Artificial Intelligence

Algorithms and Applications with Python

Exam Preparation

TECHNISCHE UNIVERSITÄT DARMSTADT

WIRTSCHAFTS INFORMATIK

AIAA 1 + 2

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</> course material: ↗ https://github.com/dominikjung42 | syllabus: ↗ www.is.tu-darmstadt.de

Image source: ↗ Pixabay (2019) / ↗ CC0

Agenda

5.1 Exam Organisation and Preparation

5.2 Questions and Restrictions

5.3 Course Evaluation and Discussion

What is Artificial Intelligence As Domain About?

Example:
Drive with your Porsche to work

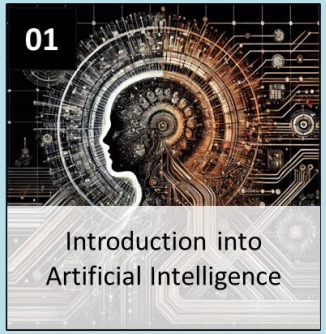
Human Intelligence	AI Research Domains
Plan your route	Automated Planning and Searching
Know traffic rules	Knowledge Reasoning and Representation
See the road	Computer Vision
Learn to drive	Machine Learning
Make situational decisions	Probabilistic Reasoning
Control/**move** the car	Agents / Robotics
Talk to the driver	Natural Language Processing
...	...

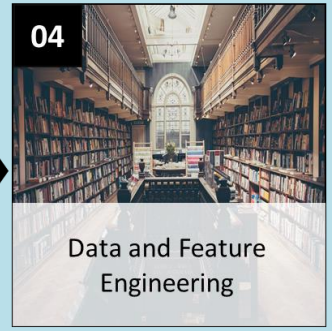
? What forms of intelligence you need to solve this task?

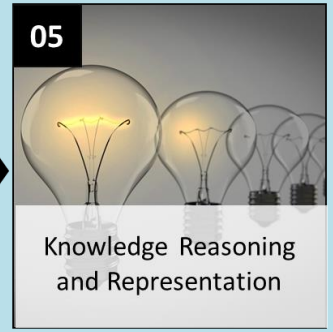
Develop machines that behave as if they had intelligence.
- John McCarty (1955)

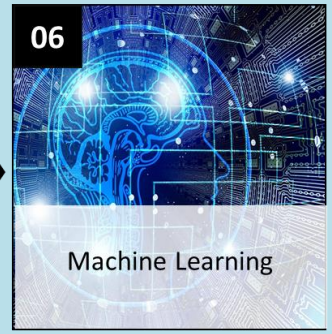
AI is the study of how to make computers do things, at which, at the moment, people are better.
- Elaine Rich (1991)

Course Overview





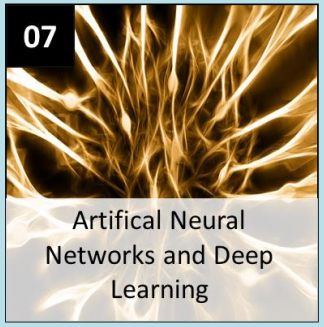


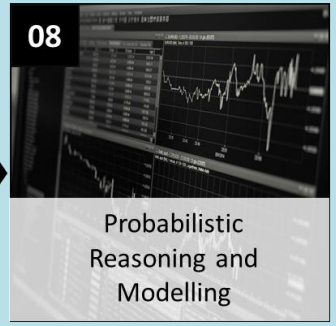


Workbook Exercises

Code Lectorial
Python

Workbook & Coding Exercises



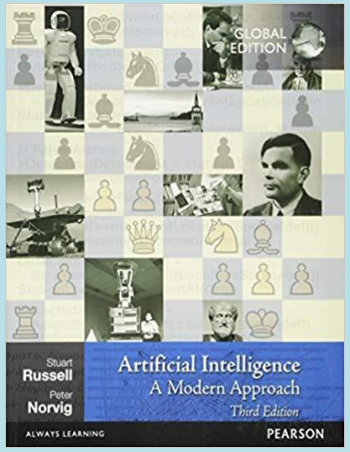


Further units:

- Live Coding Sessions
- Consultation Hours
- Capstone

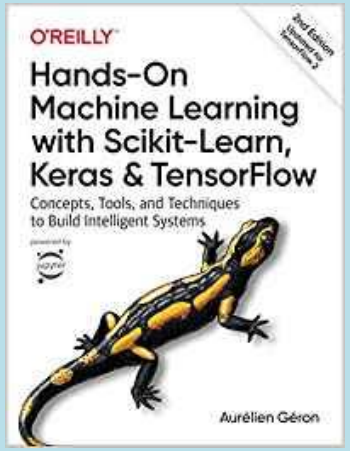
Workbook & Coding Exercises

Literature Recommendations



Rusell, S. & Norvig, P. - *Artificial Intelligence: A Modern Approach.*

- Availability: ↗University Library Darmstadt | ↗Amazon

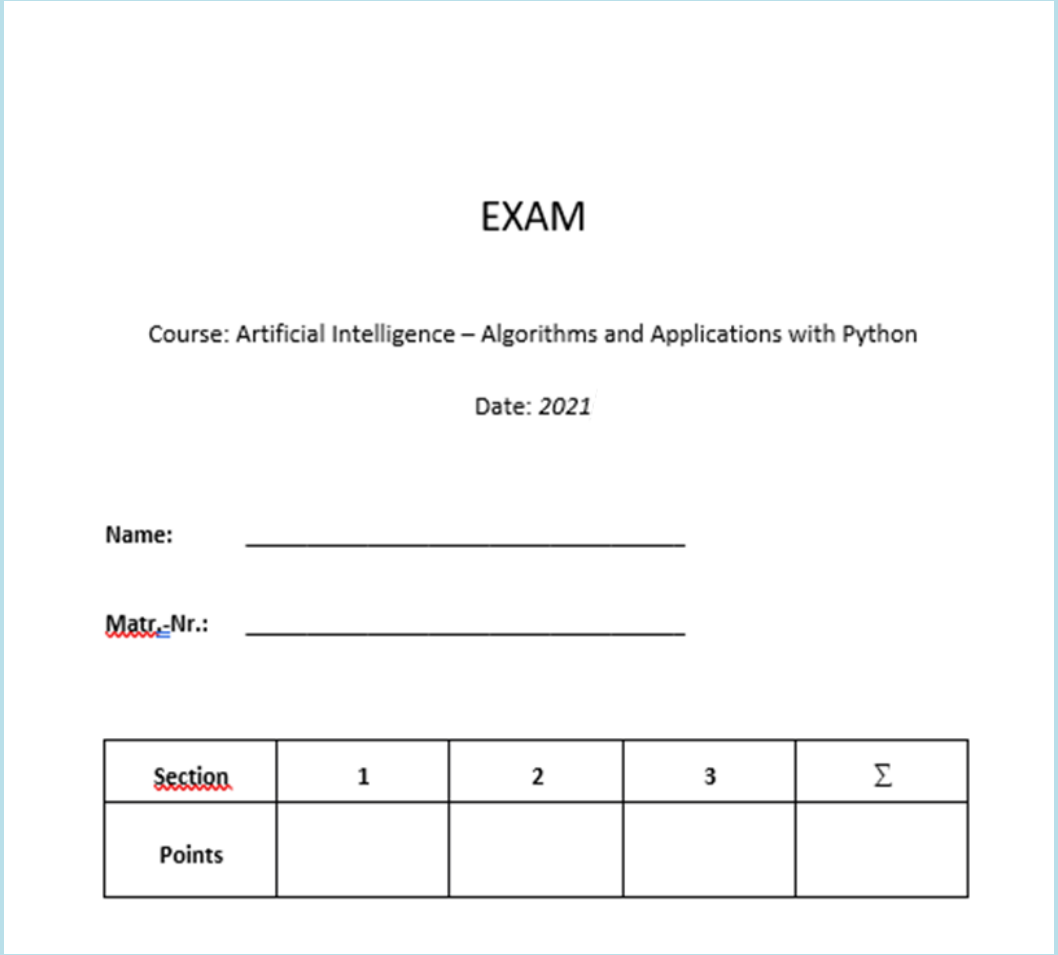


Géron, A. - *Hands-on machine learning with Scikit-Learn and TensorFlow: Concepts, tools, and techniques to build intelligent systems.*

- Availability: ↗University Library Darmstadt | ↗Amazon

TU Darmstadt Semester Reserve: The reserve is located on the 2nd floor at the GeSoWiss department. One can find the note “2nd floor / Course reserve BWL / Jung/Sturm/Buxmann - Artificial Intelligence” on the ULB website for the two books.

Previous Exams are Online Available



EXAM

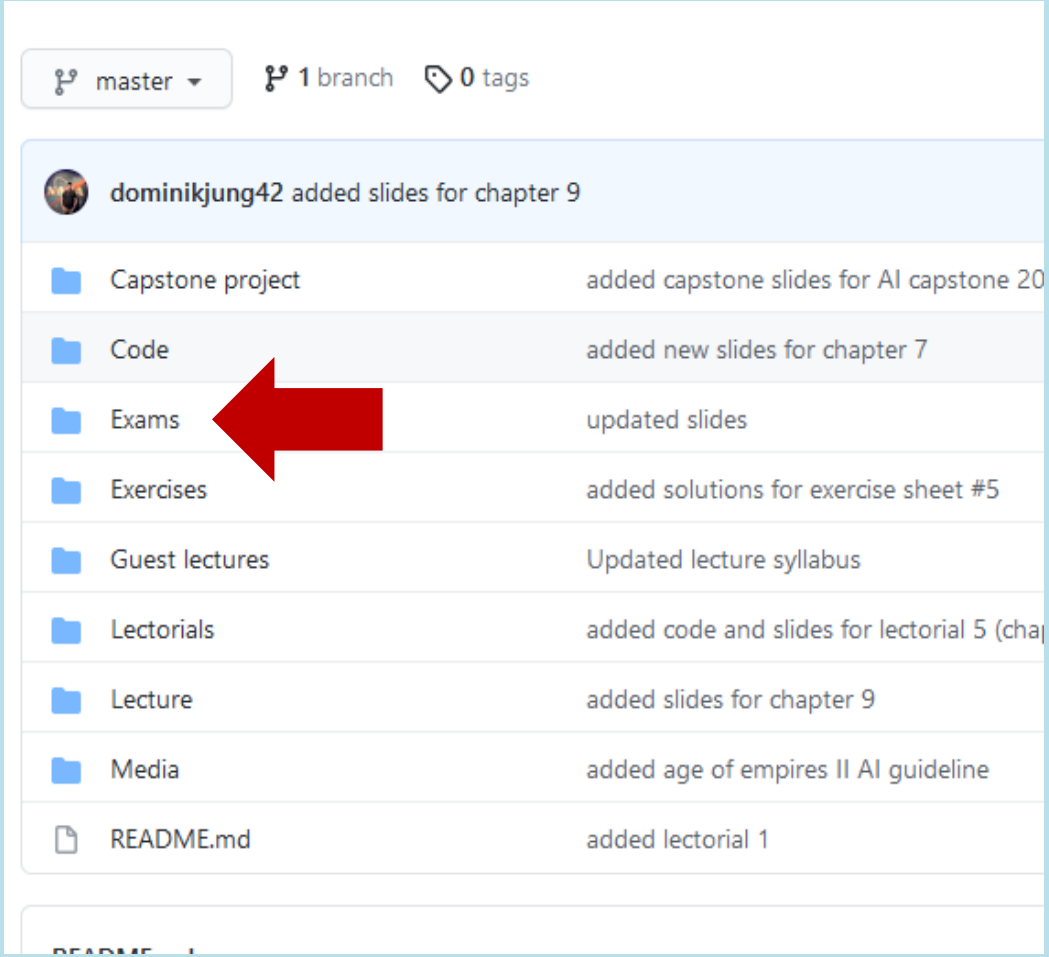
Course: Artificial Intelligence – Algorithms and Applications with Python

Date: *2021*

Name: _____

Matr.-Nr.: _____

Section	1	2	3	Σ
Points				



Closed Book and Closed Notes Exam (preliminary!)

33 %

BASIC CONCEPTS AND THEORETICAL BACKGROUND

- You will have to answer multiple questions related to basic concepts of the lecture or give basic definitions or formulas.
- Aka “knowledge questions”.

33 %

APPLYING THEORY TO PRACTICE

- You will have to show that you understand the algorithms and concepts and that you can use them to solve a (business/real-life) problem.
- For this kind of task you might need your calculator or geometrical triangle, pen and eraser.

34 %

PROGRAMMING

- You will have to write, read and understand code examples in the context of artificial intelligence problems (search, machine learning, etc.).
- Use the exercises, lectorials and the code examples to prepare!

Note: It may be possible that the point distribution differs in the final exam

Example: Basic Concepts and Theoretical Background

1 Basic Concepts and Theoretical Background

1.1 Many people have tried to define the concept "artificial intelligence". The most popular one is from McCarthy. Please give his definition of *Artificial Intelligence* we have discussed in lecture. (1 P)

1.2 What is the potential problem of his definition? (1 P)

Exam ST 2020

Example: Application of Theoretical Concepts

2 Application of Genetic Algorithm and Optimization

Consider the following **AI problem**:

A genetic algorithm uses ***chromosomes*** in the form $c = G_1G_2G_3G_4G_5G_6G_7G_8$.

The chromosomes are of a ***fixed length*** of eight genes G_i.

Each gene can be any digit between 0 and 9.

The fitness of an individual x is calculated by the following ***fitness function***:

$$fitness = (G_1 + G_2) - (G_3 + G_4) + (G_5 + G_6) - (G_7 + G_8)$$

The ***initial population*** consists of four individuals with the following chromosomes:

$$c_1 = 56415333;\ c_2 = 78176601;\ c_3 = 32291258;\ c_4 = 14854321$$

2.1 Please **calculate** the ***fitness*** of **each** of the above given **individuals** and ***rank*** them from the **least fit one** to the **fittest one**. (5 P)

Exam ST 2022

Example: Programming

3 Data Preprocessing with Python

In your current project for a big German sport car company, you plan to investigate unknown car failures. You aim to find correlations between different parts to identify the root cause. During your first analysis, you face the following dataset that you received from the R&D department:

PartID	Height (inches)	Height (cm)	Weight
1	68	26,77	120
2	74	29,13	130
3	76	29,92	141
…	…	…	…

3.1 Firstly, you try to **load the dataset** in your IDE. However, the upload **does not work** and **returns** the following **errors**.

Python Code

```
connection = sqlite3.connect("failures.db")
cursor = connection.cursor()
sql = "SELECT * FROM failure_report"
cursor.execute(sql)

Traceback (most recent call last):
  File "C:\Users\dominik\.spyder-py3\temp.py", line 7, in <module>
  connection = sqlite3.connect("failures.db")
  NameError: name 'sqlite3' is not defined
```

Please **explain** the (a) ***reason for the errors*** and (b) ***how to solve them***. By doing so, please **provide code** in Python that solves this issue. (1 P)

Exam ST 2021

How to Start

- Start to recapitulate the storyline of the lecture. Read the related chapters of the literature if you feel unsecure or repeat the video recordings of the lecture
- Answer all the classroom tasks, discuss the results with your learning group
- Take a deeper dive at the coding exercises. Solve the coding exercises of each chapter
- Solve the previous exams that are online available!

Which Content is Relevant for the Exam?

Outline

2 Artificial Intelligence and Information Systems

- 2.1 Artificial Intelligence Project Management
- 2.2 Artificial Intelligence Project Lifecycle
- 2.3 Skills and Roles in Artificial Intelligence Projects
- 2.4 Types of Artificial Intelligence based Information Systems

▶ **What we will learn:**

- How typical AI projects are implemented, and how their life cycle and phases look like
- What skills are needed to implement an AI project
- Why the industry needs AI specialists, and how typical AI jobs look like
- Which types of AI based information systems exists and how they can be used to solve real-world problems

Image source: ↗ Pixabay (2019) / ↗ CC0

▶ **Duration:**

- 120 min

▶ **Relevant for Exam:**

- 2.1-2.4

Artifical Intelligence: Building AI-Based Information Systems with Python - Dr. Dominik Jung

Note: There might still be questions where you might need a basic understanding of the content of the excluded chapters

Always exam relevant

- **Lecture** slides, **lectorials** and **exercises** (*except excluded chapters on the overview*)
- **Referenced chapters** of **the course books** and **all literature downloads** available in GIT (*look at the folder "literature"*)
- The **handouts** for the business cases and the **discussion results**
- **Every teaching material** accompanying this lecture (**code examples**, guest lectures etc.)

Overview Relevant Chapters

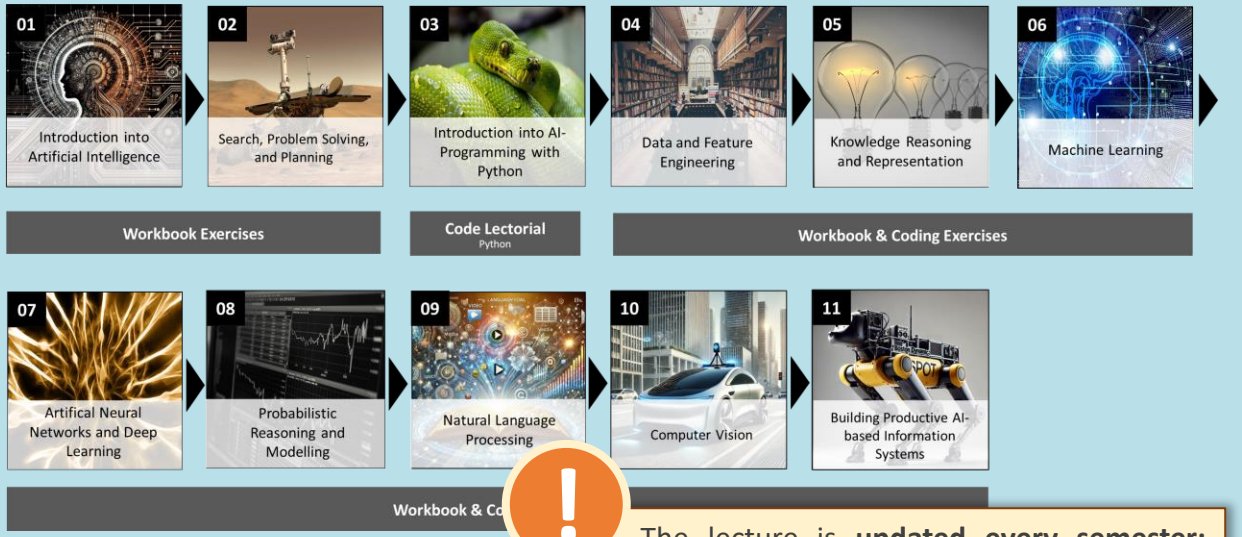
Regularly relevant chapters for the exam

Semester 1

1.1	2.1	3.1	4.1	5.1	6.1	Lectorial 1
1.2	2.2	3.2	4.2	5.2	6.2	Lectorial 2
1.3	2.3	3.3	4.3	~~5.3~~	6.3	Lectorial 3
~~1.4~~	~~2.4~~		4.4	~~5.4~~	6.4	Lectorial 4
	~~2.5~~		4.5	~~5.5~~	~~6.5~~	Exercises
					~~6.6~~	

Semester 2

7.1	8.1	9.1	10.1	11.1	Capstone
7.2	8.2	~~9.2~~	10.2	11.2	Case challenge
7.3	8.3	9.3	10.3	11.3	Guest lecture
7.4	8.4	9.4		11.4	Lectorial 5
	~~8.5~~			~~11.5~~	~~Lectorial 6~~
					~~Lectorial 7~~
					Exercises



The lecture is **updated every semester;** hence the **content can be slightly different** each time. If you decide to write the exam next semester do not forget to **check for updated content**!

For once, the following subchapters are not tested explicitly for the **written** exam for **this** semester:

8.1-8.4, 9.3-9.4, 10.1-10.3, 11.2-11.3, guest lectures

Questions

Just

{ Keep }

Coding