Lecture VI - Computational Kindness

Programming with Python

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Computational Kindness

Computational Kindness

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Question: An idea what that is?

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- Idea of introducing empathy in algorithms
- Consider human cognitive load and limitations
- Making choices that reduce mental burden for others
- Creating systems that are easy to understand and interact

Scheduling Meetings

- Propose specific times!
- Don't ask "when are you free?"
- Reduces cognitive load for others
- Transforms an open-ended problem

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! Important

Now a simple yes/no decision!

Communication

- Be explicit rather than implicit
- Provide clear options instead
- Avoid open-ended questions
- State your preferences

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Avoid deferring → "I'm fine with whatever"!

The Cost of Flexibility

- "I'm free whenever" seems helpful
- Being too flexible can be unhelpful
- But it is not!
  - Forces others to consider all possibilities
  - Increases cognitive load
  - Makes decision-making more complex

Principles

1. Reduce Options: Fewer choices lead to better decisions
2. Be Explicit: Clear constraints help others decide
3. Consider Cognitive Load: Design interactions minimizing mental effort for others
4. Make Decisions: Taking responsibility can be kind

Key Concepts

Topics from the Lecture

- Optimal Stopping: How to decide when to stop looking for better options.
- Explore/Exploit Tradeoff: Balancing between trying new things and sticking with known options.
- Caching: Storing and reusing information by sticking to a task to improve performance.
- Scheduling: Efficiently managing tasks and time.
- Randomness: Understanding and working with uncertainty.

How to continue?

How to continue learning?

- We have covered a lot of topics
- But there are many more to explore!

Bayes' Rule

- Fundamental theorem in probability theory
- Updates probability of hypothesis based on new evidence
- Used in statistics, machine learning, and decision-making

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> Helps make informed predictions and decisions under uncertainty in the real world!

Overfitting

- Occurs when a model learns the training data too well
- Captures noise and outliers rather than pattern

- Results in poor generalization to new data

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! Important

Several ways to counter overfitting, e.g. cross-validation.

Game Theory

- Strategic interactions among rational decision-makers
- Analyzes situations with multiple agents and their strategies

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Many applications in economics, politics, and biology!

Networking

- Study of information exchange over networks
- Includes understanding protocols and data transmission
- Optimizes network resources

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Important in computer networks, the internet and social life!

Relaxation

- Simplifies complex problems to make them more tractable
- Involves relaxing certain constraints
- Provides insights or approximate solutions

Continue programming?

- The best way to continue learning is to keep programming in the future
- Potentially, you will continue to do so during your studies
- Coding in your Thesis is a another great way to improve
- Try to find a way to apply programming in your work
- There are many interesting topics to explore!

Advent of Code

- Advent of Code is a fun way to keep programming
- Here you can solve programming puzzles during Advent
- It is completely free and ad-free and starts each year at 01.12.

That's it for the Lecture Series!

- We now have covered the basics of Python
- I hope you enjoyed the lecture and found it helpful
- If you have questions or feedback, please let me know!
- I wish you all the best for your studies and your career!

Q&A

Literature

Interesting literature to start

- Christian, B., & Griffiths, T. (2016). Algorithms to live by: the computer science of human decisions. First international edition. New York, Henry Holt and Company.[1]

Books on Programming

- Downey, A. B. (2024). Think Python: How to think like a computer scientist (Third edition). O'Reilly. Here
- Elter, S. (2021). Schrödinger programmiert Python: Das etwas andere Fachbuch (1. Auflage). Rheinwerk Verlag.

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i Note

Think Python is a great book to start with. It's available online for free. Schrödinger Programmiert Python is a great alternative for German students, as it is a very playful introduction to programming with lots of examples.

More Literature

For more interesting literature, take a look at the literature list of this course.

[1] The main inspiration for this lecture. Nils and I have read it and discussed it in depth, always wanting to translate it into a course.