02465 Syllabus and practical information

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DTU Learn

If you are enrolled in the course you can access material and participate in the course through the DTU learn homepage

Lectures

The lectures will take place Fridays from 08:00-10:00. building B303A, auditorium 41. Video of lectures will be streamed and recorded (see DTU Learn).

Exercises

Exercises will take place after lectures Fridays from 10:00-12:00. Format may be subject to change as dictated by the coronavirus situation. If you cannot participate physically, you can participate in the exercises over Microsoft teams.

- **Building B303A, auditorium 41**: Chengyandan Shen: s192117@student.dtu.dk
- **Building B308/databar 009**: Kristoffer Marboe: s194249@student.dtu.dk

Reading material, lecture slides and exercises

The course will use lecture notes and other freely available material. Lecture notes, slides, course assignment instructions etc. is available on DTU learn.

Online help and QA

For online help and discussion you can use Piazza: http://piazza.com/dtu.dk/spring2022/02465/hom
For those who are concerned about privacy an equivalent service is available on the DTU Learn forum.

Teachers

Tue Herlau (TH): tuhe@dtu.dk

Lecture schedule

No	Date		Subject	Reading
			Dynamical programming	
1	4 February, 2022	TH	The finite-horizon decision problem	[Her21, Chapter 4] Introduction [Her21, Chapter 1-3] Introduction to programming as used in the course
2	11 February, 2022	TH	Dynamical Programming **(Fruit test project due)**	[Her21, Chapter 5-6.2] Formalization of the decision problem and the DP algorithm
3	18 February, 2022	TH	Forward DP and other reformulations	[Her21, Chapter 7] Forward-DP, [Her21, Chapter 6.3]
			Control	
4	25 February, 2022	TH	The continuous control problem and PID control **(Report part 1 due)**	[Her21, Chapter 10-12]
5	4 March, 2022	TH	Direct methods and control by optimization	[Her21, Chapter 13] (alternative resource: [Kel17])
6	11 March, 2022	TH	Linear-quadratic regulator and iLQR	[Her21, Chapter 14+15] Focus on basic iLQR. (alternative reference: [TET12])
7	18 March, 2022	TH	Adaptive control and MPC **(Report part 2 due)**	[Her21, Chapter 16]. The LMPC method (section 16.3) is only described at a high level and the specific details do not have to be understood in details. Those feeling brave can consult [RCB17, sections II, III and V, part A]. For linear regression see [HMS20].
			Reinforcement learning	
8	25 March, 2022	TH	Exploration and Bandits	[SB18, Chapter 1] This chapter is mainly thought to be background information [SB18, Chapter 2]
9	1 April, 2022	TH	Policy and value iteration	[SB18, Chapter 3] Decide for yourself if the examples are of help, otherwise they can be skipped [SB18, Chapter 4]
10	8 April, 2022	TH	Monte-carlo methods and TD learning	[SB18, Chapter 5-5.4+5.10] [SB18, Chapter 6-6.3]
			Holiday	
11	22 April, 2022	TH	Model-Free Control with tabular and linear methods **(Report part 3 due)**	[SB18, Chapter 6.4-6.5] I recommend all of chapter 6 as background material [SB18, Chapter 7-7.2] [SB18, Chapter 9-9.4] [SB18, Chapter 10.1]
12	29 April, 2022	TH	Eligibility traces and value-function approximations	[SB18, Chapter 10.2] [SB18, Chapter 12-12.8] Note the chapter does not provide tabular sarsa(lambda) explicitly. A reference is given in the exercises which I strongly recommend reading
13	6 May, 2022	TH	Q-learning and deep-Q learning	[SB18, Chapter 6.6-6.9] [SB18, Chapter 8.1-8.4] [SB18, Chapter 16-16.2, 16.5+16.6]

References

[Her21] Tue Herlau. Sequential decision making. (See **02465_Notes.pdf**), 2021.

[HMS20] Tue Herlau, Morten Mørup, and Mikkel N. Schmidt. *Introduction to Machine Learning and Data Mining*. 02450 Lecture notes, 2020. (See **02450Book.pdf**).

[Kel17] Matthew Kelly. An introduction to trajectory optimization: How to do your own direct collocation. *SIAM Review*, 59(4):849–904, 2017. (See **kelly2017.pdf**).

[RCB17] Ugo Rosolia, Ashwin Carvalho, and Francesco Borrelli. Autonomous racing using learning model predictive control. In *2017 American Control Conference (ACC)*, pages 5115–5120. IEEE, 2017. (See **rosolia2017.pdf**).

[SB18] Richard S. Sutton and Andrew G. Barto. *Reinforcement Learning: An Introduction*. The MIT Press, second edition, 2018. (See **sutton2018.pdf**).

[TET12] Yuval Tassa, Tom Erez, and Emanuel Todorov. Synthesis and stabilization of complex behaviors through online trajectory optimization. In *2012 IEEE/RSJ*

International Conference on Intelligent Robots and Systems, pages 4906–4913. IEEE, 2012. (See **tassa2012.pdf**).