

Introduction to the Research Process

Tools and Methodology

Stéphane Zuckerman¹ and Jordane Lorandel¹

{stephane.zuckerman, jordane.lorandel}@u-cergy.fr

*ETIS / Université Paris-Seine – ENSEA - Université de Cergy-Pontoise - CNRS -
UMR 8051*

F-95000 Cergy-Pontoise Cedex, France



Université // Paris Seine



Outline

- 1 Objectives of this Talk
- 2 Building a Bibliography
- 3 Communicating Results

Objectives

- To acquire a good research methodology
 - Tools
 - Analysis methodology
 - Technological/Research “watch”
- To learn how to tackle a scientific paper, from a reading and writing perspective
- To understand the role and objectives of various communication media
 - Poster
 - Presentations / slides
 - *etc.*

Objectives

- To acquire a good research methodology
 - Tools
 - Analysis methodology
 - Technological/Research “watch”
- To learn how to tackle a scientific paper, from a reading and writing perspective
- To understand the role and objectives of various communication media
 - Poster
 - Presentations / slides
 - *etc.*

Eventually, to better understand what a research project is, and how to shed a positive light on your results.

Why Build a Bibliography? I

- To speak about a given topic, we need to prove that we know:
 - The fundamentals that underly this topic
 - The state of the art and related work
 - *I.E.*, the latest research pertaining to that topic
- Hence, we must read specifications or texts describing the principles of operations we're interested in. For instance:
 - Internet protocols:
 - RFC 793—TCP
 - RFC 791—IP
 - RFC 768—UDP
 - MIPS: A Microprocessor Architecture Hennessy et al. 1982
 - Fundamental paper describing the RISC architecture simplifying a microprocessor's instruction sets.
 - IBM Power9 Processor Architecture Sadasivam et al. 2017 par S. K. Sadasivam et al., 2017.
 - Latest version of the POWER processor targeting data centers

Why Build a Bibliography? II

- It allows us to compare our work to other people's
 - Constructive criticism: positive or negative
 - Based on a contrasted view of the presented work, its methodology, and the results displayed

Research Tools

- Google scholar — <https://scholar.google.com>
- IEEE — <https://ieeexplore.ieee.org>
- ACM — <https://portal.acm.org> and <https://queue.acm.org>
- Cite Seer X — <http://citeseer.ist.psu.edu/>
 - Generally: articles published a while ago. Mostly “pre-published” versions.
- HAL Archives — <https://hal.archives-ouvertes.fr>
- Sci-Hub — see the Wikipedia page to get its current URL, IP adresse, *etc.*
 - French commercial ISPs (among others) are mandated by law to block this site.
 - RENATER (the French Research network) does not block it (not a commercial ISP).
- Ask a professor or researcher for some help
- If all else fails: write to the authors!

Reading a paper I

Different Types

- Generic articles (conferences, journals)
- Specific articles
 - Surveys: a synthesis of numerous works about a specific research problem type
 - Letters: works without significant results yet, but very innovative/inventive
 - *etc.*

Reading a paper II

Understanding a Paper's Structure

- Abstract/Summary
- Introduction : Context and problem statement
- State of the art / Related work: state of the current knowledge on this type of problem – scientific positioning
- Methodology – results
- Conclusion
- References + appendix

Questions to Ask Oneself

- We must develop a critical view, in the “scientific” sense.

Grouping Works I

Once a paper was read and analyzed (context, problem statement, methodology, results, critical discussion), we can group them in various ways.

Context & Problem Statement

- In a given context, what method to use?
- Group papers we read into “families” of methods to solve problems situated in the same context.

Methodology

- While the contexts may be different (but with some similarities), re-use an existing methodology
- Example: Heat transfer modeling (Laplace equations) *and* some image processing filters use similar algorithms

Grouping Works II

Some Useful Tools

- Mendeley
- Zotero (free/libre software)
- EndNote
- \LaTeX + Bibtex/Biblatex

Citations

Format

- Authors
- Title
- Title where the article was published (journal/conference name)
- Year of publication
- Possibly the URL where to find the paper / Digital Object Identifier (DOI)

Example

Attea, B. A., & Khalil, E. A. (2012). A new evolutionary based routing protocol for clustered heterogeneous wireless sensor networks. Applied Soft Computing, 12(7), 1950–1957.

First Deadline I

Bibliography-centric Elements

- Bibliography part of your report due by December 20
- Format: no specific one. However, we strongly suggest to learn the use of \LaTeX
- 5 pages min.
- Where to submit this report: email your tutor(s), and copy to admins (Anthony Carqueijeiro)
- Language to use: preferably English, but French is accepted.
- Don't forget the list of citations.
 - Again: Bibtex/Biblatex is probably your best friend to manage this easily.

First Deadline II

Other Elements

- Progress Report (3 pages min): tested algorithms (illustrated with charts), images, schemas. . .
 - Anything allowing us to show you're making progress

This preliminary report will be the basis of your *final* report—written like an actual article. **Please check your emails for more specific instructions!**

Plan

- 1 Objectives of this Talk
- 2 Building a Bibliography
- 3 **Communicating Results**
 - ▷ Writing Papers
 - ▷ Other Media

How to Write an Article I

Basic Structure of an Article

- 1 Abstract / Summary
- 2 Introduction : Context & problem statement
- 3 State of the art / Related work: state of knowledge on this problem
– scientific positioning
- 4 Methodologie – Results
- 5 Conclusion
- 6 References + Appendix

How to Write an Article II

Proper Order to Write an Article's Sections

- Writing a paper in the order of its sections is rarely a good idea.
- It is often better to focus on the “meat” of the work first, or which problem we are trying to solve.
- Oft-used orders include:
 - 2, 4, 3, 5, 6, 1
 - 2, 3, 4, 5, 6, 1
 - 4, 2, 3, 5, 6, 1

Make a Detailed Outline

- Section names
- Sub-section names
- A bullet list of ideas for each (sub-)section.

The Writing Process

- What is the context of our research?
- What is the specific problem we are trying to solve—*i.e.*, what is the problem statement?
- What is the proposed solution, *i.e.*, the *methodology*, we want to use to solve this problem?
 - Are there intrinsic limitations?
 - Is this methodology based on an implementation, or is it of a more theoretical nature?
- What results did we get?
 - Did we get what we expected?
 - How do they compare with respect to other methodologies, *i.e.*, compared to the state of the art?
 - Methodology/process
 - “Raw” results, *e.g.*, performance, complexity (space and/or time), *etc.*

If you feel like this list looks *a lot* like one or two other slides we already presented, it's because it's true! It is the same methodology!

Plan

- 1 Objectives of this Talk
- 2 Building a Bibliography
- 3 **Communicating Results**
 - ▷ Writing Papers
 - ▷ **Other Media**

Posters

- Must be readable without their author hanging around
- But must not be filled with “walls of text”
- Often partitioned into 4-6 areas
- Format: landscape or portrait (may depend on the venue)
- In general:
 - Feature a paragraph providing context + problem statement
 - Only “wall of text” allowed in the poster
 - Feature schemas to detail the methodology
 - Each area has a title
 - Unique sentence to explain the methodology at a high level
 - Results
 - References (not many)

Slide Presentation

- Must be readable without their author hanging around **for someone who knows the field**
- But must not be filled with “walls of text”
- Assume 1m30 to 2m per content slide
 - Hence: a 15-minute talk must not have more than 10 **content** slides on average!
 - We do not count the title, outline, and reference slides as content.
- In general:
 - 1-2 **context** slides: *Why* this research? *What* problem do we want to solve?
 - 1 **related work** slide: *Who* is the “competition?” Cite 2-3 works
 - 1-4 **methodology** slides: *How* do we want to solve our problem?
 - Feature schemas to detail the methodology
 - As much as possible: have bullet points fit in a single line
 - Use sub-bullets to break down complex concepts and ideas
 - 1-4 **results** slides
 - 1 **conclusion** slide (and possibly future work)
 - Possibly, include references at the end of your talk (as many slides as you want)
 - Some people prefer to include the citations where they are used
 - They use (very) small fonts, and locate these references at the bottom of their slide

Second Deadline: Oral Presentation – End of March I

The Actual Presentation

- Around 10 minutes (see email you received recently)
- The evaluation jury is composed of professors, but not necessarily experts on your topic
 - Context will be very important
 - Be careful with acronyms and jargon/vocabulary

Second Deadline: Oral Presentation – End of March II

Some last few pieces of advice

- Avoid using written notes \Rightarrow instead prepare your slides well!
- Respect the time you were given \Rightarrow rehearse your presentation!
- Title slide:
 - title / Author's name / Tutor's name / Date
- Number your slides!
- Include references / citations
- Avoid superfluous animations!
 - Animations are good when they help understand what you are saying.

A Few Useful Resources

To write your report and other articles, using a template can save you a lot of time. For example:

- `https://journals.ieeeauthorcenter.ieee.org/create-your-ieee-journal-article/authoring-tools-and-templates/ieee-article-templates/templates-for-transactions`
- They provide several formats, mostly MS-Word and \LaTeX

Conclusion

- This will most likely be your first research experience
- The bibliography and progress report are due by the end of December
 - No fixed format
- The final report must be written using an IEEE format (see previous slide)
- Presentation / Defense:
 - Must be a clear summary of your work, in front of a jury composed of the ETIS laboratory

If you have further questions, you should address your project tutor first! They're your first line of defense against blocks/issues during your research work.

- Hennessy, John et al. (1982). "MIPS: A microprocessor architecture".
In: *ACM SIGMICRO Newsletter* 13.4, pp. 17–22.
- Sadasivam, S. K. et al. (Mar. 2017). "IBM Power9 Processor
Architecture". In: *IEEE Micro* 37.2, pp. 40–51. DOI:
10.1109/MM.2017.40.