

# Writing Your First Paper: From Code to Research

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## ABSTRACT

'Publish or perish,' once a term used to refer to the pressure placed on professors to publish their research has since expanded to apply to students and professionals in industry. There are numerous benefits to doing research and publishing the results, including personal satisfaction, career advancement, and prestige. In this session we will discuss how to begin doing research and write a first paper.

## AUDIENCE

This talk is geared towards undergraduate and early graduate students who want to start doing research; early career professionals in industry who are interested in increasing the impact that their work has in the research community will also benefit from attending this session.

## INTRODUCTION

I will introduce the topic by discussing some of my motivations for wanting to publish and asking the participants why they are interested in doing research and publishing that research. This will help me tailor the rest of the discussion to best meet the participants' needs.

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My main reasons for publishing are that it provides a mechanism for networking with a community of researchers with similar interests to my own and that presenting my work to that network allows me to get valuable feedback about ways that I can improve my research. The prestige associated with publishing has also proven to have a positive impact on my career progression.

## GETTING INVOLVED

A first and crucial step to writing a research paper is to start doing research. The transition from solving problems that have answers in the back of the book to solving problems for which no one knows the answer can be daunting for someone who is just starting out, but it doesn't have to be so intimidating.

One of the great benefits of publishing your research is that it enables you to expand your professional network, but having a small network in place already can make getting started a lot easier. Students can often take advantage of existing research networks at their universities. This can be as simple as approaching a professor who works in a field that interests you and asking them if you can help with their research; it is often even possible to get funded as a research assistant or to receive course credit as an independent study for the work done. Many schools, particularly those

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with a large graduate student population, have themed research groups for students who are working as research assistants. Attending meetings of a research group, even if you aren't formally a member, can be a great way to connect with other students and faculty members who are doing research in an area which interests you. If you want to do research, but aren't sure what area is most interesting to you, attending meetings of multiple research groups can allow you to get a better idea of what doing research in different areas entails and help you to decide which area would be best for you.

There are plenty of options for getting started with research even if your school doesn't have a formal research program in an area of interest to you. If you are a US citizen or permanent resident of the US, then you can spend a summer participating in a research experience for undergraduates (REU). This will provide you the opportunity to work on a research problem under the guidance of a professor in that field [1]. Additionally, many companies offer internships where you can get to do research.

## DOING RESEARCH

A research paper constitutes a novel contribution to the field, something no one else has studied before. Before you can do something that no one else has done and write about your results, it is important to know what has already been studied in your field. While it likely isn't feasible to read all of the papers in your field, reading a survey paper can help you learn what the key results are and understand how they are connected and why they are important.

Once you understand what others have done, you need to decide what *you* are going to do. Perhaps reading through previous work gave you an idea for an experiment that you would like to try: go try it. Reading the future work sections of papers in your field can help you learn what other researchers thought were interesting research problems and you can try to solve one of those. Once you have picked the research question that you want to answer, identify what results you will need to have in order to answer that question. What experiments will you need to run in order to get those results?

The key components to a successful experiment are data, an algorithm, a baseline result or gold standard annotations of your data, and a metric. For most research papers, the algorithm will be the key contribution; this is the idea that you had that no one else has studied yet. Data allows you to have something to run your algorithm on, a metric allows you to measure the performance of your algorithm and a gold standard is often necessary for computing the metric (but not necessary for all metrics), and a baseline result will allow you to know how well your algorithm performs comparatively. Often the baseline result can be someone else's algorithm to solve the same problem that you are trying to solve. Many fields have established data sets, gold standard annotations, and metrics that allow researchers to easily compare their results to each other. If you field is new and doesn't have these yet, you can create them and write a research paper about that.

## WRITING THE PAPER

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The anatomy of a research paper consists of background, motivation, methodology, experimental results, conclusion, and future work sections. Your paper should include a brief description of related work by other researchers, a description of why this problem is important, detailed information on what you did that would allow another researcher to reproduce your work, the results of your experiments, analysis of what those results mean in relation to your research problem, and a discussion of ideas that you could try in the future that might produce even better results.

## GETTING ACCEPTED

Once you have your research paper, you need to decide where to submit it. The key to getting a paper accepted is to submit it to a venue that is a good match. Look for a venue whose call for papers includes a topic that closely matches your research. Publishing your paper in a large, well-known conference or journal typically comes with more prestige and can help more researchers find out about your paper, but it is also more difficult to get accepted into this type of venue; many of them will only accept around 20% of the papers which are submitted. You can also submit your paper to a smaller workshop. These will usually be more focused on a narrow domain, which will give you the opportunity to connect with researchers who are interested in the same area as you. If your paper isn't accepted to the first venue that you submit it to, read the reviewers' comment and suggestions and try to improve your work; then you can find a new venue and hopefully get accepted there.

## OUTCOMES

Attendees should walk away from this talk with an increased understanding of how to better manage their time in order to make writing research papers that correspond to their code easier and faster. They should also understand some of the benefits of publishing their work in computer science and related disciplines.

## PARTICIPATION STATEMENT

I will attend the conference if accepted.

## BIO

Kara Greenfield began her research career by working as a research assistant in the database systems research group at Worcester Polytechnic Institute (WPI). While at WPI, Kara also participated in the human robotics interaction research group and completed research projects in graph theory and natural language processing. After receiving her MS in Industrial Mathematics from WPI, Kara began working in the Human Language Technology group at MIT Lincoln Laboratory. As a researcher at MIT Lincoln Laboratory, Kara has worked in areas such as social network analysis, speaker identification, natural language processing, and threat finance.

## BIBLIOGRAPHY

- [1] National Science Foundation, "Research Experiences for Undergraduates (REU)," [Online]. Available:  
[http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=5517&org=NSF](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517&org=NSF). [Accessed 1 March 2016].