word, "key," instead of "important."

> *ORIGINAL:*
>
> *An important feature of the GVG is that it is a concise one dimensional representation of the robot's multi-dimensional configuration space.*
>
> *BETTER:*
>
> *A key feature of the GVG is that it is a concise one-dimensional representation of a robot's multi-dimensional configuration space. (The configuration space represents all of the positions and postures of a robot.)*

An example of wasted space that is preachy is

> *As computing machines become more powerful and pervasive, there is a strong need to incorporate sensor information reflecting the state of the environment directly into the computing system. In the future, user interfaces will use visual and audible input and thus, bypass the keyboard in many applications.*

Instead, just state what you want to do and what specific future applications may exist.

Make sure that not all of your sentences begin with I.

2.2 Resume

Be concise. Paragraphs should read in bullet form. Use a consistent style. Do not mix such sentences with explanatory sentences. The sentences want to read like items in a list.

ORIGINAL

Dissertation research involves sensor based planning for autonomous robots. Sensor based planning incorporates sensor information into the planning stages of the robot.

BETTER:

Dissertation research involves sensor based planning for autonomous robots in which sensor information, reflecting the state of the environment, is incorporated into the planning stages of the robot.

In fact, in an effort to be concise, "reflecting the state of the environment," should be eliminated because it is obvious that sensor information reflects the state of the environment.

ORIGINAL:

Dissertation research involves sensor based planning for autonomous robots. I developed the Generalized Voronoi Graph (GVG).

BETTER:

Dissertation research involves sensor based planning for autonomous robots. Developed the Generalized Voronoi Graph (GVG).

ORIGINAL:

Created a graphical user interface. This interface can be used to control the robot from anywhere on the Internet.

BETTER:

Created a graphical user interface that can control robot from anywhere on the Internet.

Do not go into too much detail.

ORIGINAL:

Dissertation research involves sensor based planning for autonomous robots. Sensor based planning incorporates sensor information, reflecting the state of the environment into the planning stages of the robot. My research involves both entire global path plans and local changes in the robot's plan. The former is called global sensor based planning, and the latter is called local sensor based planning. In both cases, the robot must determine what information is essential and acquire it. In the global scenario, the robot can not sense the entire world and plan from that, because there is no one vantage point from which it can see the whole world. Furthermore, there is no exact way to model the world. Schemes for global sensor based planning and exploration in arbitrary dimensions are underway. An efficient exploration and mapping procedure has been demonstrated on an actual planar mobile robot.

In the local case, the robot may have to react quickly and can not spend time processing information. Thus, a local sensor based planning scheme has been developed for hyper-redundant manipulators, robot snakes. The theory was demonstrated on a robot snake with sensor circuitry which was co-designed and built as part of my research effort.

BETTER:

Dissertation research involves sensor based planning for autonomous robots in which sensor information, reflecting the state of the environment, is incorporated into the planning stages of the robot. Developed the Generalized Voronoi Graph (GVG), a geometric structure which is a concise representation of a multi-dimensional configuration space, useful for motion planning of many types of robots such as hyper-redundant manipulators, and has extensions into other aspects of computational geometry. Prescribed incremental construction of the GVG using only local sensor data. Implemented the sensor based planning scheme on a mobile robot with sonar sensors. Derived new results in nonsmooth analysis used in the incremental construction technique. Deployed sensors and developed circuitry for an already existing thirty degree of freedom hyper-redundant manipulator. Created a graphical user interface that can control robot from anywhere on the Internet. Implemented a local sensor based algorithm for the hyper-redundant robot so that it quickly and locally adapts to a changing environment using the above sensory system.

Make sure your phone number, address, name, and email are correct. A lot of the resumes I sent out had Jim Ostrowski's office number because I copied his latex resume template file.

2.3 References

Do not be embarrassed to get as many as five references. Most schools require three or four. I made the mistake of not asking my undergraduate advisor for a letter since I felt that he did not know my work enough to comment on it. I should have let him make that decision. Six months after I sent out my first application, I asked him to be a reference and he happily agreed.

If the university requests that your references write you a letter, be sure to remind them every now and then. Getting a job is very important and it would be a shame if it hinged on a lazy letter writer.

3 The Interview

Congratulations, you made it to the interview. Interviews are held for a number of reasons:

- reality check: the department wants to reaffirm that you are the person described in the application;

- personality match: the faculty want to see if your personality is compatible with others in the department;
- test speaking: they want to make sure that you can readily communicate your own research and be qualified to teach courses.

Just as the department is interviewing you, you are interviewing the department. This is a fact-finding mission for you as well. Keep in mind the following:

- Is this department what you had hoped it to be? Have you been pleasantly or unpleasantly surprised?
- Do you feel your personality matches well with the others?
- Do you want to be in academia?

Even if you are not strongly interested in the position, you should go on the interview. Interview practice is very important and there is nothing like the real thing. Also, you do not know exactly what a place is like until you see it first hand; your interest in the department may drastically change when you arrive.

3.1 The Talk

This is perhaps the most important part of the interview. Here you demonstrate not only your rigorous and creative research, but also show the other faculty that you can clearly communicate your ideas.

Give more than one practice talk, but not so many that you get sick of it. I gave four: two to large audiences and two to small audiences. I found that each talk provided me with useful criticism which significantly improved my talk. I also thought on my own about how to improve what I wanted to say.

- Make sure you make clear what your work is.
  - State clearly what you are doing.
  - State clearly how it relates to previous work and where you come into play
- Motivate your work. Real world applications are quite useful.
- Some new comers to your field may not realize how important your problem is, so you may have to educate them a little bit. Also, casting your problem in their terms or easy to understand terms would be good.
- Each slide must serve a purpose.

- Spend time describing each of your figures. They may not be obvious to your audience. Speak as if you are reading a detailed caption of the figure. Slowly move the pointer around the exterior of special items.
- Do not be sloppy with the pointer.
- Have good transitions. It should be clear where certain sections of the talk start and end. Also, the transition from slide to slide should be smooth.
- Do not clutter your slides with too much text.
- Do not belittle anything in your talk to give contrast to what is important.

  Instead of saying, "What is not important is that you understand this equation, but what is important this equations contains this and that," just say, "This equation contains this and that."

- Try not to use technical terms that you define, but just explain them in an intuitive manner. Be sure to remind the audience your defined technical structures as you need them.
- Do not use small fonts.
- Use the conclusion slide to remind the audience what general problem you are solving and how your approach solves it. Also, point out avenues of future research. Do not refer to avenues of future research as limitations.
- When pointing at the screen or turning towards the screen, speak a bit louder since your mouth will not be pointing towards the audience.
- Do not garble words that you use over and over again. I liked to make the words "Sensor Based Planning," one word sometimes.
- Do not mention something which is beyond the scope of the talk and then invite other people to talk about that topic later. If something tangential is mentioned, it should only be to strongly impress upon the audience how good you are. If it does not make such a strong impression, then it is not worth the time.
- Maintain a level of formality.

  I said we placed sensors on the snake robot, played with the snake for some time and then found out we had to take a step back to really see what is going on. Instead, say something like, after placing sensors on the snake, initial experiments indicated that sensor based planning for snake robots was quite a difficult problem.

3.2 Meetings with Faculty

The following is a list of questions that will probably be asked on your interview. I strongly suggest that you rehearse answers in your mind and that you practice these questions with other people. The answers to these questions are almost like one paragraph talks. The more your practice the answers, the more it will seem like you can competently interact under fire.

1. Where will you look for research money?
2. What is the subject of your first research proposal?
3. Tell me something about yourself.
4. What research are you interested in?
5. What applications does your research have?
6. What is your long term research plan?
7. In what journals do you intend to publish?
8. What kind of person do you consider yourself?
9. Are you an XXXXXX person?

   For my CMU interview, a lot of people asked me if I was a controls person. I said no since I had thought that they were confusing robotics for controls. In actuality, they were looking for a controls lecturer and my definition of controls was different from theirs. I was qualified to teach the course they had in mind, but had not realized it at the time.

10. What do you *want* to teach?

    Make sure you know ahead of time what the department's teaching needs are. This can be done in many ways:

    - ask,
    - acquire a course catalogue to see what is being offered and what is lacking,
    - look for clues during the interview. For example, if they keep asking you if you are a controls person, then perhaps they needs a controls lecturer.

    This question is slightly different from what can you teach.

    On my BU interview, one of the faculty was turned off when I answered this question with what I can teach, not what I want to teach.

Do not be intimidated if the course you want to teach is different from your background. You have a P.h.D. and therefore can learn anything new. Furthermore, courses tend to have some sort of support.

> *On my BU interview, I learned that they were interested in hiring me to teach a particular lab class in manufacturing, something I know nothing about. I was quite intimidated by this and wrongly let the department head know. It turned out that this course has one full time staff member, four or five graduate students, and a handful of graders supporting the class. I certainly could run the class with that kind of support.*

11. In what direction is your field going in the long term?

12. Why are you a good match to this department?

13. How much lab space do you require? Why?

14. How much start up money do you need? Why?

    - Summer salary
    - Graduate students (typically one to two graduate student years)
    - Computing needs
    - Equipment
    - Travel
    - Misc.

15. What special opportunities do you see in your research?

16. Why did you change advisor, major, school, department, etc.?

Next, it would be good to have a set of questions in mind for you to ask the faculty members. Remember, the interview is a fact-finding mission not only for the department, but also for you. Moreover, if you ask a lot of questions, it gives the impression that you are intelligent and care about getting a job in the department. The following is a list of questions I found to be quite useful, but try to stay alert for new questions which may present themselves during the interview.

1. What do you dislike most about this department?

2. What do you like most about this department?

3. How are the students? (In fact, I requested to speak with some students.)

4. What do the undergraduate and graduate students do after they graduate?

5. Are there internal funding units to get projects started?
6. How does tenure work?
7. How many journal papers a year are required for tenure? (The department may not count journal papers with which your advisor is a co-author)
8. How many people have been denied tenure in the last five years?
9. How many people have left your department in the last five years?
10. Is there some sort of feedback system from the department to better qualify professors seeking tenure?
11. What is life as an assistant professor like?
12. What sorts of shared resources are there?
13. Is there interaction among the professors in the department?
14. Is there interaction among professors from different departments?
15. What is the required coarse load? Is it different for new faculty members? Is there a buy off scheme in which one can pay to not teach a course?
16. How is the XXXXX at this university (where XXXXX is something important to you)?
17. What is it like to live in the city/town/island/etc where the university is located?
18. How many people do you intend to hire this year? Next year?

After the interview, be sure to take down some notes on the people you met. It is quite easy to forget. In fact, if you could get a bulletin with the professors' pictures, that would be quite useful. On my CMU interview, I introduced a faculty member by the incorrect name.

Read a little bit about each of the faculty members in the department so you are aware of their background. Typically, each person you meet will describe his background to you, but the reason for knowing the background ahead of time is so you can have prepared questions. This way it seems as if you can instantly ask intelligent questions. When meeting other professors, do not show off you know something about them by telling them what their backgrounds are; they already know that.

Do not promise any toys or trinkets to anyone for after the interview. You may not be able to acquire them or you may forget. During my interview, I promised two wobble stones to two different faculty. I thought all I had to do was go to JPL and get them. Unfortunately, JPL and the local gaming store were out of them.

Try not to get lost on your interview. I did and missed a meeting because of it.

After the interview, keep interactions with other faculty as short as possible. It amazed me how I could be so stupid once my guard was down.

Finally, do not forget the thank-you letters. I found that e-mail thank-you notes were sufficient for immediately after the interview. The thank you letter reminds the faculty members who you were and gives you an opportunity to emphasize points you failed to address during the interview process. Keep these letters as short as possible.

4 Accepting the Offer

Congratulations on getting an offer. What you negotiate now will highly influence your next few years. Be aware of the following.

- salary: typically, this is a nine month salary. For the first and maybe second years, they will provide summer support. However, this summer support may only be for *two* of the three summer months. Also, many schools require that you bring in a certain percentage of your salary in the form of grants. CMU's is 25 percent.
- start-up money: this is a lump of cash which can go to anything you want. If you want more, be ready to justify it.
- graduate student support: this can come in the form of a T.A. slot assigned to you or a research assistantship.
- lab space: usually, more is better. Also, make sure if the lab space has to be renovated and who pays for it. CMU expected me to pay for my renovations, so I had to negotiate more start-up money.
- teaching load.
- secretary support: (At CMU, I get either 1/4 or 1/3 of one, and it seems as if I do not have to directly pay for it)
- phone/fax/etc. This could be part of your startup funds. I was lucky enough to have them pay for my first year of phoning and fax'ing
- travel: some places give additional money for one trip for the first couple of years. Others require you to pay for travel out of your startup money

It may be awkward to get a letter specifically detailing your offer in writing, however, when you send your acknowledgement letter, you can summarize the offer so this way, if there is a misunderstanding, it could be caught earlier than your arrival.

GOOD LUCK