Neural Networks: 0. Introduction & Appetizer (Part 0)

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About me:

- Mathematics-Economics M.Sc (Københavns Universitet, 2017)
- Research Assistant (PhD Student) at the chair of Management (JGU Mainz, 2018)
- Research Assistant (PhD Student) at the chair of Application Management (DHBW, 2019)

- Research interests: (Time Series) Econometrics, Macroeconometrics & passion for everything statistic-ish

About you:

- Solid background in calculus (derivatives)
- Python coding skills (presumably more than I have)
- Recap the lecture to not loose track
- Looking for typos (thank you)
- In-lecture-feedback (pace, difficulty,...)

Administrative Things

- Lecture times: 1-2 times a week (as regular as possible)
- Slides: Google Calendar
- 10 lectures of 3h each
- Lecture 7(?): Paper
- Sources:
  - Lecture Notes (best!)
  - Neural Networks and Deep Learning (Charu C. Aggarwall)
  - Deep Learning (Ian Goodfellow, Yoshua Bengio & Aaron Courville)
- Questions? Email me!

Exam

- 15.07. (?)
- 60min (?) or oral? If not $\rightarrow$ don't forget your calculator
- Theoretical (I want you to understand the idea behind NN)
- Mathematical
- Coding (Pseudocode) - presumably, but not settled yet
- Paper

Structure (formal)

0. Appetizer
I. Initialization
II. Model
III. Loss (function)
IV. Optimization

Structure (circle-ish)

1. Recognize handwritten digits (coding)
2. Understand the theory behind the code
3. Extend the theory
4. Improve the code

Timeline

1. Today: Appetizer
2. First 3-4 Weeks: Understand the appetizer
3. Last 6-7 Weeks: Dive into Neural Networks
4. Week 11: Off
5. Week 12: Exam

0. Appetizer

Recognize handwritten digits using a NN in Tensorflow

Tensor

- complex mathematical map
- what we have to know about them:
  - **type**: tf.float32, tf.int64, tf.string,...
  - **rank**: rank 0: Scalar. rank 1: Vector. rank 2: Matrix. rank 3: 3-Tensor (Cube)...
  - **shape**: Number of elements in each dimension
    - scalar has shape ( )
    - vector has shape (N0)
    - matrix has shape (N0,N1)

Tensor

Why Tensors and not matrices?

Because we don't have to define the shape of a Tensor