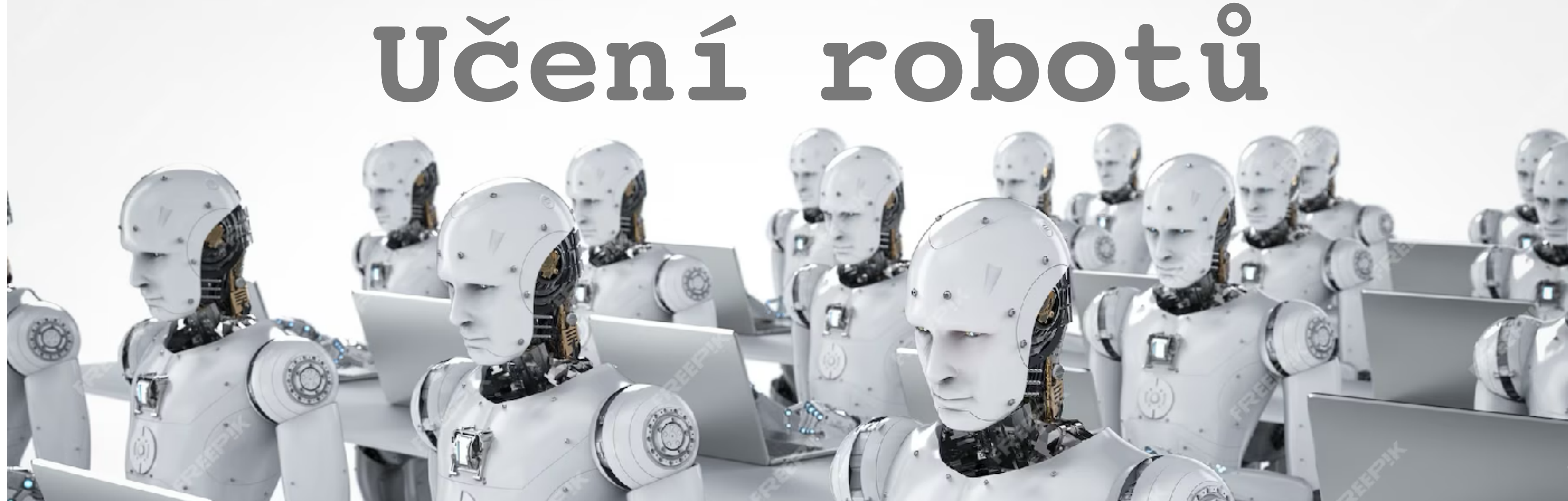


# Učení robotů



## Outline of the course

**Teachers, content, credits, grades, ...**

**Karel Zimmermann**

<https://cw.fel.cvut.cz/b231/courses/b3b33urob/start>

# Outline

- Introduction of the our teachers
- Outline of the course - lectures
- Outline of the course - labs
- Organization (homework, tests, semestral work)



- **Karel Zimmermann** (associate professor at CTU)
- main lecturer



- **Aleš Kučera (MSc student)**
- head of the labs



- **Jan Vlk (MSc student)**
- labs tutor

... and others who did not provide their photos in time ...

- **Roman Šíp (PhD student, eForce developer)**
- **David Čapek (MSc student)**

- Introduction of the VIR-team
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First half of the semester:

Date	Lecture	Lab	Lecturer	Homework
23.9.2024	Lec 1: Machine learning 101: model, loss, learning, issues, regression, classification	Intro: ML	Ales	-
30.9.2024	Lec 2: Under the hood of a linear classifier: two-class and multi-class linear classifier on RGB images	1D regression and 2D classification: Revision of the regression and classification theory, analytic gradient computation, gradient in computational graph and loss minimization.	Karel	-
7.10.2024	Lec 3: Where the hell does the loss come from? MAP and ML estimate, KL divergence and losses.	Loss, MLP	Ales	HW1 - MLP
14.10.2024	Lec 4: The story of the cat's brain surgery: fully-connected NN + fast backpropagation via Vector-Jacobian-Product (VJP), cortex + convolutional layer	Convolutional neural networks.	Honza	-
21.10.2024	Lec 5: Under the hood of auto-differentiation: Vector-Jacobian-Product (VJP) vs chainrule and multiplication of Jacobians, convolutional layer and its VJP	Backpropagation	Honza	HW2 - Autograd
28.10.2024	Independence Day of Czechoslovakia	Preparation for midterm test	??	-

Second half of the semester:

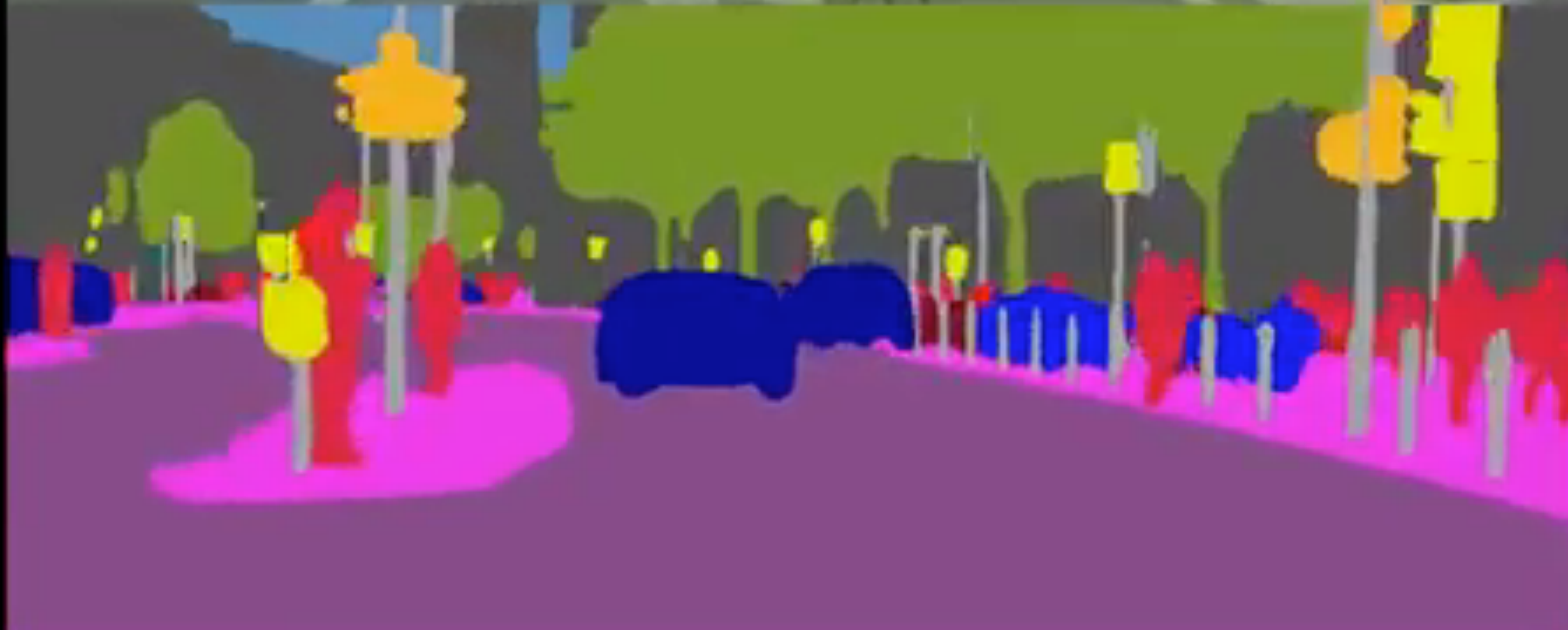
Date	Lecture	Lab	Lecturer	Homework
4.11.2024	Midterm test	HPC Tutorial	Roman	-
11.11.2024	Lec 6: Why is learning prone to fail? - Structural issues: layers + issues, batch-norm, drop-out	Layers	Roman	HW3 - Segmentation
18.11.2024	Lec 7: Why is learning prone to fail? - Optimization issues: optimization vs learning, KL divergence, SGD, momentum, convergence rate, Adagrad, RMSProp, AdamOptimizer, diminishing/exploding gradient, oscillation, double descent	Optimization	Karel	-
25.11.2024	Lec 8: Architectures, Transformers	Transformers	David	HW4 - Transformers
2.12.2024	Lec 9: Transformers	Transformers	David	-
9.12.2024	Lec 10: Reinforcement learning: Approximated Q-learning, DQN, DDPG, Derivation of the policy gradient (REINFORCE), A2C, TRPO, PPO, Reward shaping, Inverse RL, Applications,	Reinforcement learning I	Typek od Romana	-
16.12.2024	Lec 11: Implicit layers	Reinforcement learning II	Typek od Romana	HW5 - RL
6.1.2024	Exam	-	-	-



# Semantic segmentation



- road
- sideway
- pedestrian
- traffic sign
- trees
- sky





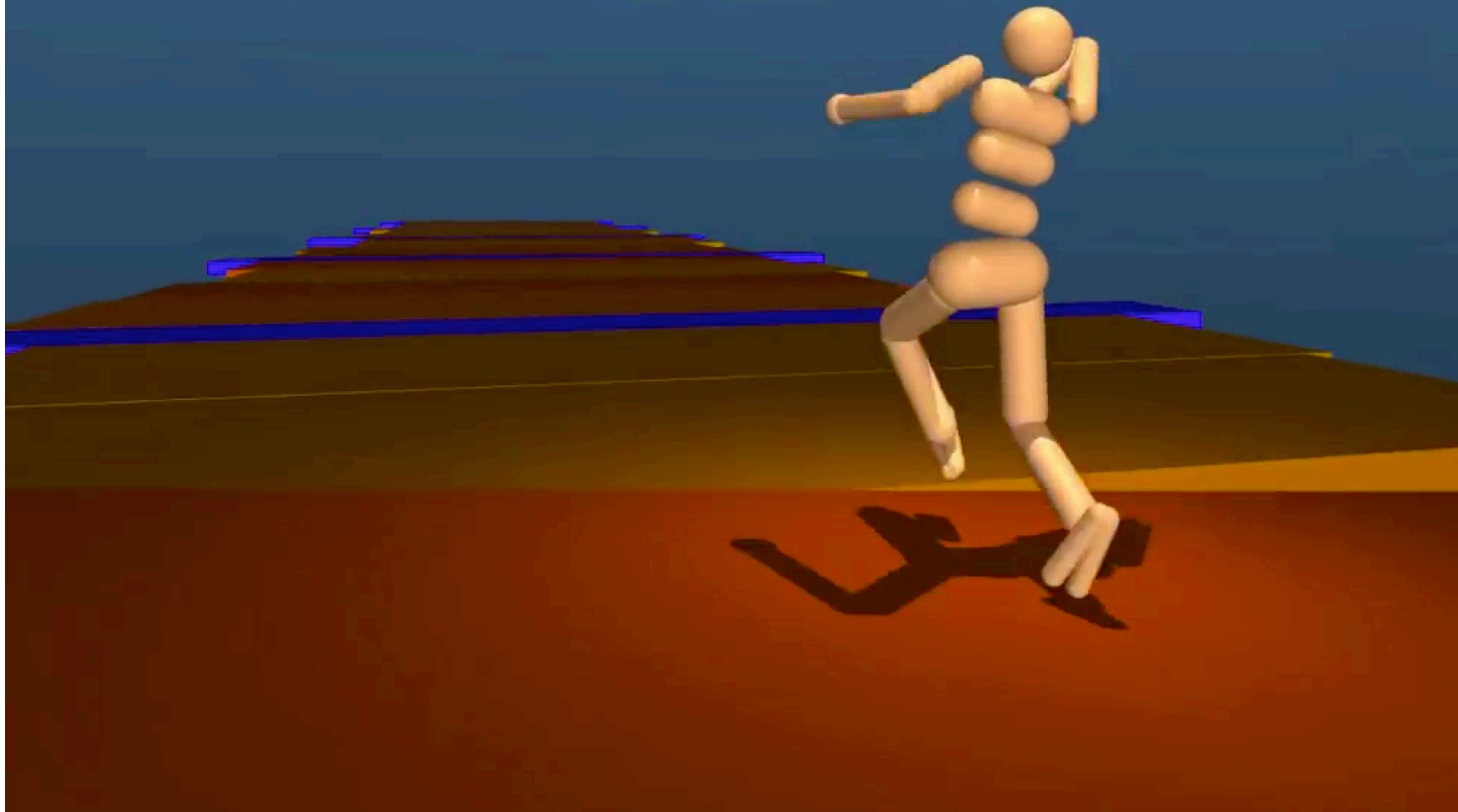
# Object detection





[Heess 2017] <https://arxiv.org/abs/1707.02286>

This agent, trained on several terrain types, has never seen the "see-saw" terrain.





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# Labs

- Head of the labs is Ales Kucera
- You can use personal / school computers
- You will use Python, Numpy, PyTorch, Pycharm  
try to install it to your notebooks in advance)

```
import numpy as np
```

<http://www.numpy.org>

```
import torch
```

<https://pytorch.org/>



<https://www.jetbrains.com/pycharm/>



<https://colab.research.google.com/>

- Optionally you can use school computers



## Labs

- Small cluster of 48 GPUs with 3 interactive apps (Jupyter Notebook, VS Code and Matlab)  
<https://gpu.fel.cvut.cz/wiki/>
- Student computers with remote access:
  - **cantor.fel.cvut.cz**
    - 16 jader / 32 threadu,
    - 256GB RAM, 500GB SSD,
    - 8 x NVIDIA GTX 1080Ti
  - **taylor.fel.cvut.cz**
    - 16 jader / 32 threadu,
    - 256GB RAM, 500GB SSD,
    - 8 x NVIDIA GTX 1080Ti

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## Credit requirements and point summary

- **50 points** from 5 homeworks (10x5 points)
  - automatic evaluation
  - competitive setting if applicable
  - in well justified cases HWs can be replaced by individual work
- **50 points** from tests (T1, ET)
  - midterm test 25b
  - exam test 25b
- **minimum credit requirements** is:
  - at least 1 point from each homework
  - at least 1 point from each test
- bonus points for activity

## Final grade

- final grade determined by the total number of points

No of points	Exam assessment
0-49	F
50- 59	E
60-69	D
70-79	C
80-89	B
90-100	A