Organization & Grading

Applied Machine & Deep Learning (190.015)

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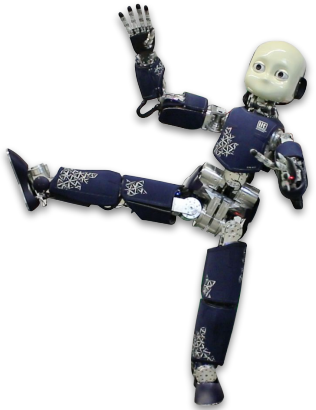


WO AUS FORSCHUNG ZUKUNFT WIRD

Chair of Cyber-Physical-Systems

Outlook of this lecture

- Organization of the 1st week
- Dates & Locations
- Course Materials & Links
- Grading
- Some Remarks by Linus Nwankwo, M.Sc.

1st Week:

	MON 02.10.2023	TUE 03.10.2023	WED 04.10.2023	THUR 05.10.2023	FRI 06.10.2023
Topic	**Intro to ML Organisation**	**Neural Networks**	**Representation Learning**	**Robot Learning**	**AML Projects**
9 am :15					
:30					
:45					
10 am :15					
:15	Quizz on ML	Quizz on Neural Nets	Introduction to Deep Representation Learning		Quizz on AML
:30	Introduction to ML	Introduction to Multi-Layer-Perceptrons			Project Topic Presentations
:45					
11 am :15	15 min Break	15 min Break	JupyterHub NB on Rep. Learning		
:15	Statistics, Model Validation, Figures & Evaluations	Handout on Neural Networks using playground.tensorflow			Team Ass., Git Repos & Wiki Instructions
:30			30 min Break		
:45					AML Summary
12 pm :15	30 min Lunch Break	30 min Lunch Break	Curiosity (MLPs), Imagination (Dreamer) and Information (Empowerment)	Quizz on Robotics	
:30	Course Organisation & Grading	Introduction to CNNs		Introduction to Robot Learning	
:45					
1 pm :15	15 min Break	15 min Break	Quizz Summary	15 min Break	
:15	Python Programming with our JupyterHub	JupyterHub NB on MLPs CNNs		Handout on Robot Learning (Model Learning & RL)	
:30					
:45	Quizz Summary	Quizz Summary			
2 pm :15				15 min Break	
:30				Introduction to Mobile Robotics & SLAM	
:45					
3 pm :15				JupyterHub NB on Path Planning	
:30				Quizz Summary	
:45					

Legend

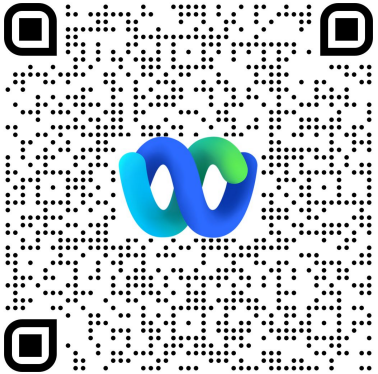
Quizz on ML	Online Quizz using https://tweedback.de
Course Content Presentation	Using google slides, etc.
15 min Break	Breaks to recover or to continue programming
Organisation & Instructions	Using google slides, etc.
Practical Exercise	Using online tools, our JupyterHub, etc.
Latest Research	State-of-the-art research

Dates & Locations

- **Dates:** 02.10 – 06.10.2023
  - **Location:** HS 3 Studienzentrum, Montanuniversität, Leoben
  - Recordings of the lectures of of the 1st week will be put on Moodle.
  - Full link: https://moodle.unileoben.ac.at/course/view.php?id=3082

Dates & Locations

- **Dates:** 07.10 – 31.01.2024
  - **Online** Every Wednesday from 17:00 - 18:00 via Webex
  - Full link: https://unileoben.webex.com/unileoben/j.php?MTID=m5e17e864e5784737dffd2fa1d27d161c
  - Meeting number (access code): 2789 858 4770
  - Meeting password: vTHYP5QMj77



Course Materials & Links

- **Resources:**
  - **Everything is linked via course webpage:**
  - https://cps.unileoben.ac.at/190-015-applied-machine-and-deep-learning-5sh-il-ws/
  - Jupyter Notebooks are hosted on our public git repository: Link will be added here on the 02.10.2023.

- **Services:**
  - https://jupyter.cps.unileoben.ac.at
  - https://studgit.cps.unileoben.ac.at (domain not yet activated)

Grading

Project Work	
Code*	0 - 30 pts
Report*	0 - 40 pts
Final Oral Presentation & Discussion (Dates will be assigned to the teams after the 31st of January 2024). Location is the office of Prof. Rueckert.	0 - 30 pts
Total	100 pts
Bonus Points on the Project Work	
Excellent Report using wiki repository	0 - 20 pts
Excellent Algorithmic Implementation	0 - 20 pts
Active Participation in the 1st Week	
Physical attendance	0 - 10 pts

Grading

Cumulative Points	Final Grade
0 - 49.9	5
50 - 65.9	4
66 - 79.9	3
80 - 91.9	2
92 - 100	1

A minimum of 50 points need to be achieved to be positive. Git repositories with either not code or no documentation will result in a 5.

Some Remarks by Linus Nwankwo, M.Sc.

Teaching Assistant of the AML course: Linus Nwankwo, M.Sc.

Short Bio: Mr. Linus Nwankwo started as a PhD student at the Chair of Cyber-Physical-Systems (CPS) in August 2021. Prior to joining CPS, he worked as a research intern at the Department of Electrical and Computer Engineering, Technische Universität Kaiserslautern, Germany.

In 2020, he obtained his M.Sc. degree in Automation and Robotics, a speciality in control for Green Mechatronics (GreeM) at the University of Bourgogne Franche-Comté (UBFC), France. In his M.Sc. thesis, he implemented a stabilisation control for a mobile inverted pendulum robot and investigated the possibility of controlling and stabilising the robot via CANopen communication network.

Notes

- Course tutorials and materials will be posted on our JupyterHub.

- Online assistance will be limited, therefore, it is encouraged to attend the course in person so that you can get unlimited assistance to enable you finish or at least figure out how to finish the exercise before the due time.

- An account will be created for each group in our JupyterHub for submission of the exercise.

- The accounts will remain active till the end of the semester.

- The final project results will be presented in a written report in form of a git repository wiki page, and presented for a final 5 -10 mins.

Communication and Academic Integrity

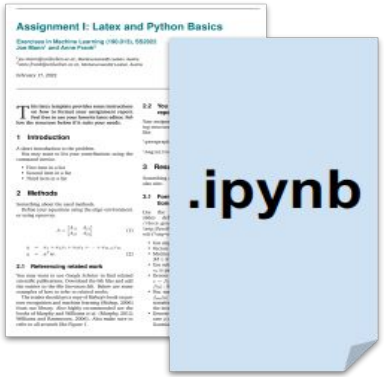
- **Office Hours:** If you have any questions or need assistance, please come during the office hour. If you cannot make it to office hours, email me to schedule an appointment.
- **Emails:** It is extremely hard to discuss technical questions through emails. Therefore, we encourage you to come to the lab for such a discussion.
- **Discussions among teams**: Encouraged for a better understanding of course materials. However, each of you (or your team) should work on your code independently after the discussions.
- **Lab safety:** In case your chosen project requires a physical robot or other hardware in our lab, please seek permission from the technician or the person in charge of such hardware.
- **Citation:** Reference any website or academic material used in your project.

Prerequisites

- A laptop or tablet.
- Internet access. You could use the Uni. internet or eduroam.
- Basic Python programming. No worries if you do not have some experience, we will start with the basics.
- Basic background in statistics, e.g., probability, descriptive statistics (measures of central tendency and dispersion), visual representation of data (histograms, bar charts, pie charts, scatter plots, etc.).
- Recommended Prerequisites: Introduction to Machine Learning (“190.012” and “190.013”).

The Project Workflow

Project Presentation → Grouping, Q & A → Reports and Code Submission → Exercise points and grading



Project/Task Presentation

- Introduction to the task: **06.10.2023**
- Motivation & Objectives
- Research Questions & Related Work
- Problem & Dataset Description
- Approach & Methods
- Tutorial if required, Q & A

Q & A

- During the lecture & office hours

- If technical question(s) that involve hardware:
  - come to the lab
  - schedule an appointment

Report and Code

Report:

- All reports must be in the **Wiki repository** or **README.md** format.
- **HANDWRITTEN** report will not be accepted

Code:

- All the code must be written using Jupyter Notebook or Google Colab.
- Use our **JupyterHub** templates at the following repository:
  - Jupyter Notebook
  - Just open it and start filling it.
- **Inline comments** in the code are necessary, but not mandatory.
- The file must be in .**ipynb** format.

Alternative Submission Method

If there are hitches, or you are unable to work with our JupyterHub, then:

- Create a .zip file with the following contents:
  - .ipynb of your code
  - .md of the wiki report
- Name it m-number_firstname_lastname_task<#>.zip
  - For example: m123456789_john_smith_assign1.zip
  - Upload it to the cloud at Direct Upload
- Note: No submission will be accepted via email.

2

PROJECTS OVERVIEW

Projects Overview

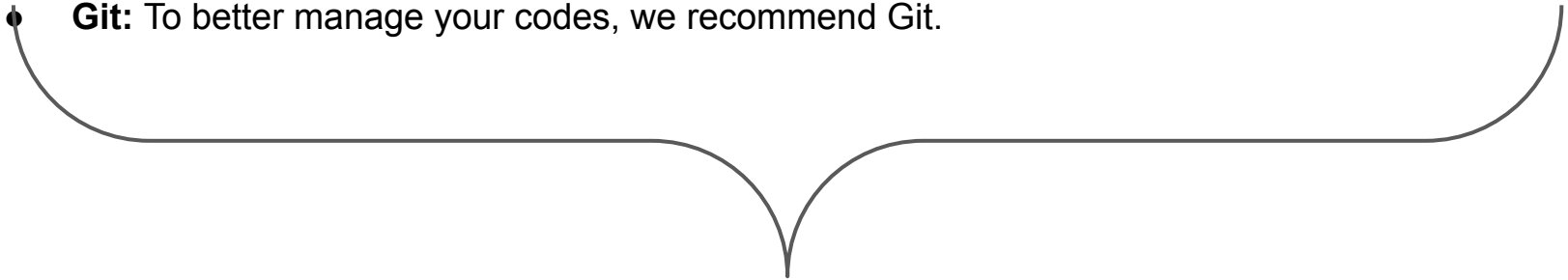
For the course, we have five (5) projects to be worked on by the students (individual or group):

- Application and comparison of deep neural networks for steel quality prediction in continuous casting plants with data from the ‘Stahl- und Walzwerk Marienhütte GmbH Graz’.
- Predictive maintenance of bearing shells using frequency analysis in decision trees and deep neural networks based on acoustic measurement data.
- Motion analysis and path planning for human-machine interaction in logistics tasks with mobile robots of the Chair of CPS.
- Autonomous navigation and mapping with RGB-D cameras of the four-legged robot Unitree Go1 for excavation inspection in mining.

Getting Started Tools

Necessary tools to get started:

- **Linux:** Basic commands are required.
- **Python:** You just need to have a basic idea about data structures, operators, functions, etc.
- **ROS:** ROS Wiki Documentation has all that you need to get started.
- **Virtual Machines:** If your OS is not Linux, do not worry, VMware will work on Windows and Mac.
- **Git:** To better manage your codes, we recommend Git.



Installing and using these tools in your project will be discussed in details in our next lab.

Project Objectives

At the end of this course, you should be able to:

- Implement or independently adapt modern machine learning methods, and in particular deep learning methods, in Python.
- Analyse data of complex industrial problems, process (filter) the data, and divide it into training- and test data sets such that a meaningful interpretation is possible.
- Define criteria and metrics to evaluate, predict, and generate statistical analysis of data.
- Develop, evaluate, and discuss meaningful real-world experiments.
- Identify and describe assumptions, problems, and ideas for improvement of practical learning problems.

Summary of Organization & Grading

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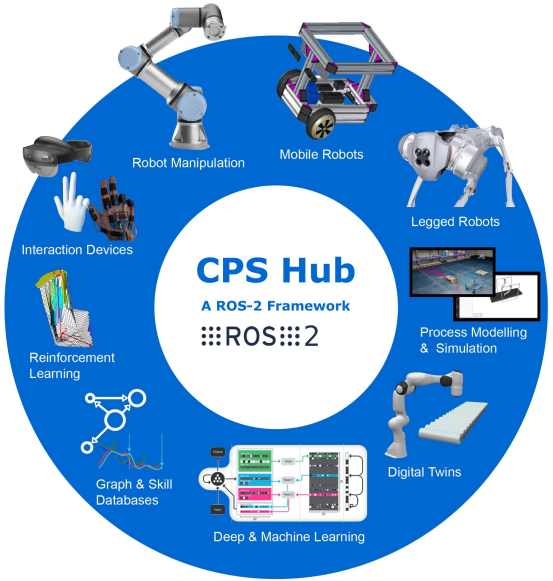
Thank you for your attention!

Visit our Youtube Channel:
https://youtube.com/@CPSAustria

YouTube 117



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