# Teaching Statement

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My goal in teaching is to ensure the students understand the foundations of the discipline to become independent learners. This is of particular importance in CS as a field in constant expansion. I want my students to have a strong knowledge on the core concepts and get in contact with the current advances in the field. I have a vast experience in teaching undergraduate and graduate courses especially in algorithms and artificial intelligence. During my experience, I have tested and adapted my teaching methods to keep students motivated, ensure a minimum understanding of the topic, and find and equilibrium between theory and practice, when applicable. Throughout my career as a professor, I have mentored many students, both undergraduate and graduate, teaching the basics of research to undergraduate students using simpler research problems, and paving the path to a solid thesis with Ph.d. students.

## Teaching Philosophy

When preparing the materials for a course, I keep these 3 questions in mind:

1. What is the main motivation for learning this topic?
2. What are the minimum requirements needed to have a good understanding of the basics and advanced topics for this course?
3. How can I provide the necessary means to achieve excellence and equal learning opportunities to every student in the class?

**Starting with the basics:** at the start of a course, especially for advanced topics, I start with a two days summary of the very basic to assess whether every student is at the same level. In some courses I also apply an initial test to help assessing the current state of each student. Depending on the outcome of this initial assessment, I provide additional materials composed of books, tutorials, video lectures, to provide additional support to students without the necessary skills. Depending of time and resource (classrooms, labs, etc.) availability, I also offer extra sessions for these students in the form of reinforcement lectures. When teaching basic coursers such as introduction to programming, these initial assessments helped me to identify the background of the students, whether they had already contact with the topic or not and if there are some more advanced students enrolled into the course. With this understanding I can adapt the course to a more fast paced approach and taking the time to develop some interesting end of semester projects (e.g., developing a game, or a simple AI agent). If a few students are much more advanced in the topic, I can create extra assignments or customized lecture notes to keep the course interesting for them as well. When considering more advanced courses, such as *machine learning*, the initial weeks are crucial to review all the algebra and calculus background with a application orientation approach, showing them how the theoretical concepts relate to a practical use. This has proven to be essential for the correct understanding of the course even if the student already have a strong background. Additionally, this assessment serves as a guide for the students to understand the minimum requirements to attend the course, enabling them to prepare for the lectures beforehand.

**Motivating the topics/ problem based approach:** whenever possible, I try to add a motivating example at the beginning of a lecture and build the lecture around that example to help the students visualize and fixate the topic. This example is often in the form of an illustrative problem crafted especially to require the concepts learned in the current lecture. In some courses it is possible to use a recurrent example that involves each topic of the course. Having a motivating example often helps the students to understand the reasoning process behind the theory. One example of this approach, is the creation of an AI agent to play Super Mario World in Artificial Intelligence course. The course start with the implementation of a very basic rule based agent in which allows the student to think about how a human player would play this game and try to compact the reasoning in the form of simple rules. Next, we apply search algorithms (BFS, DFS, A*) to find the shortest sequence of button presses to beat a level. As the course continues and they get in contact with more advanced techniques, they have to create an intelligent agent that can beat at least two levels. The results for the 2021 class can be seen on YouTube (`https://www.youtube.com/watch?v=zOF8ZTvHne8`). Another example is for the Network Science course, in which I ask the students to form groups and go through the process of collecting data and analyzing a

real-world graph structure. The idea of going through all the process from data acquisition to final conclusions help to get them more involved with the topic to the point of proudly defending their findings in the form of a final presentation. Throughout the many offerings of this course, they have analyzed the interaction of different movies characters (notable example of a group trying to predict the next death in Game of Thrones with the interaction graph), optimization of transport network, mapping of predator-prey relationship of local species. **Creating a constantly supporting environment:** while the previous items already helps to create a supporting environment for the students, it is always important to acknowledge the progress of the students and respect the pace in which each individual student learn the core concepts. Providing constant feedback and being open to help them creates a safe net that they can rely is an important step to monitor the progress and make adjustments to the lectures to accommodate for any challenge. On the other hand, the course may become too easy for some of the more knowledgeable students which require additional challenges. Whenever possible, I create an *advanced track* with extra contents for such students.

## Teaching Interests

I am comfortable to teach many different disciplines, especially those related to algorithms, data structures, and machine learning. My main interests are in teaching **functional programming**, **machine learning**, and **classical artificial intelligence**. Specifically about functional programming, I have developed, together with a colleague, an extensive course (`https://haskell.pesquisa.ufabc.edu.br/`) involving introductory and advanced material about functional programming in Haskell with many examples of applications, type-driven development, functional data structures, and a revisitation of the classic category theory for programmers based on the material by Bartosz Milewski (`https://bartoszmilewski.com/2014/10/28/category-theory-for-programmers-the-preface/`). This page also highlights some example of student's final projects developed during the course. I am also very eager to implement a graduate level course on Symbolic Regression with the objective of reaching not only the CS audience, but also a broader audience of other sciences teaching how to make use of such approach to help on scientific discovery. Some of the courses that I have taught along my career are: Symbolic Regression, Introduction to Programming, Type Driven Development, Functional Programming, Artificial Intelligence, Network Science, Bio-Inspired Computing, Explainable AI, Category Theory for Programmers, Machine Learning with Big Data, Data Structures, Machine Learning, Structured Programming, Formal Languages and Automata, Information Theory.

## Mentoring

I have mentored many undergraduate and graduate students throughout my career. Regarding the undergrad students, I have participated in the "Scientific Initiation" and "Research from the Very Beginning" programs. In the former program, we have to mentor third and fourth year undergraduate students with basic research projects. In the latter we should mentor freshmen students involving them in data collection or simple analysis of current research projects. Besides these two programs, I often mentor final year students for their final projects. One outstanding example was a student that worked with me in two Scientific Initiation projects, his final project, and enrolled in the graduate program, defending his thesis in 2024. In numbers, I have mentored 15 undergraduate students so far, and I am currently advising 3 more. Regarding the graduate program, I have acted as the advisor of 5 master dissertations, 2 Ph.d. thesis, and supervised 1 post-doc. I am currently advising 1 master degree student and 3 Ph.d. students, planned to defend by the end of 2025.

## Leadership

I am one of the founders and current head of the Heuristics, Analysis and Learning Laboratory (HAL) at Federal University of ABC. The main principle of this laboratory is to create a collaboration space between undergraduate, graduate students, professors, and visitors. This laboratory is composed of two independent spaces, one equipped with Desktop PCs to support the students and another one used for general meetings and get together, equipped with coffee equipments. In this second room, we often offer fraternization parties, where we talk about our current projects and discuss ideas. From 2023 until 2026, I was the coordinator of the graduate program in CS with the role to manage the students and professors activities, create plans to improve the overall quality, stimulate the production of high-impact research, and advertising the program to the external community. I often participate on the welcoming festival at the university that brings high-school students to know the university and its corresponding courses. I am responsible in describing the course and giving a tour at the facilities, together with other colleagues.