CMSC 601: Proposals

Some material adapted from slides by Marie desJardins

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Sources

- Tom Dietterich, CS 519 course slides, Oregon State University.

Outline

- Introduction
- Proposal Contents
- General Advice
- Sources of Funding
- Proposal Evaluation
While True: Proposal().write()

• For many of us, proposals are a way of life
• In most jobs you will have to write proposals to
  – Your boss
  – Your management
  – You colleagues/peers/co-workers
  – Your (potential) clients
  – Other companies
  – Government funding agencies
• The details will vary, but some aspects are common

Proposal Content

Proposal Strategy

• Just having a good idea is not enough!
• Need to convince reviewers that:
  – The problem is important
  – It has not yet been solved
  – You have a good approach to solve the problem
  – Your approach is likely to succeed
  – You have a well developed research plan
  – The timeline is appropriate and feasible
  – The cost (if any) is appropriate and reasonable
  – You have the qualifications to do the work

Know Your Goals

• Dissertation proposal
  – Convince committee you’re on the right track
• External funding proposal
  – Convince reviewers and program manager to give you money
• Internal proposal
  – Convince boss or review committee that work is a good allocation of organization resources
Proposal Bones

- **Problem**
  Describe the general problem the proposed work addresses

- **Objective**
  Define the specific objective(s) you will achieve in the proposed work

- **Approach**
  Describe the technical approach you will follow to achieve your objective

Proposal Bones: Example

- **Problem**
  Mobile phones have no model of their user’s context so are unable to intelligently adapt their services

- **Objective**
  Develop an ontology to model a person’s activities and a use sensor data from a phone to predict a user’s current activity and her role in it

- **Approach**
  Define the ontology in OWL; implement Android module to acquire training data; use it to train an SVM classifier to predict activity; use that to adapt services

Proposal Bones

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Proposal Flesh

- **Problem**

- **Motivation and significance**

- **Related work**

- **Objective**

- **Approach**

- **Evaluation**

- **Management plan**

- **Qualifications**

- **Budget**
Problem and Motivation

- Describe the lack of a solution in negative terms
- Describe a solution in positive terms
- Sketch the long-term goals and vision providing the big picture with a broad focus
- Motivate solving the problem with specific positive examples of what could be
- Say why you want to work on this problem and why other people should care about it
  - in the field, in other fields, in society, in the program, on your committee

Related work

- Research proposals must have some discussion of related work
  - Who else has worked on this problem?
  - Why have previous approaches been unsuccessful?
  - If this is a new problem, why is it needed?
  - How does your method build on, or depart from, previous approaches?
- You need to convince the reader that you know what’s been done
- More important for a dissertation proposal

Objective

- Objective = Specific goal or goals
- What part of the big picture will you focus on?
- What specific tasks will you accomplish?

Approach

- The longest and most technical part
- Describe your methodology, algorithms, data sets, domains, experiments
- Why should we believe you will be able to carry out this research plan?
  - Present any preliminary results as evidence that your approach is feasible
- Identify expected or required deliverables
- For a 2-5 year project, give a road map of the order in which you will do things
Risks in your Approach

• What might go wrong?
• How will you recover?
• What’s your backup or contingency plan?

Evaluation

• Evaluating your results has become an important criterion for most proposals
• How will you test your claims?
• How will you demonstrate success?
  – A longer project will need one or more “mid-term” exams

Timetable

• Typical research grant: 2-3 years, sometimes up to 5
• Typical dissertation timeline (from proposal): 1-3 years
• What are your milestones?
• Approximately when do you expect to complete each milestone?
• Relevant deadlines (deliverables, conference deadlines, program meetings, integrated demonstrations)

Budget and Justification

• Proposals requesting funding must provide
• How much money do you need?
• How will it be spent
• Why is each line item important to the project?
• Direct charges: salary, benefits (~33%), equipment, tuition, travel, supplies
• Indirect: overhead – 48% for UMBC and higher for companies and institutes
• Companies can also include fee (i.e., profit)
Qualifications

- External proposals must show that you (and your team) are qualified to do the work
- Often 1-2 paragraph biosketches of the principals describe their relevant accomplishments
- Many proposals also ask for a one- or two-page abbreviated CV
- You don’t need to do this for a dissertation proposal and probably not for an internal proposal in your organization

References

- The more researchy your proposal is, the more references you will tend to have
- NSF proposals have a rigid 15 page limit, but it does not include references
- For thesis proposal only:
  - Annotated bibliography is very helpful
  - Can include important/relevant papers that you plan to read, but haven’t read yet. (should discuss these separately in Related Work section)

Chicken-and-egg problem

- 🎉 If you don’t have preliminary results and a well developed approach, you’re not likely to make a convincing case for success
- 😞 If you already have preliminary results and a well developed approach, you’re already doing the research!
- ➡️ By the time you get the funding, you’ll be done!
- 😊 ...so with the funding you get, you’ll write the journal papers, and start developing preliminary results for the next proposal...

General Advice
Go to proposals and defenses

• Our dissertation proposals are generally open to anyone
• Our MS thesis and PhD dissertation defenses are public
• Attending man of these is a great way to demystify the process
• You will also learn many things from the content

Sources of Funding

General Proposal Advice

• Start writing early!
• First impressions count:
  — A good introduction/summary is absolutely essential!!
  — Be neat!
• Be as specific as possible
• Don’t make your reviewers work too hard
• Keep revising
• Get feedback from peers and mentors
• Resubmit if necessary
• Read other people’s proposals

Funding Sources

• Internal, e.g.
  — Developing new products
  — Your company’s IRAD* program
  — Corporate research center
• External from a company or government organization
• Funding types:
  — Gifts
  — Grants
  — Contracts

* IRAD = Internal Research And Development
Government Agencies

- NSF
- NIH
- DoD
  - DARPA
  - AFOSR
  - ARL
- Departments of Education, Energy, ...
- Other agencies

Industry

- Sponsored research
- Partnerships
- Gifts
- Equipment grants
SBIR and STTR

- **SBIR**: Small Business Innovation Research
  - A USG program to support small businesses (1-50?)
  - 2.5% of research budgets, ~ $1B
  - Phase I <$100K, phase II <$750K
- **STTR**: Small Business Technology Transfer Program
  - 0.3% of research budgets, ~ $100K
  - Often requires a company lead team with some set fraction (e.g., 30%) going to a University
  - Phase I, Phase II, Phase III

Proposal Evaluation

Different kinds of reviews

- **Dissertation**
  - Not competitive
  - Your adviser and committee want you to succeed
  - Almost no one fails outright; if there are problems, you can fix them usually w/o a new presentation
- **Internal or external funding**
  - Competitive – a few win, many lose
  - If you fail your only option is to resubmit next time (if there is a next time) or somewhere else

Your roles

- It’s likely that you will get a chance to serve in both roles: proposer and reviewer
- NSF uses a peer review process where a panel of scientists review and score a proposal
- DARPA pays some organizations (e.g., MITRE) to review proposals
- Your company may have a committee that reviews and recommends IRAD* proposals

* IRAD = Internal Research And Development
**NSF Review Criteria**

- Intellectual Merit
  - Increasing knowledge and understanding within a field
  - Qualifications of proposers
  - Creativity and originality
  - Scope and organization of proposed research
  - Access to resources

- Broader Impact
  - Teaching, training, and learning
  - Participation of underrepresented groups
  - Enhancement of research infrastructure
  - Dissemination of results
  - Benefits to society

**NSF Ratings**

- Excellent
  - Perhaps 10% of proposals; should definitely be funded

- Very Good
  - Top 1/3 of proposals; should be considered for funding if sufficient funds are available

- Good
  - Middle 1/3 of proposals; worthy of support (but likely will not be enough funding for this category)

- Fair
  - Bottom 1/3 of proposals; unlikely to be considered for funding

- Poor
  - Proposal has serious deficiencies and should not be funded

- Typical funded proposal has at least one Excellent and two Very Goods
- Many NSF programs have a 10% funding rate

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**NSF and CISE Funding Rate Trends**

Source: NSF Budget Reports, 1994-2009

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**Funding Rate for Competitive Awards in CISE**

Source: NSF Budget Requests, CISE, 1994-2008
**NSF: How it Really Works**

Specific areas are usually not targeted...
- ...but some program managers have areas they like or dislike
- ...and sometimes your research won’t fit in any of the NSF programs, especially if you’re doing interdisciplinary work
- It never hurts to visit and chat with the program manager(s)

**NSF: How it Really Works**

Peer review panel provides primary input
- If you don’t get a good peer rating, you’re doomed
- Panelist who knows your area inside and out can shoot your proposal down (or champion it!)
- Panelists who don’t know your area can shoot you proposal down (or be intrigued by it!)

**DARPA: How it Works**

- DARPA program managers develop ideas
  - May fund initial exploration as seedling projects
  - May use a study group to explore ideas
- Pitch idea for a new program to DARPA Director
- If selected, issue a BAA (Broad Agency Announcement) soliciting proposals for a 3-5 year program
- Proposals evaluated by contractors and PM makes selection
- Projects may have common metrics/deliverables and may have to face a *downselect* after 18 or 24 months

**Heilmeier’s Catechism**

When George Heilmeier was the ARPA director in the mid 1970s he had a standard set of questions he expected every proposal for a new research program to answer.

1. What is the problem, why is it hard?
2. How is it solved today?
3. What is the new technical idea; why can we succeed now?
4. What is the impact if successful?
5. How will the program be organized?
6. How will intermediate results be generated?
7. How will you measure progress?
8. What will it cost?
DARPA Proposal Roadmap

- Goal
- Tangible benefits to end users
- Critical technical barriers
- Main elements of proposed approach
- Rationale: why will the proposed approach overcome the technical barriers?
- Nature of expected results
- Risk if the work is not done
- Criteria for evaluating progress
- Cost of the proposed effort

DARPA: How it Really Works

- Who you know is of primary importance
- Marketing to program managers is key
- Seedling programs
  - Contributing to the development of program announcements (BAA = Broad Agency Announcement)
- Many awards are to large teams comprising 3-6 organizations
  - Usually lead by a big company (LMCO) or org (SRI)
- Awards are contracts with many deliverables and much program manager control

NSF vs. DARPA

- Politics and agency goals notwithstanding...
- NSF awards are grants
  - ☑ No specific deliverables (except annual reports)
  - ☑ Little program manager control
  - ☑ Work on what you want to (but do good work!)
  - ☑ Funding rarely goes away, once awarded
  - ☑ Extremely competitive
  - ☑ Less $$$
- DARPA awards are contracts
  - ☑ Many deliverables
  - ☑ Much program manager control
  - ☑ Focus might change
  - ☑ Funding might disappear
  - ☑ Once you’re hooked in, the money can be pretty steady
  - ☑ More $$$

Final Thoughts

- A good strategy is to have a mixed and balanced portfolio
  - Comprising projects from NSF, DoD and Industry
- Each funding type goes through cycles and when one is down for you (e.g., DARPA) the others may be up (e.g., NSF)
  - Its not just the level of funding, but also the interest IT or your sub-area (e.g., NLP)
- This is true with in a group as well
  - IBM, Google, Microsoft, Yahoo, …