

The Australian National University
2600 ACT | Canberra | Australia



Australian
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University

School of Computing

College of Engineering, Computing
and Cybernetics (CECC)

Crop-yielding Prediction using Neural Network for Stochastic Differential Equation Parameters Estimation

— 12 pt research project (S2/S1 2024–2025)

A report submitted for the course
COMP8755, Individual Computing Project

By:
Vito Rihaldijiran

Supervisors:
Dr. Ayman Elgharabawy
Dr. Brian Parker

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Declaration:

I declare that this work:

- upholds the principles of academic integrity, as defined in the [University Academic Misconduct Rules](#);
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August, Vito Rihaldijiran

Acknowledgements

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Abstract

This study examines the challenge of precisely forecasting crop yields through the integration of neural networks and stochastic differential equations (SDEs). The primary goal is to construct a predictive framework capable of accurately determining the parameters of SDEs that govern the dynamics of crop yields, especially in the presence of environmental variability. Through the utilization of artificial neural networks (ANNs), the research endeavor seeks to simulate and forecast the erratic patterns observed in crop yields, such as those of wheat, across temporal scales. The efficiency of the proposed model is assessed using both Euler and Stratonovich methodologies, which are essential for elucidating the impact of noise on crop yield prognostications. This novel methodology not only improves the precision of forecasts but also offers valuable insights into the stochastic mechanisms influencing crop yields, thereby advancing the effectiveness of agricultural planning and resource allocation.

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Introduction

The introduction serves two purposes: (Not necessarily in this order.)

1. To give a high-level *introduction* into the research area and
2. to *motivate* your research done within it.

Point 1 is important because you should not assume any technical background in the specific subject matter of your work. Provide a high-level introduction, but avoid technical definitions unless they are used as an easy-to-understand example that doesn't require prior knowledge. The rule of thumb is that you can assume a very basic understanding of the respective (more general) research area, like computer science, engineering, mathematics, and so on – based on the audience for which the work is conducted. What such an accurate level of abstraction/presentation is might depend on the specific topic of your work. Also consult your supervisor(s) for their opinion(s) and preferences.

Point 2 should make clear why the investigated research question is worth being investigated – why is it relevant and important? This is the part where you should make the readers look forward reading your work! Make them interested and passionate!

Be specific about the precise contributions that your work actually does and list them in the text (preferably in a separate paragraph; depending on the number of contributions and how well they can be separated you could also provide them in a bullet point list).

An introduction is usually between 1 and 3 pages. You can also get some inspiration from papers published at top-tier conferences, although they are of course *much* shorter due to space constraints.

Some people prefer ending the introduction with a paragraph that gives an overview of the following chapters. However, this is more usual for scientific papers (published at conferences or in journals) but not in project/thesis reports since they have a table of contents anyway. You are still free to add one if you prefer.

Background

This section should explain all the technical background that is important for being able to read your report. Recall that your report must be completely self-contained, so you should only assume “mathematical understanding”, but no specific knowledge. All such knowledge should be provided here, e.g., the formalization and vocabulary of the research areas in which your work resides.

Note that this is not the same as reviewing related work. Related work puts the work done/described in your report into context of other (mostly recent) work that’s done by others. In contrast the current chapter is not so much about what work others have done, and more about the formalization (and possibly standard techniques) that you require to describe your contributions (but since you probably didn’t come up with these formalizations, you of course still need to cite the respective authors).

Please make use of sections and subsections as it’s reasonable to better structure this (or any) chapter.

Related Work

This chapter reviews the work that is most related to the research questions investigated by you in this work. Please note that there are various options on *where* you include it.

- You could include it *here* (i.e., where you see it right now in the template). Since it's after the formal definitions (Chapter 2), you can explain what the other works have done on some level of detail, yet you need to keep in mind that you did not yet explain your own contributions (except abstractly in the abstract), which slightly limits the level of technical detail on which you can compare these approaches here.
- You could also make it a subsection of Chapter 2. This choice might also depend on the length of this chapter. Is it worth its own full chapter?
- Alternatively, you might include this chapter after the main part of your report, i.e., right before Chapter ???. When you do this, you can go into more technical detail since the readers will have read your entire work, so they know exactly what you've done and you can therefore discuss differences (like pros/cons etc.) in more detail.
- When you take a look at scientific papers (preferably at top-tier venues), you might notice that not every single paper has a related work section. This is because in principle related works might also be addressed/positioned in the introduction or in the main part of the work. But since this is not a “standardized scientific publication”, it is very strongly advised that you devote its own section to related work as done in this template.

If you prefer any of the latter two options, discuss this with your supervisor(s).

Method Used

Bibliography
