University of
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CO3519
Artificial Intelligence

Tutorial 2.3 discussion
Review of parts 1 to 3
End-of-year reflection

Where opportunity creates success

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Tutorial 2.3 discussion

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14th December 2021

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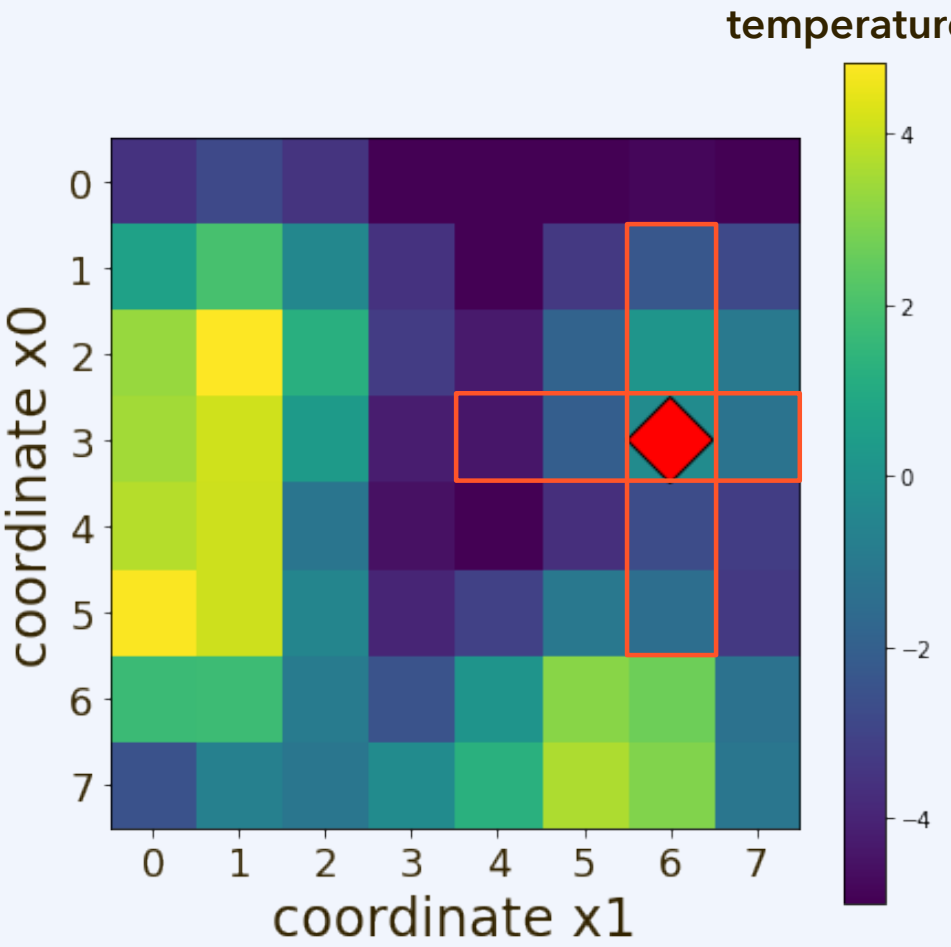
Agent escaping extreme temperatures



See **agent-function-evaluation** Jupyter Notebook.

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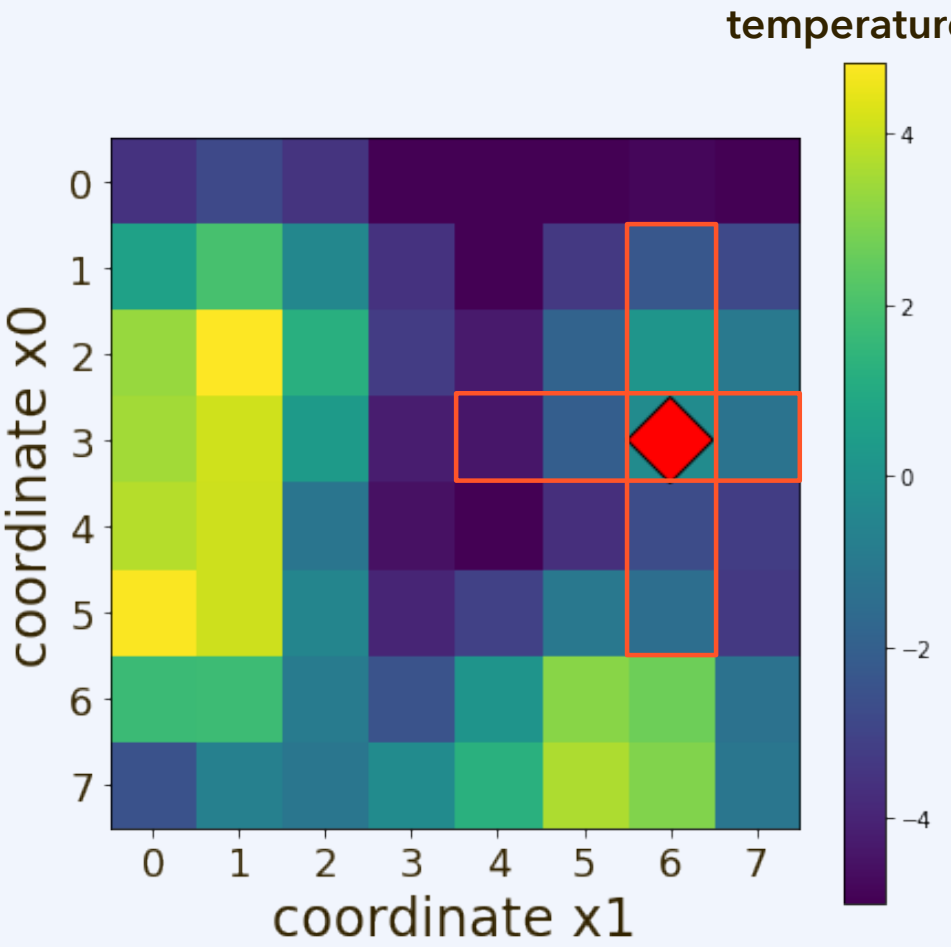

Good and comparably simple agent function:

- Check which of the immediately adjacent fields have | *T* | closest to zero.
- Go in that direction, or stay put if they all have a greater | *T* | than the present location.

Average life time: 134 steps.

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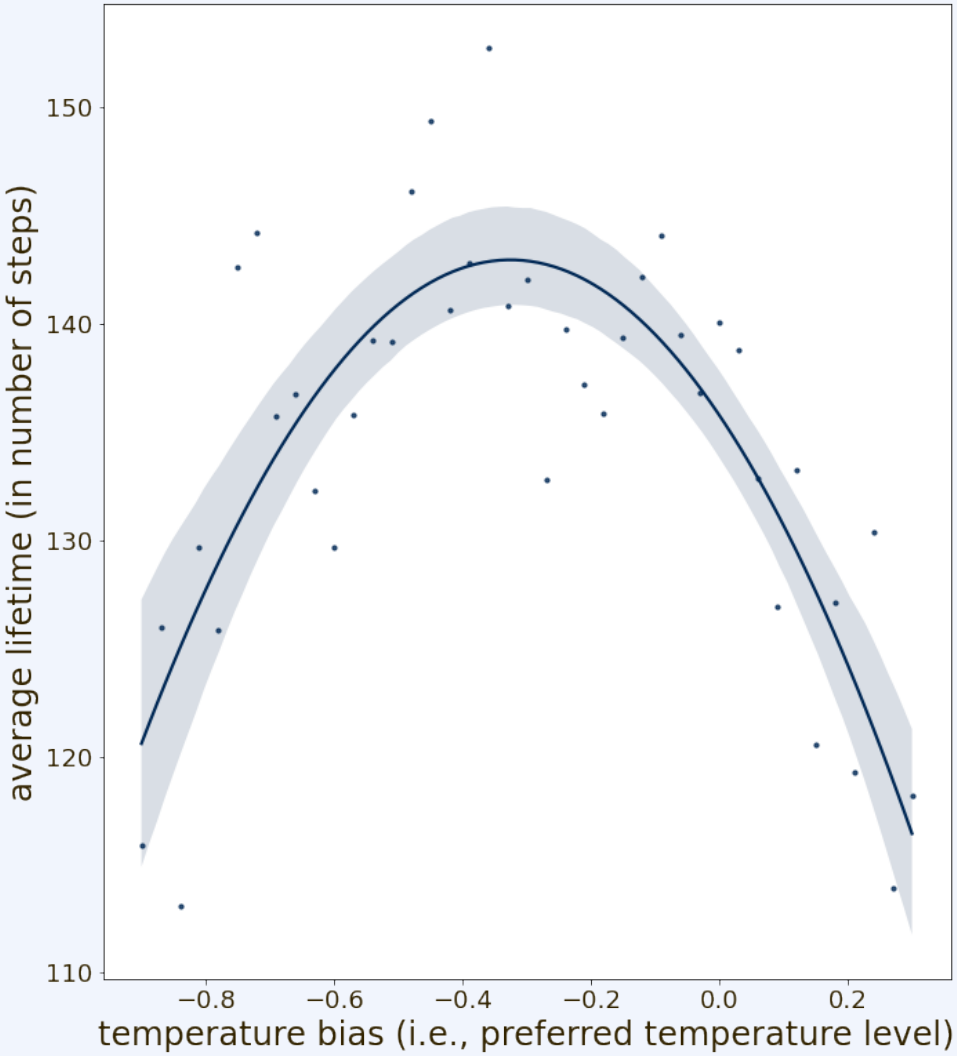

Agent function optimization, with one free parameter, yields:

- Check which of the immediately adjacent fields have $|T + \frac{1}{3}|$ closest to zero.
- Go in that direction, or stay put if they all have a greater $|T + \frac{1}{3}|$ than the present location.

Average life time: 146 steps.

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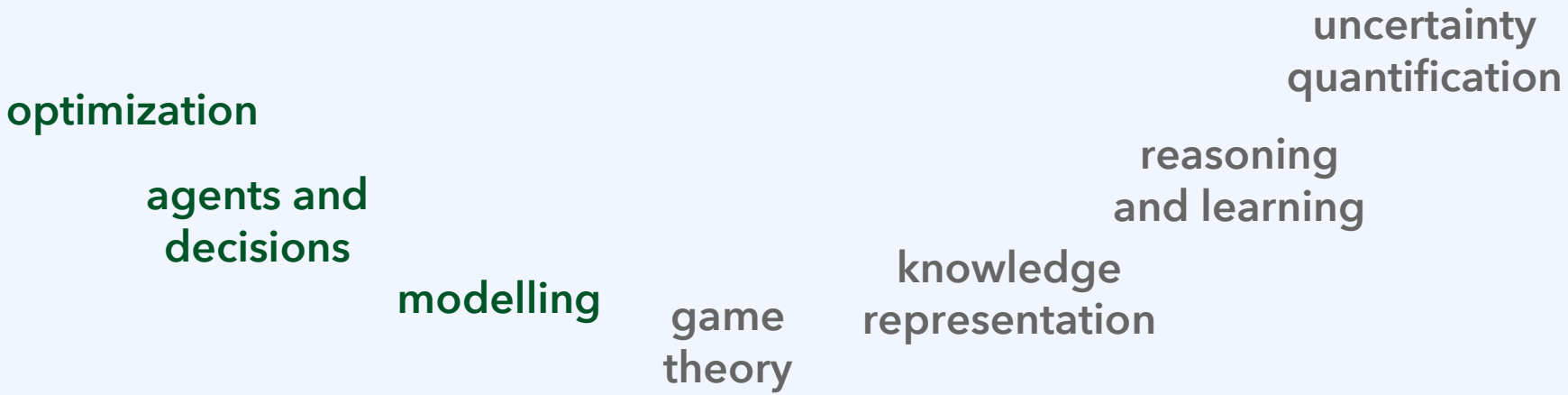
Module structure

Upon successful completion of this module, a student will be able to:

1) Explain the theoretical underpinnings of algorithms and techniques specific to artificial intelligence;
2) Critically evaluate the principles and algorithms of artificial intelligence;
3) Analyse and evaluate the theoretical foundations of artificial intelligence and computing;
4) Implement artificial intelligence algorithms.



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Part 1: Optimization

On the field of **optimization**, we have:

- Discussed single-parameter, single-objective problems as the base case in optimization; there, $y = f(x)$ is minimized or maximized;
- Looked at local and global optimization algorithms and the way in which local optimization is based on the functions' derivatives;
- Introduced multivariate and multicriteria optimization.

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hill climbing (local)

Newton's method (local)

global optimization

multivariate optimization

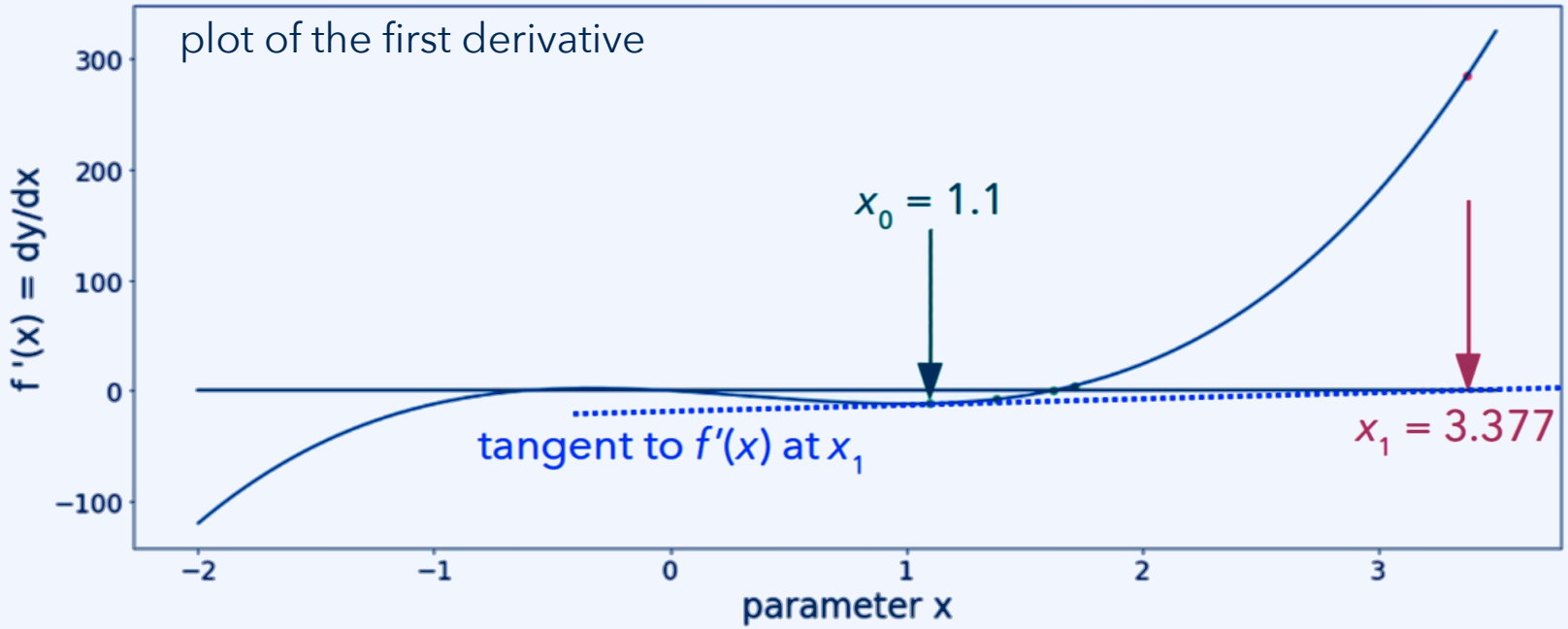
multicriteria optimization

Pareto front

Part 1: Optimization

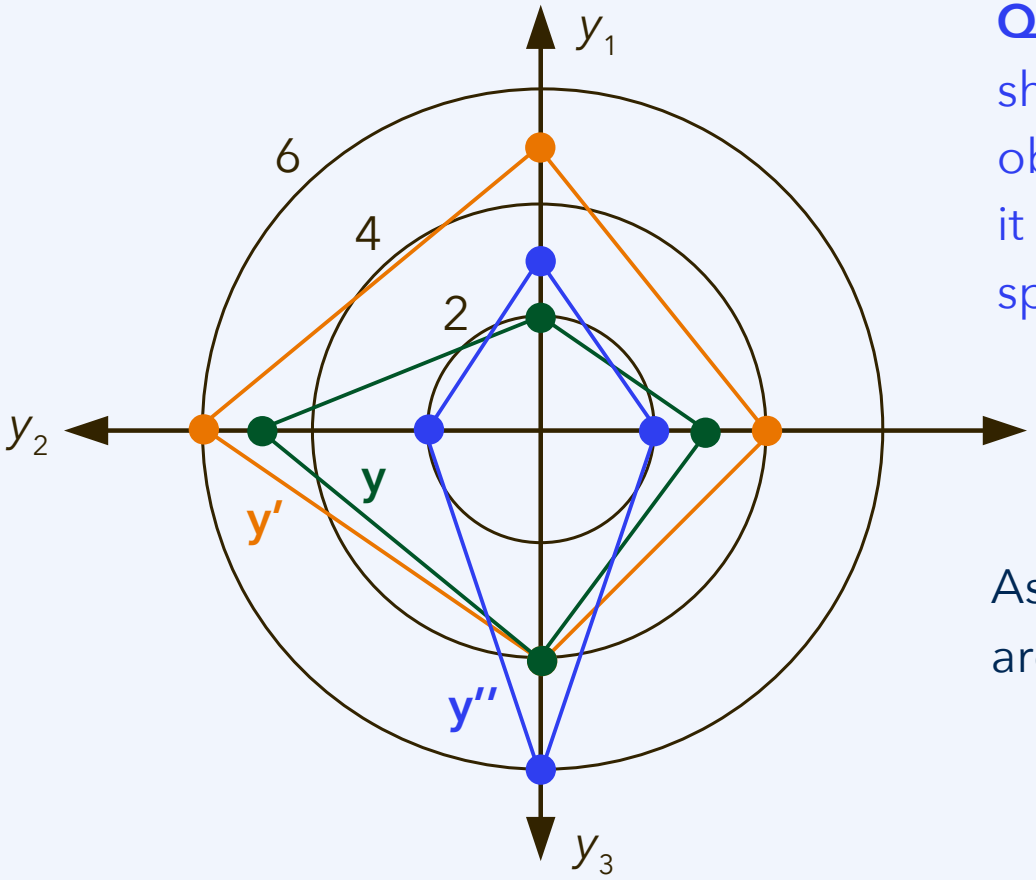
Revising the concepts

Question: What property does a function $y = f(x) = \ldots$ need to have so that, using **Newton's method**, we find the minimum **exactly** within **a single step**?



Part 1: Optimization

Revising the concepts



Question: In a **spider diagram** showing the values for multiple objectives, how can we recognize it when one point in objective space **dominates** another?

Assume that y_0, y_1, y_2, and y_3 are all minimization objectives.

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Part 2: Agents and decisions

On the field of **agents and decisions**, we have:

- Reviewed common definitions of agency and intelligent agents;
- Discussed the use of AI in assisting human decision making;
- Explored philosophical issues related to the field.

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important types of agents:

decision support

agent

agent function

Turing test

goal-oriented agent

intelligent agent

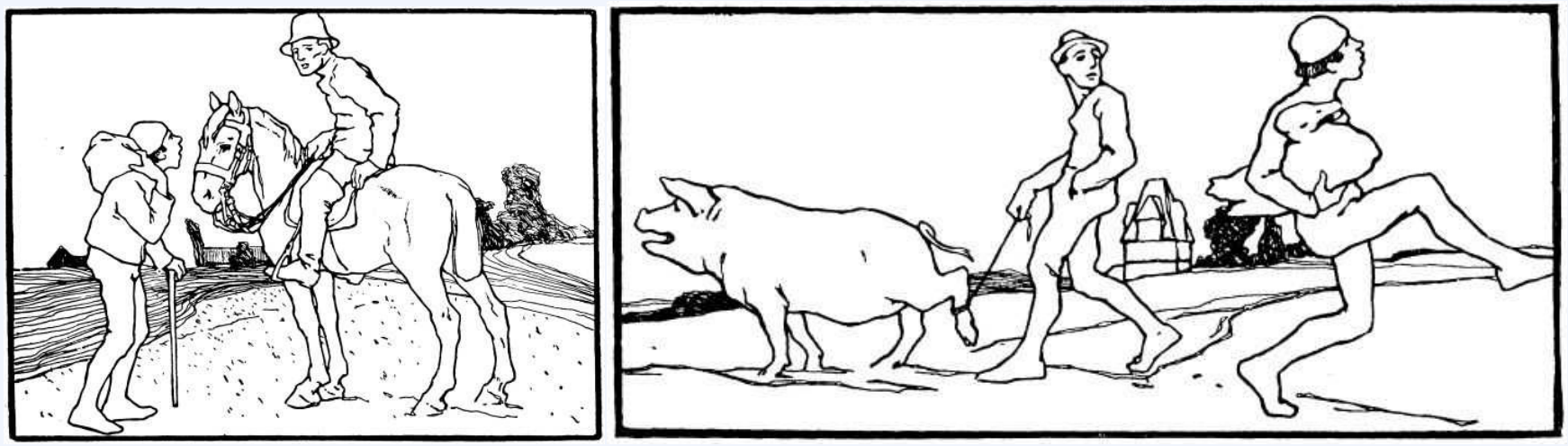
rational agent

knowledge-based agent

Part 2: Agents and decisions

Hans moves to the city to work, earn money, and make savings.
From his savings, he buys a horse.
He exchanges the horse against a cow, then a pig, a goose, and a grindstone.
But the grindstone is too heavy, so he throws it into a well.

Question: Why do we say that Hans is not a rational agent?



"Hans im Glück" (Hans in luck); artist: O. Ubbelohde (1909).

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Part 3: Modelling

On the field of **modelling**, we have:

- Discussed the use of models in optimization and decision support;
- Used optimization to parameterize models;
- Assessed model quality by validation and testing.

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supervised learning **training** **hypotheses**

linear regression **validation** **overfitting**

***p* value** **testing** **margin of error**

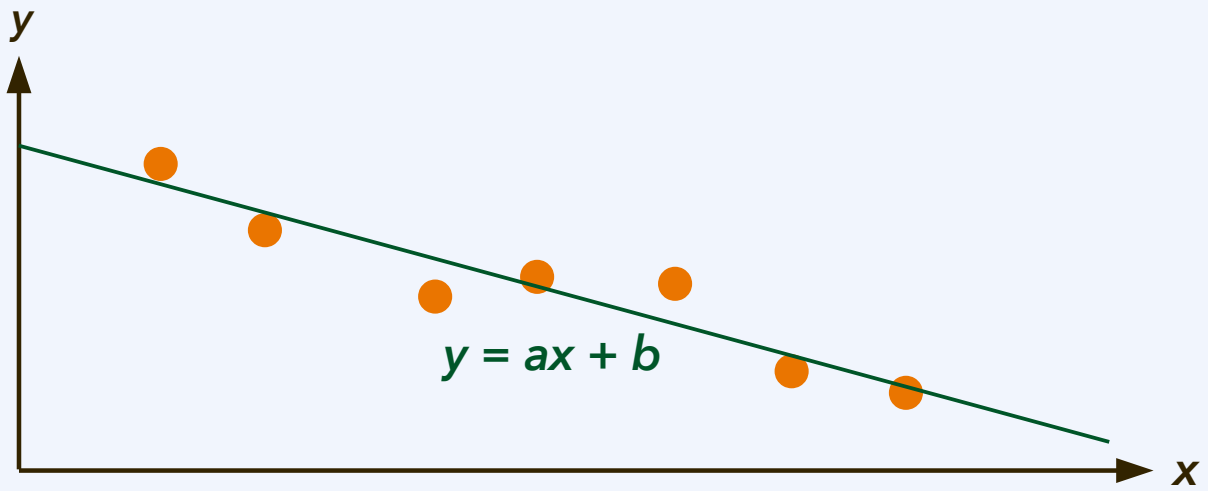
Part 3: Modelling

Revising the concepts

Model parameterization: Determine coefficients such as a, b, c in $ax^2 + bx + c$.

- Used optimization to parameterize models;

Question: How and where did we use **optimization** to parameterize models?



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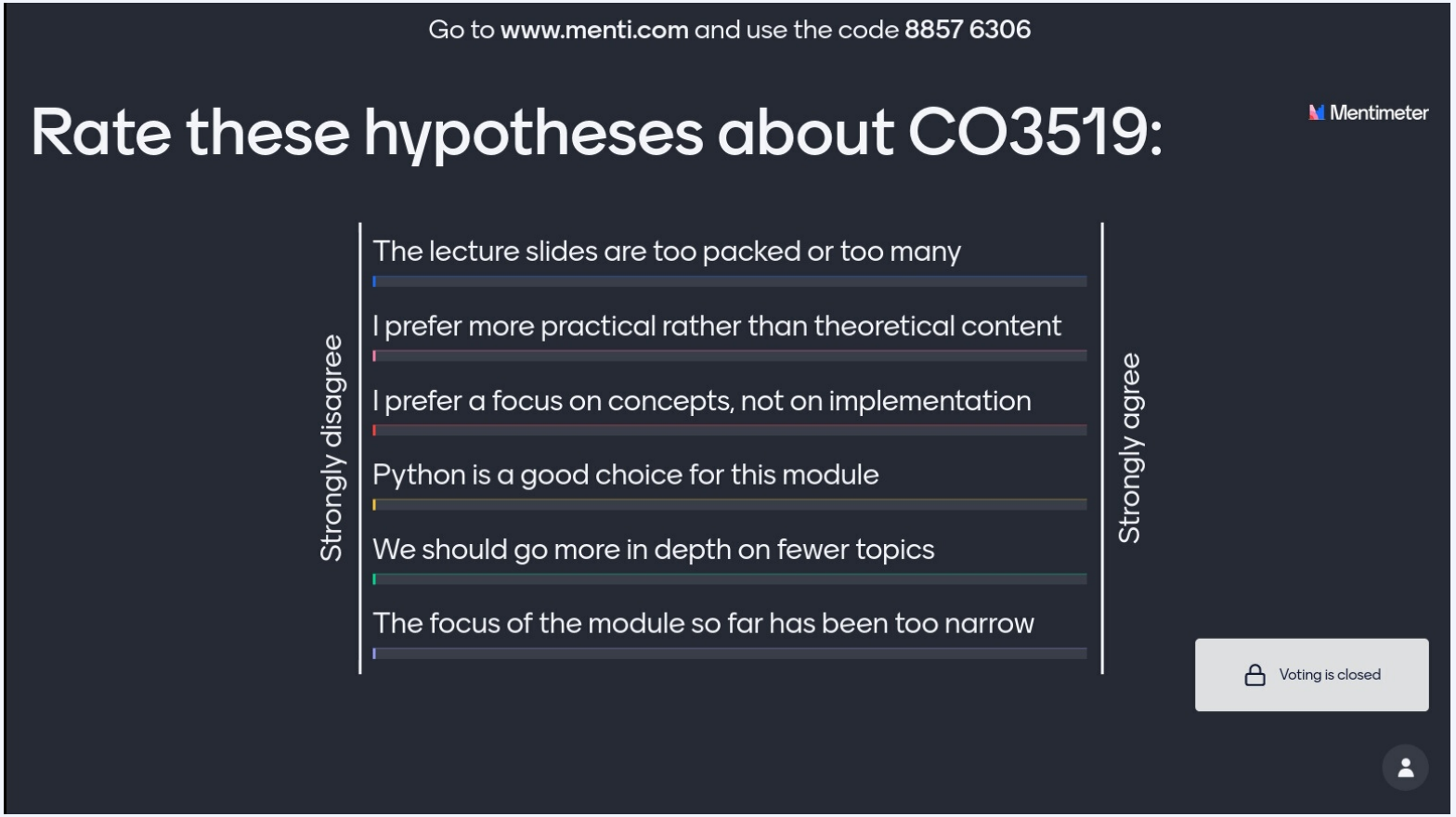
Help improve the module for the coming year



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