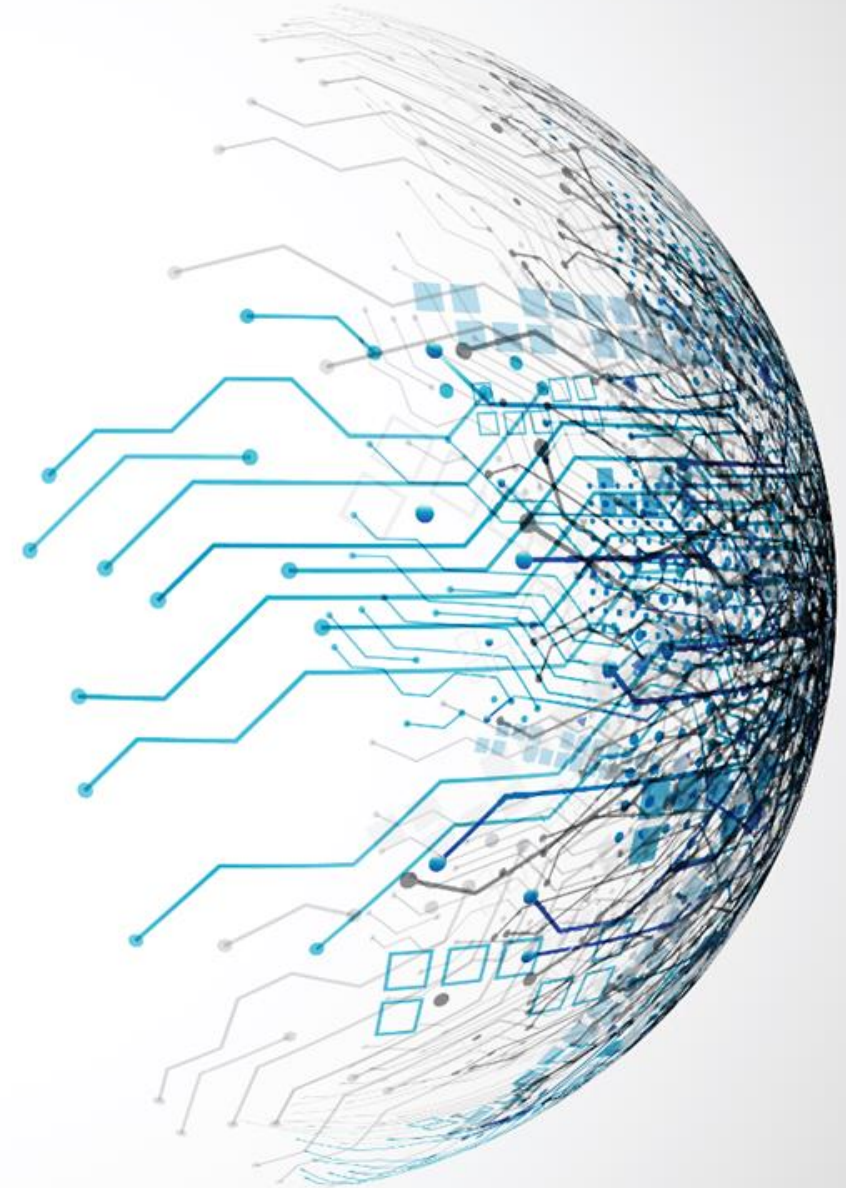


Deep Learning

INFORMATION

Dr. Mohammed Salah Al-Radhi
(slides by: Dr. Bálint Gyires-Tóth)



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Outline

1. Team
2. Goal of the class
3. Prerequisites and time needed
4. Lectures and practices
5. Grading
6. Topics and timeline
7. Assessments
8. Schedule
9. References

An abstract network diagram featuring a series of interconnected nodes and lines. The nodes are represented by small circles in various shades of teal and grey, while the connecting lines are thin and light grey. The overall structure is horizontal and spread across the width of the slide, with some nodes having multiple connections, creating a web-like appearance. A semi-transparent white rectangular box is positioned in the upper-middle section of the image, containing the text "Meet the Team".

Meet the Team

Team

➤ Lecturers



Mohammed



Bálint



Csaba

➤ PhD students



Ali



Dosti



M.Abed



Shaima



Rami

Dr. Mohammed Salah Al-Radhi



- Research fellow
 - Budapest University of Technology and Economics (BME)
 - Department of Telecommunications and Artificial Intelligence (TMIT)
 - Faculty of Electrical Engineering and Informatics (VIK)
 - Speech Technology and Smart Interactions Laboratory (SmartLab)
- **Research topics:** Text-to-Speech synthesis, Voice conversion, Neural vocoder, Brain-to-Speech synthesis, Fake-voice detection

malradhi.github.io

Deep Learning education and research

- Education:
 - Deep learning in practice based on Python and LUA
 - BSc, MSc, PhD
- Research:
 - Basic and applied research
 - Domestic and international projects



Prof. Dr. Németh Géza, DSc
Head of Laboratory

<http://smartlab.tmit.bme.hu>

An abstract network diagram with numerous nodes (small circles) and connecting lines (edges) in shades of teal and grey, creating a complex web-like structure across the slide background.

Goal of the class

Goal of the class

Machine learning operations (MLOps) approach to deep learning education at beginner to intermediate level. Focus on software tools, PyTorch generally.

Recommended classes:

- Deep learning in practice (VITMAV45): Deep learning at beginner level with experience-based theory and practice. Generally, in TensorFlow Keras.
- Applied Artificial Intelligence models in practice (BMEVITMAV78): Introduces the usage of AI methods and techniques to make your life easier. („prompt engineering”)
- Neural networks (VIMIJV07): Theory oriented class on neural networks.

An abstract network diagram with numerous nodes (small circles) and connecting lines (edges) in shades of blue and green, creating a complex web-like structure across the slide.

Prerequisites and time needed

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Prerequisites

- Basic Python programming skills
- Data analysis with Python

Time needed

- Lectures and practices (70% minimum)
- Practices: cca. 2-4 hours (including the class) per person
- Project work: cca. 60-120 hours per 2-3 person

An abstract network diagram with numerous nodes (small circles) and connecting lines (edges) in shades of teal and grey, creating a complex web-like structure across the slide background.

Lectures & Practices

Lectures and practices

- Lectures:
 - every Tuesday, 14:15 – 16:00
 - 14 occasions
 - I.B. 146
- Practices:
 - every 1st & then 2nd Wednesday, 14:15 – 16:00
 - 7 occasions
 - I.B. 147
 - 70% presence needed
 - Assessments



An abstract network diagram with numerous nodes and connecting lines. The nodes are represented by small circles in various shades of blue and green. The lines are thin and light blue, creating a complex web of connections across the slide. A semi-transparent white rectangular box is positioned horizontally across the middle of the slide, containing the word 'Grading' in a large, bold, black font.

Grading

Grading

1. Project Work (Basic Level):
 - Mandatory to receive a “signature” (pass)
2. Oral exam
3. Assessment Score
 - mark (max 500 points)
 - 200 points: Minimum for a “signature”
 - 350 points: Qualifies for a +1 mark bonus

Option A

Perform well in the oral exam and accumulate 350+ points in assessments to boost your grade by 1.

Grading

1. Project Work (Advanced Level):

- Mark 4: Good performance
- Mark 5: Excellent performance

Option B

2. Assessment Score

- mark (max 500 points)
- 200 points: Minimum for a “signature”
- 350 points: Qualifies for a +1 mark bonus

Score 350+ points in assessments and excel in the project to secure a grade of 4 or 5.

An abstract network diagram featuring a series of interconnected nodes and lines. The nodes are represented by small circles in various shades of teal and grey, while the lines are thin and light grey. The connections form a complex web that spans the width of the slide, with some nodes having multiple links and others being isolated. The overall aesthetic is clean and modern, typical of a professional presentation.

Project work

Project work

Basic level



Focus on foundational tasks

- **Containerization:** Setting up the environment.
- **Data Acquisition:** Collecting data for the project.
- **Data Preparation:** Preparing data for model input.
- **Baseline (Reference) Model:** Creating a simple model as a starting point.
- **Model Development:** Building and training the model.
- **Basic Evaluation:** Evaluating the model's performance with simple metrics.

| Project work

Advanced level



Dive deeper with analysis, incremental improvements, and deployment

- **Containerization:** Environment setup with advanced configurations.
- **Data Acquisition and Analysis:** Collecting and analyzing data.
- **Data Cleansing and Preparation:** Cleaning and preparing data for optimal model performance.
- **Defining Evaluation Criteria:** Establishing detailed metrics and benchmarks.
- **Baseline (Reference) Model:** Developing a more sophisticated baseline model.
- **Incremental Model Development:** Iteratively improving the model.
- **Advanced Evaluation:** Conducting in-depth evaluation using advanced metrics.
- **ML as a Service (Prototype):** Developing a prototype to deploy the model as a service.

Project work rules

- 2-3 people / team
- Deadlines:
 - Group and topic selection
 - Milestone 1: containerization, data acquisition, data preparation
 - Milestone 2: baseline evaluation, baseline model
 - Final submission





Project work topics

- Image classification using pretrained convolutional networks
- Image generation with diffusion models
- Vision transformers for medical image segmentation
- Model Ensemble for Medical Image Segmentation
- Brain-to-speech synthesis
- Fake Voice Detection
- Conversational AI
- Disease-gene interaction prediction with graph neural networks

... your topic with similar complexity...

An abstract network diagram with numerous nodes and connecting lines. The nodes are represented by small circles in teal and grey colors. The lines are thin and connect the nodes in a complex, web-like pattern. The background is a light grey gradient.

Assessments

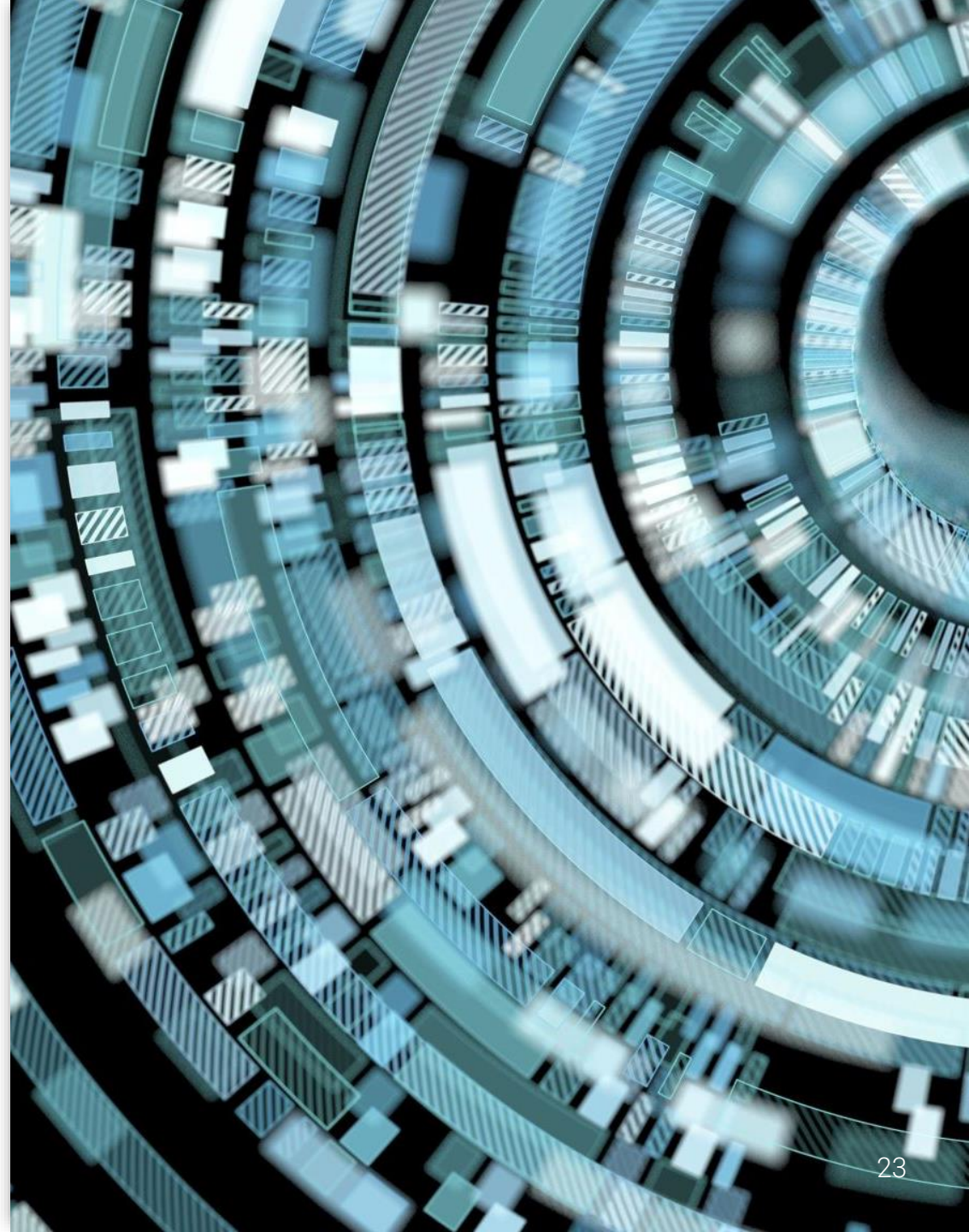
Assessments

Part of the practices

Topics:

- Hyperparameter tuning + Weights & Biases integration
- Nontrivial regression/classification with detailed pipeline
- Common problems in Computer Vision
- Deep learning-based speech and audio
- Transformer-based Language Models
- Graph neural networks

Submit by Wednesday 23:59



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Schedule

Schedule

	A ▼	B	C	D	E	G	H	I	J
1	No.	Date / Time	Lecture	Topic	Deadline	No.	Date / Time	Lecture	Topic
2	Week #1	03.09.2024	Theoretical	Introduction and Software Stack		Week #1	04.09.2024	Practical	Python, Docker, Gradio
3	Week #2	10.09.2024	Theoretical	Hardware Architecture and Backpropagation	Project work topic and group selection				
4	Week #3	17.09.2024	Theoretical	Hyperparameter Optimization		Week #3	18.09.2024	Practical	Regression
5	Week #4	24.09.2024	Theoretical	DL Frameworks and PyTorch Basics					
6	Week #5	01.10.2024	Theoretical	Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM)		Week #5	02.10.2024	Practical	Pytorch, CNN
7	Week #6	08.10.2024	Theoretical	Classification and Convolutional Neural Networks (CNN)	Milestone 1: data acquisition, data preparation				
8	Week #7	15.10.2024	Theoretical	Generative Adversarial Networks (GAN)		Week #7	16.10.2024	Practical	Classification
9	Week #8	22.10.2024	Theoretical	Transfer Learning, Computer Vision, and Data Augmentation					
10	Week #9	29.10.2024	Theoretical	Unsupervised Learning and Autoencoders		Week #9	30.10.2024	Practical	Computer Vision
11	Week #10	05.11.2024	Theoretical	Deep Learning for Speech: Text-to-Speech (TTS)	Milestone 2: baseline evaluation, baseline model				
12	Week #11	12.11.2024	Theoretical	Deep Learning for Automatic Speech Recognition (ASR) and Speaker Verification		Week #11	13.11.2024	Practical	TTS & ASR
13	Week #12	19.11.2024	Theoretical	Natural Language Processing with Transformer-based Models and Large Language Models (LLMs)					
14	Week #13	26.11.2024	Theoretical	Graph Neural Networks (GNN)		Week #13	27.11.2024	Practical	Graph Neural Networks
15	Week #14	03.12.2024	Theoretical	Ethical Considerations and Future Trends in Deep Learning	Project work - final submission				

An abstract network diagram with numerous nodes and connecting lines, rendered in a light teal color. The nodes are small circles, and the lines are thin, creating a complex web-like structure. A semi-transparent white rectangular box is centered horizontally across the middle of the image, containing the word "References" in a bold, black, sans-serif font.

References

References

Class related

- Presentation and notebooks: on Moodle
<https://edu.vik.bme.hu/course/view.php?id=13253>

Catch-up materials

- Python basics: <https://developers.google.com/edu/python>
- Data analytics: https://github.com/stefmolin/Hands-On-Data-Analysis-with-Pandas-2nd-edition/tree/2nd_edition

References

<https://bit.ly/3AFIKuT>



Attendance and Quiz

Kahoot!

Name: your NEPTUN code!

<https://kahoot.it>

Project laboratory, thesis work

You can join project laboratory and thesis work classes at:

Dept. of Telecommunications and Media Informatics:

<https://laborweb.tmit.bme.hu/temalista>

Faculty of Electrical Engineering and Informatics:

<https://www.vik.bme.hu/page/1004/>

Please, don't forget
to send feedback:

<https://bit.ly/bme-dl>



Thank you for your attention

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03 September 2024

