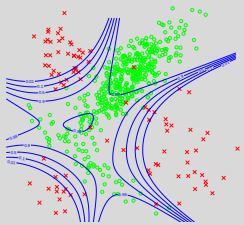

Neural Networks and Deep Learning Introduction

Lecture *Machine Learning* vom 11-13.3.2024

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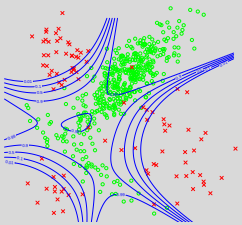
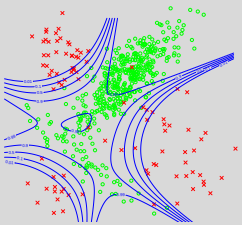
Universität Greifswald



Organization

- Time: 9:00am to 4pm from March 11 to March 13
- Lunch break: ∼12:00-13:00
- Course material (slides, code, data sets, ...):
  - `https://moodle.uni-greifswald.de/course/view.php?id=5405`
  - `https://bioinf.uni-greifswald.de/bioinf/teaching/NNDL24/KI-Block.tgz`

    Extract with `tar xzf KI-Block.tgz`
- Questions and feedback outside of the course (moodle forum):
  - `https://moodle.uni-greifswald.de/mod/forum/view.php?id=146549`
- AppHub Uni Greifswald:
  - `https://apphub.wolke.uni-greifswald.de/`
- Course instructors:
  - Mario Stanke – Professor for Bioinformatics
  - Lars Gabriel – PhD student in Bioinformatics



Prerequisites

- Connection to the network of the University of Greifswald
- Basic programming skills, preferably in Python
- Basic calculus and linear algebra (derivation, matrix multiplication)

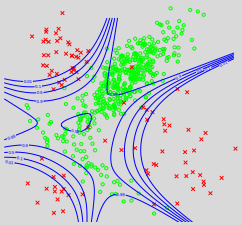
$$\nabla E(\theta) = \left(\frac{\partial E(\theta)}{\partial \theta_0}, \cdots, \frac{\partial E(\theta)}{\partial \theta_n}\right)^T, \quad \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix} \cdot \begin{pmatrix} 3 & 2 & 1 \\ 4 & 1 & 0 \end{pmatrix} = \begin{pmatrix} 11 & 4 & 1 \\ 25 & 10 & 3 \\ 39 & 16 & 5 \end{pmatrix}$$

- Familiarity with `numpy` syntax

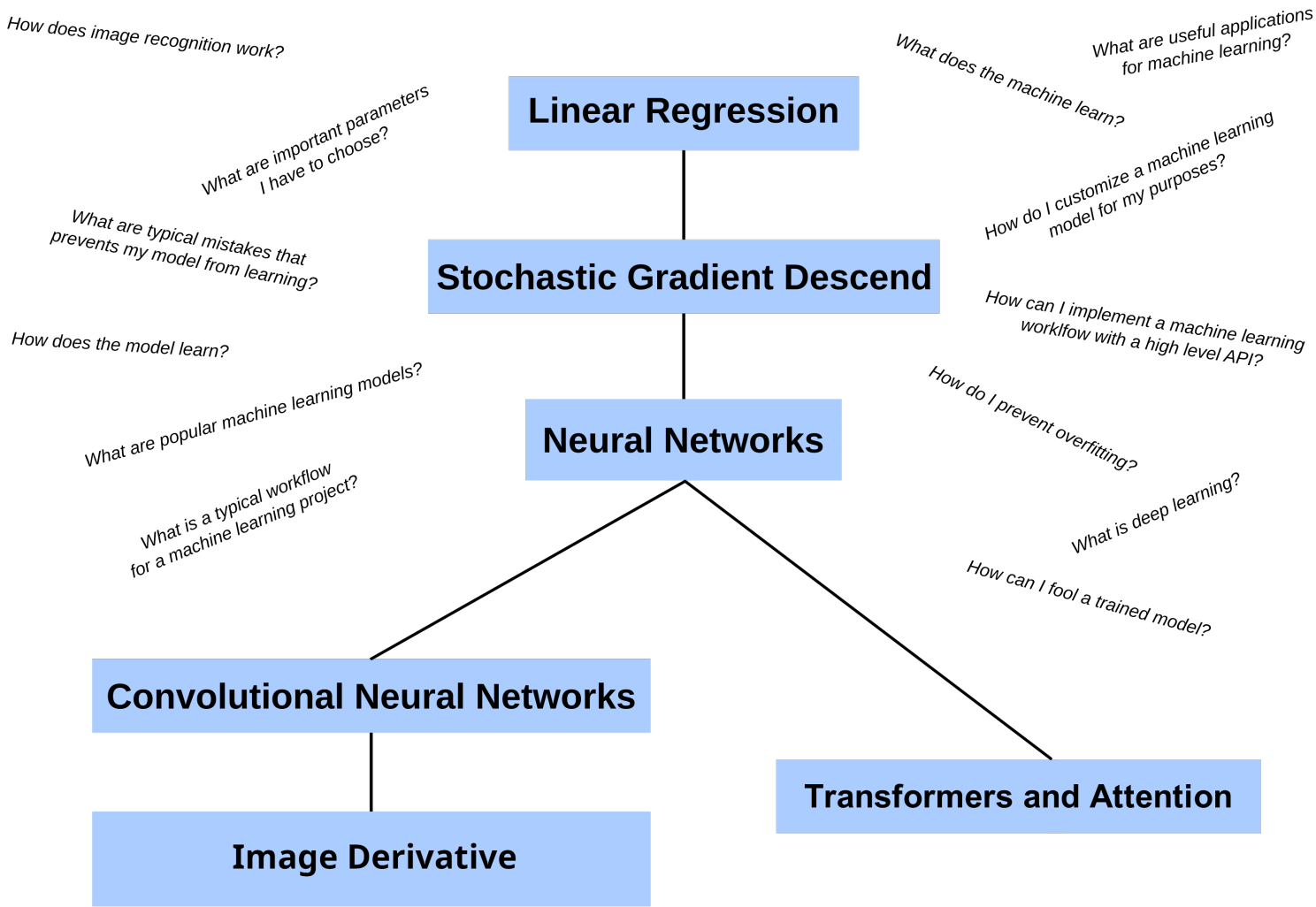
```
[1]: import numpy as np

[3]: A = np.array([[1,2],[3,4],[5,6]])
     B = np.array([[3,2,1],[4,1,0]])
     C = np.matmul(A,B)
     C

[3]: array([[11,  4,  1],
            [25, 10,  3],
            [39, 16,  5]])
```



Syllabus


How does image recognition work?
What does the machine learn?
What are useful applications for machine learning?
Linear Regression
What are important parameters I have to choose?
How do I customize a machine learning model for my purposes?
What are typical mistakes that prevents my model from learning?
Stochastic Gradient Descend
How can I implement a machine learning worklfow with a high level API?
How does the model learn?
What are popular machine learning models?
How do I prevent overfitting?
Neural Networks
What is a typical workflow for a machine learning project?
What is deep learning?
How can I fool a trained model?
Convolutional Neural Networks
Transformers and Attention
Image Derivative