Researching Responsbile Natural Language Processing

Session 16: Scientific Writing: Proposals

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Overview

Heilmeier's Questions

Things Heilmeier Doesn't Cover

Reading: Alley (2018), ch. 9 (pp. 174–198).

Please also look at Alley's web site, which has a lot of videos and additional materials: https://www.craftofscientificwriting.com/

Overview

Most scientific documents report completed work. But proposals describe work you are *planning to do.* They are required in a range of contexts:

- planning a student project (e.g., IEP proposal, PhD proposal)
- applying for research funding (grant proposal, fellowship proposal)
- applying for an academic position (often requires a research statement)
- planning a research or development project for a company
- pitching a business idea to an investor

Many of the things we've learned so far readily apply to proposals.

Overview

Audience: Who are they, why are they reading, what do they know? For proposals, often a mix of expert reviewers and generalists (panel members, management).

Purpose and occasion: get your project funded/approved, so the focus is on persuasive writing.

Structure: not unlike a paper; but often detailed instructions or even a template is provided by the funding agency etc.

Precision and clarity, structure, use of figures, tables and diagrams: essentially the same advice applies as for other scientific writing.

Alley has a lot of good advice on proposals and lots of examples: how to write the intro, how to use of illustrations, etc.

Heilmeier's Questions

Heilmeier's Questions

George Heilmeier was a director of DARPA, back in the days when the agency funded high risk/high gain research. He developed a set of questions that every proposal should answer:

1. What are you trying to do? Articulate your objectives using absolutely no jargon.
2. How is it done today, and what are the limits of current practice?
3. What is new in your approach and why do you think it will be successful?
4. Who cares?
5. If you are successful, what difference will it make?
6. What are the risks?
7. How much will it cost? How long will it take?
8. What are the mid-term and final "exams" to check for success?

This is known as the *Heilmeier catechism.* Alley's advice complements this.

How to use Heilmeier's Questions

- Think about how each question relates to the proposed project.
- Write down an answer to each question: in full sentences, explicitly and specific
- Consider Q7: this determines the scope of your project (being overambitious is a common mistake!)
- If you've been given instructions, a fixed structure, a call for proposals, or a template: map that onto your answers
- Now make an outline with the required structure; make sure all of Heilmeier's questions are covered
- Turn the outline into a full text proposal

Bear in mind reviewers/markers will also be given a fixed structure when they assess your proposal! *Make their job easy:* show them where the relevant information is.

1. What are you trying to do?

Give an overview of the proposal, without jargon and acronyms:

- state the overall goal of your research
- break it down into distinct research questions/hypotheses
- list the research objectives required answer these questions:
  - what are the intermediate steps?
  - which methods will be used?
  - which data will be collected?
  - how will you evaluate?

The answer to Q1 should be in the summary and in the intro of the proposal.

2. How is it done today, and what are the limits of current practice?

This is the related work or background section:

- describe the current state of the art
- identify gaps in the literature, unanswered questions, limitations of current methods
- explain how you will fill these gaps
- now you're allowed to use jargon ...

3. What is new in your approach and why do you think it will be successful?

Most funders put a high premium on novelty:

- what is new in your proposal, for instance:
  - theory
  - approach
  - methods
  - datasets
- why is your approach not only novel but also *better:* higher accuracy, faster, less memory/compute, etc.
- your approach is not only novel and better, but *it will work*
- ideally, refer to pilot data, preliminary experiments, similar work you have done
- also talk about your plan B: what will you do if your initial idea doesn't work?

4. Who cares?

- Researchers in your narrow field will of course care
- But who else will be interested? Are there:
  - application to new problems in the same field
  - application in other disciplines
  - users in industry
  - benefits to the economy or society as a whole
- How will you make sure that your work reaches other researchers, disciplines, users in industry or society?

Funding agencies call this *relevance to beneficiaries,* and take it rather seriously.

5. If you are successful, what difference will it make?

Argue that your project will:

- create new knowledge
- solve important scientific, technological, or societal problem
- contributes to research infrastructure and technical capabilities
- benefit economic development
- train the next generation of scientists and engineers

Funding agencies call this *impact.* Again, taken very seriously. Why should the taxpayer pay for this project?

6. What are the risks?

In Q4 and Q5 you argued that your project has a lot of benefits and high impact. But what are the *risks?*

- all novel ideas carry risk, in science things often don't work as expected
- it is important to *balance* risk and reward
- propose some things that are safe, and some things that are risky, but come with a high pay-off
- give the impression that you have thought about the risk
- suggest ways of managing risk; have a plan B if things don't work

7. How much will it cost? How long will it take?

These questions help you figure out the scope of the proposed project:

- Can what you suggest be done by one person in one semester (IEP) or in three years (PhD); by a team in five years (large project)?
- Think not only in terms of money, but also in terms of time and resources (infrastructure, expertise, data, compute)
- Often the call for proposals specifies a limit to how much time your have and how much budget you can ask for
- Often a timeline is required or a breakdown in terms of work packages (with person months for each)
- At this point, you often seen a Gantt chart in the proposal ...

8. What are the mid-term and final “exams” to check for success?

Explain how you will know that you’re on track:

- Most projects require a mid-term and final evaluation
- The IEP requires a progress presentation (half way) and a final report
- The PhD requires annual reports and a final report (aka thesis), as well as an oral exam
- In your proposal, say how you will evaluate progress, how you will deal with lack of progress
- This is a good place to talk about evaluation methods, metrics, test sets

Over to You

Exercise 1

Sadly, we don't have time to study full proposals. But on the next pages you will find the summaries of two grant proposals:

- Can you find answers to some of the Heilmeier questions?
- Which questions are not covered?
- Do the summaries contain additional information not requested by Heilmeier?
- Comment on the level of detail and technicality of the summaries.

Addressing Hallucinations in Generative AI for Customer Service Applications (Titov, Lapata)

Advances in Deep Learning have made Large Language Models (LLMs) a potential game-changer for customer service, as well as other commercial applications. These models can generate natural interactions without explicit instructions or manual data, unlike current conversational Artificial Intelligence (cAI) systems.

However, this technology carries the risk of incorrect or fabricated answers, known as 'hallucinations', which can undermine customer trust and harm a company's reputation.

In this collaborative project, the consortium consisting of Algomo, YuLife, Natwest and the Universities of Edinburgh and Essex will research and develop technologies that will identify, monitor and address hallucinations for customer service applications.

This project fits Algomo perfectly, as it improves upon our core product, a cAI platform, and addresses the market need for trustworthy and reliable generative cAI.

By developing a technology that effectively addresses hallucinations, we will increase trust and confidence in the outputs of LLMs, ultimately accelerating their commercial adoption not only for customer service but also for a variety of other use-cases.

Muted Registers: A Feminist Intersectional (Re)figuring of Red-teaming (Taylor)

This fellowship seeks to understand the practice of red-teaming to produce actionable insights for policy and governance. The focus is on collaboration, dissemination of tools, and broad public engagement.

As an emerging practice, there are still fundamental questions to be asked of red-teaming and its use in building safe and responsible, generative AI systems. Who, exactly, works in these 'red teams'? What conditions do red-teams operate in, and what are the lasting individual and structural consequences of these conditions? And what taken for granted logics, norms and values are being applied in the drive to mitigate harms and improve AI safety?

This fellowship will seek a deeper understanding of and critical engagement with red-teaming in order to inform both organisational governance and national policies linked to Responsible AI. Grounded research will draw on scholarship in the humanities, philosophy, Black Studies and English literature – loosely grouped under the umbrella term feminist intersectionality – to make two analytical contributions:

1. It will provide a means to think with/against the harms both being targeted by and also arising in red-teaming. Feminist intersectionality will enable a critical examination of red teams' exposure to trauma [...]

2. It will be motivated by imaginative and hopeful ways of responding to situated, ethical and epistemic challenges. This perspective will be driven by a feminist intersectionality [...]

This project is committed to impacting governance within commercial organisations and national policy-making. The programme of work for fellowship has been designed to work closely with Microsoft Research (MSR) [...]

Things Heilmeier Doesn't Cover

Why You?

Most funding agencies require a *track record* section:

- say why you are well qualified to carry out the proposed work
- explain relevant previous work you have done; emphasize your successes
- describe your expertise in the required theory, experimental methods, evaluation techniques, etc.
- if the work will be done by a team explain why each team member is vital, and how they will contribute
- a description of the institution and its facilities and resources may also be required

This is a bit like a CV or a cover letter in a job application!

Why Now?

This is sometimes called *timeliness:*

- Why is the time ripe for the proposed project? Why should it be funded now rather than next year?
- Reasons could include:
  - new theoretical foundations make the work possible
  - new data, new results make it a logical next step
  - there's an urgent societal or economic need
  - disciplines have converged to make the proposed work feasible
- or it could also just be that the topic is currently fashionable (though best not so say it like that . . .)

Methods and Feasibility

Heilmeier's questions don't explicitly address methods and feasibility. But reviewers pay *a lot* of attention to this, and it's an explicit review criterion for most funders:

- describe how the methods follow from your research questions and objectives
- contrast them with alternatives, explain why your methods are more suitable
- describe in technical terms how you will achieve your objectives: which theories, algorithms, datasets, experimental paradigms will you use, how you will evaluate results, analyze data, etc.
- you want to convince the reader that the proposed work is *feasible,* and that you can achieve your objectives

This part of the proposal should be technical (even though other parts should be accessible to non-experts).

References

Alley, Michael. 2018. *The Craft of Scientific Writing*. Springer, New York, NY, 4 edition.