How to Write and How to Not Write Scientific AI Papers

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What this presentation is all about?
Domains of Application (conference papers/ journal papers/ theses documents… alike?)

…btw this is not a presentation on how to prepare presentations ☺ ☹ ;-)
All right, let’s take it away…
Presentation Overview

Sections…rather…Keywords

(Πλίνθοι και Κέραμοι, με μια κάποια -όχι απόλυτη- τάξη)

- Audience
- Story
- No, it’s not a novel. It’s a scientific paper.
- Message
- The role of the abstract
- The role of the intro – How should you be structuring the intro?
- The role of the core technical sections
- The role of the “conclusions and future work” section
- The role of the background and the related works sections
- How does your perception of/assumptions about the reader change as you move from section to section?
- Bonus tracks
Audience

- Does it matter that it is different (e.g., per publication venue)?
- Yes, it does.
- Is it different, really? Is every reader really unique?
Story

- Yes, you are telling a story.
- How do you do it?
No, it’s not a novel. It’s a scientific paper.

- Preciseness.
- Conciseness.
- Convincing Results. Convincing Results. Convincing Results.
- You are not just the author. You are also the reviewer.
- Still, you are the author: you know your work better than any reviewer. Show it: write with authority.
- Still, many scientists are narcissists full of themselves probably at least as good as you are: be humble [“To the best of our knowledge…”]
- Nice to have: beat the state-of-the-art. But if you don’t, don’t claim you do.
Message

- How do you (make sure that) you convey it?
- Story + Contributions
- Contributions: early on + hammer on them/the message as you go on
The role of the abstract

- Key message / key contributions / key results
- (much) Shortened / concise version of the intro
The role of the intro – How should you be structuring the intro?

• You start with a generic intro/ background (on AI/ML/MAS), especially in a thesis or a journal (where you have space). You then move to background on specific subfield of interest in the paper

  • Coalition formation, widely studied in game theory and economics [3, 31, 35, 38, 45, 50], has attracted much attention in AI as means of dynamically forming partnerships or teams of cooperating agents [32—34, 48, 52]. Most models of coalition formation assume that the values of potential coalitions are known with certainty, implying that agents possess knowledge of the capabilities of their potential partners. However, in many natural settings, rational agents must form coalitions and divide the generated value without knowing a priori what this value may be or how suitable their potential partners are for the task at hand.

  • Monte Carlo Tree Search (MCTS) is a collective name for a family of methods seeking to identify optimal decisions in a given domain, while making use of the results of simulated outcomes in the search space [1]. It has received considerable attention since its noteworthy success at the game of computer Go [11], and at the same time it has been effective in a variety of other domains [1].

  • The arrival of Connected and Automated Vehicles (CAVs) [1] promises the dawn of a new era of road transportation, that is linked to the emergence of novel, safer, and more efficient than existent traffic flow paradigms [2], [3].

  • There are many examples in the real-world of agents or teams of agents aiming to optimise their performance over long periods of time. These often involve a series of multi-step games that feed into one another as well as other factors in the wider environment. Examples of this includes security games where agents aim to constantly protect facilities against attackers that are able to change their tactics and decisions [14, 18, 23], as well as in the stock market where agents aim to continually make optimal decisions to make profits in fluid real-world environments [1, 13, 16].
The role of the intro – How should you be structuring the intro?

• You start with a generic intro/background (on AI/ML/MAS), especially in a thesis or a journal (where you have space). You then move to background on specific subfield of interest in the paper.
• You then move to what is lacking in the specific existing literature:
  • The formation of overlapping coalitions is particularly prevalent in systems demanding multiagent or multirobot coordination, computational grid networks, and sensor networks—see, e.g., the work of Patel et al. (2005), and Dang, Dash, Rogers, & Jennings (2006). To date, however, there has been essentially no theoretical treatment of the topic, with just a few exceptions (which we discuss in Section 3).
  • Research in coalition formation to date has not dealt with the sequential decision making problem facing agents forming coalitions under such type uncertainty.
  • Previous works however do not use the concept of families to improve the analysis process adapting the analyzer strategy at runtime.
  • A first generation cryptocurrency protocol has already been used in a setting with electricity prosumers, and is called NRGcoin [15]. Although it incentivizes demand and production balancing, that protocol does not promote large-scale cooperative consumption shifting.
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• You then move to what is lacking in the specific existing literature
• Then you say what you are going to do/have done about it.
  • Against this background, the goal of this paper is to introduce and study a model that explicitly takes overlapping coalition formation (OCF) into account. Our model is applicable in situations where agents need to allocate different parts of their resources to simultaneously serve different tasks as members of different coalitions. Besides allowing for overlapping coalitions, it departs from the conventional coalition formation framework in two important aspects. ...
  • By contrast, we use the available information on the families and on the characteristics of behaviors they contain, i.e., triggers, to guide the analyzer in selecting triggering actions that reflect the current belief regarding which family the malware being analyzed belongs to. [...] In our proposed Bayesian Active Malware Analysis (BAMA) approach we build the formalization upon the link between malware families and the notion of types in Bayesian games. In particular, we formalize the analysis as a Bayesian game between an analyzer agent and a malware agent, focusing on the decision making strategy for the analyzer.
  • In our work, we envisage a next-generation, special-purpose cryptocurrency software, which is executed by each cooperative member in a decentralized fashion, and is used for coordinating electricity consumption shifting actions and the sharing of the rewards.
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- Then you say what you are going to do/have done about it.
- It’s good to provide examples of what is lacking and/or how you fix it.
  - To provide more intuition, consider the example of two construction companies, 1 and 2, who are currently partners (not necessarily the only partners) working on construction projects A (“building a university campus”) and B (“building a hospital”). Assume that partner 1 has more stakes in project B.
  - Coordination on a “good” strategy profile often requires exploration in parts of policy space that are very unrewarding. In such a case, the benefits of eventual coordination to an optimal equilibrium ought to be weighed against the cost (in terms of reward sacrificed while learning to play that equilibrium) [1].
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• You then move to what is lacking in the specific existing literature.
• Then you say what you are going to do/have done about it.
• It’s good to provide examples of what is lacking and/or how you fix it.
• You make sure you provide a list with your technical contributions. Not necessarily as ”a list” – but it’s better you do it that way.
  • In summary, our contributions are the following: ...
  • Our main technical results involve ...
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- You make sure you provide a list with your technical contributions. Not necessarily as ”a list” – but it’s better you do it that way.
- Nice to have: beat the state-of-the-art. But if you don’t, don’t claim you do.
  - We beat the state of the art in the following ways: …
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- Write with authority.
The role of the core technical sections

• Tell the story – convincingly
  • Use examples
  • Explain all choices and assumptions
  • Explain how you build on previous own or related work (also in intro)
  • Explain differences with important related work / advances to the state-of-the-art (also in intro)
  • Elaborate on important or tricky technical issues
  • Present in detail your theoretical or experimental results

• Preciseness.
• Conciseness.
• Convincing Results. Convincing Results. Convincing Results.
  • Present all* results. Or if no space: at least the key ones.
  • Don’t just list tables or graphs or theorems. Discuss them / explain them. Explain how they address the questions/ how they meet expectations. Discuss what is unexpected/ non-intuitive; discuss the elegant/tricky/more-difficult-to-grasp technical issues.

• Write with authority
  
  * Sometimes less is more: filter your presentation of results to have a concrete, concise, coherent, convincing story. Where space, present less significant results in an appendix, in order to show that you have in fact done work and not just “cherry-picked” experiments/results
The role of the “conclusions and future work” section

- Provides a re-cap of the key message/contributions
- Showcases your *authority*
  - You know what is good about what you did
  - You know what is missing
  - You have an idea or two on how to move things forward
  - *Many times it’s important that you solved a problem; for real science, it’s more often much more important that your work opens up research avenues, for you and others [the reader!] to follow / expand*
Background/Related Work

- Also shows your *authority*. You know on whose shoulders you are stepping on.
  - *Related work provides a short review of existing work*
- Sometimes background + related work come together, sometimes separately (specially in long documents)
- Often come after the intro.
- Sometimes background comes within the intro itself, or after the intro; but related work comes just before conclusions
  - When you have to have provided the technical aspects first, so as to compare with the literature in a coherent manner
How does your perception of/assumptions about the reader change as you move from section to section?

- Abstract, intro: practically anyone with a university degree
  - Take this with a pinch of salt: probably anyone somewhat knowledgeable on AI/MAS/ML
- Background: practically anyone somewhat knowledgeable on AI/MAS/ML
- Related work: this is probably mostly for a more specialized audience
- Technical sections: this is definitely mostly for a more specialized audience
- Conclusions and future work: mostly for the more specialized audience, but should also be easily grasped by the generic AI/MAS/ML audience
Bonus tracks

• The paper is in English.
  • If you are not a native English speaker, do not assume you are.
  • You are not an expert science author, either.
  • So: Read - not just your (group’s/advisor’s) work – and not just scientific papers. Revise.

• Do not give in to temptations:
  • Your paper is not a blog
    • Do not write as if it is…
    • Do not copy blogs style – or material
  • Do not copy - period
    • Not even your own material
    • Plagiarism!

• Yes, your paper can be rejected. What do you do then?
  • The evil third reviewer. How to deal with them (him/her)?
  • Note about the agents’ gender – and gender neutrality in general
Suggested Readings

Intentionally left blank