

Theory of Science

Introduction

Jiri Srba, Manfred Jaeger and Radu Mardare

Practical Information

- **Part I:** Professional Communication in Computer Science
Lecturer: Jiri Srba
- **Part II:** Experiments
Lecturer: Manfred Jaeger
- **Part III:** Philosophy and History of Science
Lecturer: Radu Mardare

Exam

- passed/failed, 5 ECTS (=150 hours of work)
- running evaluation based on your active participation and on individual assignments throughout the semester
- Part I, II and III evaluated separately, all must be passed in order to pass the course

Professional Communication in Computer Science

Reading and reviewing a scientific paper



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Focus of Part I of the Course

Help you in answering the following questions:

- How does one read and evaluate a scientific paper?
- How does one write a scientific paper?
- How does one hold a scientific presentation?
- How does one behave responsibly in a scientific community?
- How does one achieve a good career in computer science?

Aims of Part I

- Help you to get oriented in the field of computer science.
- Improve the way in which you write/present your work.
- Make you think about several non-scientific issues like ethics, authorship and copyrights.
- Have fun discussing non-scientific issues.

Organization

- **Compulsory Blocks 1 to 5**
 - Two groups: DAT and SW.
 - Three common meetings (block 1, 2 and 3).
 - Other meetings will be split into two groups (DAT and SW).
- **Optional Block 13**
 - Mainly for DAT: peer-review of articles in May.

How to Pass Part I of the Course

- Individual, written report evaluated as pass/fail.
- You will write a journal with 6 deliverables (see the web-page).
- Hint: start writing the journal already today and add a new deliverable **immediately** after each meeting.
- Deadline for the journal in Part I (PDF, single file):
Monday, March 11th at 23:55 latest via MOODLE.

Credits and Thanks

Credits (and many thanks) for slides, ideas and inspiration go to:

- Luca Aceto
- Olivier Danvy
- Emmanuel Fleury
- Albrecht Schmidt

Today's Plan

- Scientific paper: definition, types, structure
- Reading a paper
- Reviewing a paper
- Competition
- Searching for papers, citations, etc.

What Is a Scientific Paper?

Scientific paper is a **written** and **published** report describing **original** research results.

A paper is the prime medium for reporting scientific results.

In computer science a paper should:

- contain a good/new idea,
- say something sound, and
- say something practical.

Variety of Papers in Computer Science

- Unpublished draft
- Technical Report
- Poster
- Workshop paper
- Conference (symposium) paper
- Journal paper

Unpublished Draft

Definition:

The first shape of something eventually developing into a paper.
Length varies.

Use:

For the author and his/her immediate collaborators.

Quality control:

The author(s).

Technical Report

Definition:

A draft to be read by others. Length usually between 10 to 100 pages.

Use:

As a time stamp or record that something has been done. (Usually made widely available by the department/faculty.)

Quality control:

Maybe a few colleagues and students.

Poster

Definition:

Visual presentation of a scientific work. Usually an overview on 1 to 2 poster size sheets.

Use:

To make your work visible at a scientific meeting, home institution, etc.

Quality control:

Program committee (if any). Usually judged by the scope of interest only.

Workshop Paper

Definition:

A record to document a talk. Length usually between 5 to 15 pages.

Use:

Communication among specialists.

Quality control:

Program committee (if any).

Conference Paper

Definition:

A record to document a talk. Length usually between 10 to 20 pages.

Use:

Communication in a larger community.

Quality control:

The program committee.

Journal Paper

Definition:

Author's last word on a particular topic. Length usually between 20 to 80 pages.

Use:

Archival purposes.

Quality control:

Journal editors and their reviewers.

Draft and Technical Report Revisited

Draft Revisited

Sometimes drafts get never published. Like wine, a draft may improve with age.

Technical Report Revisited

Technical reports are often used to make available to public extended versions of workshop/conference papers, typically including all the proofs, experimental results and measurements etc. **Often bypasses the copyright restrictions.**

How Much Should I Trust a Paper?

Trust in a Paper

Directly proportional to its advanced state and quality control.

Rule of thumb:

- journal versions are more trustworthy than conference versions
- conference versions are more trustworthy than workshop versions
- workshop versions are more trustworthy than technical reports and drafts

Papers: Submitted, Accepted, Final, Revised, Extended

Life-Cycle of a Paper

- ① Work on a (relevant) problem.
- ② Write a scientific paper.
- ③ Submit the paper to an appropriate conference/workshop (exceptionally directly to a journal).
- ④ If accepted for publication then
 - add one line to CV
 - prepare a final version based on the feedback from reviewers
 - present the work at a scientific meeting
 - if appropriate, prepare extended/revised journal version.
- ⑤ If rejected, then
 - go to Step 3, or
 - modify the paper and go to Step 3, or
 - put it to garbage.

Media for Publishing Papers

- **Technical Reports:**
electronic version plus (sometimes) hard-copy available at the faculty/departmental level.
- **Workshop/Conference Papers:**
proceedings, often as hardcopy distributed at the meeting, nowadays majority available electronically as well.
- **Journal Papers:**
electronic or printed form, organized in volumes (sometimes focused on a particular topic, sometimes mixed).

Structure of Scientific Papers

- Title, Authors, Addresses (**few lines**)
- Abstract (**5-20 lines**)
- Introduction and Related Work (**15%**)
- Preliminaries (**20%**)
- Body (**50%**)
- Conclusion (**5%**)
- References (**10%**)

Why People Read Scientific Papers?

Academic World

- **Content:** looking for new ideas/proofs for your own work
- **Topic:** what are the new directions in my field, learning about a new topic
- **Authors:** looking for valuable colleagues to work with

Company World

- **Content:** I need the most efficient algorithm/technique for my new product
- **Topic:** can I get a new product out of this crazy work?
- **Authors:** looking for new people to hire or collaborate with

Motivation

Question: What should I learn about reading a paper? I already know how to read English!

Answer: Yes, but the information

- is cryptic (notation, math formulae, references to other papers, ...),
- is hidden (where do I find an answer to my problem, where to find good papers),
- is complex (theorems, lemmas, proofs, experiments, ...).

Critical View

Three Stages of Reading (as one grows up)

- 1 The book says blah and that's why it is true.
- 2 The book says blah.
- 3 The author wrote blah.

Here

Paper, not book. However, one's critical sense should still apply.

Critical Reading of a Scientific Paper

“Don’t just read it; fight it!

Ask your own questions, look for your own examples, discover your own proofs.

Is the hypothesis necessary? Is the converse true? What happens in the classical/special case? What about the degenerate cases? Where does the proof use the hypothesis?”

– Paul Halmos, *I Want to be a Mathematician*

Different Texts Require Different Approaches/Skills

- “Introduction to Databases”
- “Advances in Databases”
- “A New Technique for Query Processing in Object-Oriented Databases”

Information Acquisition

In principle, a paper provides enough information for its reader to reproduce its content:

- proof,
- experiment.

Question: How to efficiently retrieve the information in a paper?

A Tip

It is a good idea to keep reading notes! (Hand-written annotations, summary of what you read with the contributions.)

Step 1: First Reading Through

What to Read?

- Title and abstract
- Introduction and Related work
- Conclusion
- References (only those used in one of the previous sections)

What to Ask?

- For which community is the paper? [Introduction, Related work]
- What main contributions are in the paper? [Abstract, Introduction, Conclusion]
- What consequences can the contributions have? [Introduction, Conclusion]

Step 2: Second Reading Through

What to Read?

- Preliminaries (identify the notation, methods, techniques)
- Body (**skip the proofs or experiment settings**)

What to Ask?

- If I assume that the proofs are correct (or the experimental settings relevant), does the author meet the list of contributions?
 - If yes, go to “In Depth Reading”.
 - If no, (i) try again, (ii) talk to your colleagues, or (iii) to your supervisor.

Step 3: In Depth Reading

Only if the paper still has some interest to you!

What to Read?

- Body (everything)
- References (quick glance at external theorems/experiments, related results)

What to Ask?

- Are the proofs/methods sound?
- Can I find alternative proofs/methods?
- Can the ideas be generalized or used in different context?
- Can I use the results it in my own work?

Last Tips

A proof/experiment is too technical, I don't understand it!

- Is it relevant to understand it?

Yes: (i) Try harder, (ii) talk to colleagues, (iii) contact your adviser.

No: Skip it.

I found an error in the paper!

- Are you sure? (i) Double check, (ii) talk to your colleagues, (iii) contact your adviser, (iv) write a **very polite** email to the author (you might still be wrong yourself).
- Are the contributions of the paper still valid?

Yes: Then it is not that important.

No: Write a paper!

Refereeing a Paper — Setting Up the Scene

Purpose of Refereeing

Quality control for selection of papers to be published.

How Is it Done?

Most often by **peer-review**.

Involved parties:

- Author(s).
- Editor(s) (journals) or program committee members (workshops/conferences).
- Referees.
- Intended (target) audience.
- Time.

Role of the Referee

The task of the referee is to **evaluate** in a **timely** manner a paper for publication in a specific journal or conference proceedings.

– Alan Jay Smith, *The Task of the Referees*

Keywords:

- Evaluation (critical judgement), and
- Timeliness.

The same scientist often plays several roles (author, editor, PC member, referee, audience) at different conferences/journals.

Anonymity of Referees

The identity of referees is known exclusively to the editors or program committee only!

Evaluation and Critical Judgement

A referee should evaluate whether

- the paper is **correct**,
- the studied problem and the results are **new** and **significant**,
- the quality of presentation is **good**, and
- what changes might or should be made to improve the paper.

Referee's task is purely **advisory**; the referee should provide an **opinion**.

Editors or program committee members make **decisions** about acceptance based on two or more referee reports.

What Is a Publishable Paper?

A paper is publishable if it offers a **sufficient contribution** to the body of knowledge of the scientific community it addresses.

Examples:

- New and interesting results.
- New life from old results.
- Survey of old results.

Timeliness

Conference/Workshop paper:

- hard deadlines, referee reports cannot be delayed (usually a month or two from the submission deadline to notification to the authors)
- short refereeing time (usually from one hour up to a week)

Journal paper:

- soft deadlines, delays are common (usually several months to infinity)
- long refereeing time (whatever the paper needs)

A Remark on Timeliness

Littlewood's Zero-Infinity Law

Is this or is this not the kind of thing that I will eventually do?

If it is, then do it **now**. If it isn't, then say so **now**!

Referee's Report

Referee's report, the outcome of referee's work, is a written document that should mention (at least):

- A recommendation for/against publication. Sufficient justification of the recommendation is a **must**.
- A list of necessary/recommended changes and revisions.

Example of Referee's Report Form (from FOSSACS)

ARTICLE ID: 63

TITLE: Polynomial Time Algorithm for Solving CLIQUE

AUTHORS: George Famous

PC MEMBER: Anna Decider

REFEREE: John Reader

CONFIDENCE: 3

3: High. I am an expert in the subject area of this paper.

2: Medium. I am knowledgeable in the area, though not an expert.

1: Low. I am not an expert. My evaluation is that of an informed outsider.

Example of Referee's Report Form (cont.)

SCORE (0-9): 9

- 0: Absolutely unacceptable, incorrect, out of scope.
- 1: Very weak, definitely below conference quality.
- 2: Serious problems. I will argue to reject.
- 3: Has some merits, but doesn't meet the standards.
- 4: Neutral score, could go either way.
- 5: Marginal paper, maybe above threshold.
- 6: Typical FOSSACS paper.
- 7: Very good, clear accept.
- 8: Outstanding paper, among the 5 best accepted.
- 9: Breakthrough, best paper.

JUSTIFICATION AND COMMENTS TO THE AUTHORS:

COMMENTS FOR THE PC EYES ONLY:

A Good Justification of Recommendation

In the submitted paper, the author considers visibly pushdown automata (vPDA) as generators of (infinite) labelled transition systems and asks some natural questions from the concurrency theory viewpoint. He provides EXPTIME-completeness results for the whole class of vPDA, then PSPACE-completeness results for the subclass of visibly one-counter machines and P-completeness results for vPDA with one control state.

The author has not needed new techniques, the results consist in showing suitable reductions to previously known results, but the contribution is surely sensible and valuable since it helps to clarify the status of a new concept (vPDA) from the so far not studied viewpoint.

The paper is well-written, and I strongly recommend acceptance.

Remarks for the author: page 3, line 2: missing comma, page 4 ...

A Possible Structure of the Report

- ① **Summary** of the main points of the paper (1–5 sentences is sufficient).
- ② **Evaluation** focusing in particular on
 - Is the goal of the work worthwhile?
 - Is the development correct?
 - Is the paper well-written?
- ③ **Recommendation.**
- ④ **Comments for the authors.**

Desirable Attributes of a Scientific Paper

When refereeing a paper, look for:

- Correctness
- Significance
- Innovation
- Interest
- Timeliness
- Succinctness
- Accessibility
- Elegance
- Readability
- Style
- Polish

Fact: We are only Human

Most papers will be inadequate in at least one of these attributes.

Making Recommendations

Key Point

Set yourselves standards that are neither unrealistically high nor unrealistically low, and adopt them in all your refereeing jobs.

- All journals/conferences should aim at high standards for publication.
- The evaluation of a paper is often relative to the standards of the journal/conference it is submitted to. However, for the reasons of courtesy, do not suggest publication in a “lesser” outlet.

Few Tips

- 1 Reviews should be as **comprehensive** as possible.
- 2 Reviews should be as **courteous** as possible.
- 3 Reviews should be as **selfless** as possible.

Example of what can go wrong

David Harel started his talk at DAIMI in Aarhus (September 22nd, 1999) by a quote from a review by a journal editor:

"I have personal antipathy towards languages based on hand-written graphics."

Analysis: not comprehensive, not courteous, not selfless.

Issue 1: Is the Paper Significant?

- Exercise caution in rejecting a paper for its lack of significance.
- You must be able to defend terms such as **obvious** and **trivial** if you reject a paper simply on this ground.

"I have heard mathematicians sneer at the special theory of relativity, calling it nothing but a technically trivial quadratic equation and a few consequences. Yet it is one of the monuments of human thought."

Issue 2: Is the Paper Appropriate for the Chosen Forum?

- Refer to a description of the topics covered by the journal/conference.

Example: Journal of Information and Computation

Information and Computation welcomes original papers in all areas of theoretical Computer Science and computational applications of Information Theory. Survey articles of exceptional quality will also be considered. Particularly welcome are papers contributing new results in active theoretical areas such as

- Biological computation and computational biology.
- Computational complexity.
- Computer theorem-proving.
- Concurrency theory.
- ...

Issue 3: What If the Author Is Very Famous?

- One should not be **impressed** or **unimpressed** by the name or affiliation of the author(s).
- It is a mistake to see depth where there is merely obscurity.
- Do not underestimate unknown author(s).

Example:

- D. Knuth, Stanford University.
- M. Outsider, Handcraft School of Fashion and Design.

Issue 4: Does Anonymity Mean I Can Write Anything?

Anonymity gives power, so **never** abuse it!

- As a referee you work for the author as much as for the scientific community at large!
- Do not be personal (even in case of extremely bad papers).
Treat the author with courtesy as a fellow human being.
- Criticism should be **specific** rather than vague.
Avoid sentences like:
 - The main result of the paper is most likely wrong. [**Where and why?**]
 - The author should cite related literature. [**What papers?**]
 - ...

Some Typical Reasons for Rejection

- The subject is out of scope.
- The results are published elsewhere.
- The problems are of level of a student exercise.
- The results are of minor significance.
- The paper contains major errors.
- The paper is boring.
- The paper has high density per unit progress.
- The paper has poor exposition.

Categories of Papers — Part 1

Major results; very significant

Fewer than 1% of all papers.

Example: S.A. Cook: *The complexity of theorem proving procedures*. [This paper introduces the concept of NP-completeness.]

Good, solid and interesting work; a definite contribution

Fewer than 10% of all papers.

Example of referee report: "This paper is excellent in all respects. The contribution is important and nontrivial, the exposition is clear, and the accuracy is refreshingly high. I have very little feedback on this paper, reflecting its high quality, and strongly recommend acceptance."

Categories of Papers — Part 2

Minor, but positive, contribution to the knowledge

Perhaps 10-40%. Most papers that you will read fall into this category. Do not underestimate the importance of these papers to the development of the scientific knowledge.

Elegant and technically correct but useless

Example of real-life referee report: “ It is strange and wonderful to observe the unbounded depths to which scientists will delve into a subject, once they have started investigating it. However, there is a limit to the depth to which others can be expected to follow them and remain fascinated by what they find there.

Since this result, though unflawed, does not shine on its own light and the authors make no attempt to polish it or show where it may be used, I recommend to reject it. ”

Categories of Papers — Part 3

Neither elegant nor useful, but not actually wrong

Wrong and misleading

So badly written that technical evaluation is impossible

From a real-life report: “ I read this section n times looking for proofs or references to proofs. Results are given without proofs. This is not scientific paper level. It was acceptable when Fermat was working, but not in the last two centuries. ”

How Many Submitted Papers Get Accepted?

Acceptance rates at

- Workshops: maybe 50% accepted but varies a lot,
- Conferences: good conferences around 30% accepted or less,
- Journals: higher acceptance rates; difficult to find statistics.

Journal submissions were usually previously accepted to workshops/conferences, so there is more quality guarantee.

Bottom Line

Every paper should be **peer-reviewed** to guarantee some quality level. If not, we can talk about **fake** conferences or journals.

Example of a Fake Conference

From the web-page of WMSCI'05 (World Multi-Conference on Systemics, Cybernetics and Informatics):

“ Acceptance decisions related to submitted papers will be based on their respective content review and/or on the respective author's CV. ”

Moreover:

- Submission deadline 26.1. and notification of acceptance 23.2!
- Every year, thousands of papers accepted!!
- MIT students submitted a computer generated (nonsense) paper to WMSCI and got it accepted!!!

Check <http://pdos.csail.mit.edu/scigen/> to generate your own papers on a mouse click, submit to a fake conference and become famous :-)

Some Dilemmas

- How many papers should I referee?
- How much time should I put into a paper?
- What is the relationship between journal and conference versions?
- What if I have a conflict of interest?
Remember: All papers submitted to conferences and journals are submitted in confidence.
- Is the referee responsible for checking the technical correctness of the paper?
- Should the referee improve the writing of the paper?

What Does Refereeing Give You?

- Feeling of satisfaction for being asked to do the job by a famous scientist.
- Increased reputation.
- Good will from editors/PC members.
- Appointment to editorial boards.
- Current information.
- More work.

How to Become a Referee?

To write a paper is the best way to start!

Conclusion

Remember:

- Our currency is **reputation**. It takes lots of hard work and (scientific) social skills to build one but it takes very little to destroy it.
- Try to evaluate your own work using the standards you apply to somebody else's, but do not be your own worst enemy.

The job of the referee is

- hard,
- necessary, and
- important.

Remember that the job is best learnt by doing it.

The advice we give others is the advice that we ourselves need.

Deliverable 1 (Individual)

- Write one paragraph summary of the area where you do your current project.
- Find two suitable workshops and two suitable conferences where your current project work could be possibly published. The submission deadline for the conferences/workshops should be in this or next year.
- For each workshop/conference provide its full name, acronym, an URL to the home-page of the event and the submission deadline.