Hands-on Deep Learning for Computer Vision and Biomedicine

Practical Course Summer Term 2017

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Learning Goals

- Basics of machine learning and deep learning
- Convolutional neural networks
- Recurrent neural networks
- Tasks beyond supervised learning
- Deep learning craftsmanship
 - Understanding real data and practical problems
 - Design of architectures, choice of loss functions
 - Tuning of hyperparameters
 - Training procedures
 - Evaluating and understanding results
- Practical project experience with real-world open problems
 - The projects are geared towards scientific publications
- Presentation skills

Structure of Practical Course

- Three lectures in the beginning of the semester
 - Dates will be chosen to fit students' schedules
- Practical project
 - Own project for each group
 - Two students per group
 - Most projects: Python, NumPy
 - Deep learning requires early and regular attention
 - Regular discussions with supervisors (important for learning progress and project success)
- Final presentations
 - Introduction, Methods, Results, Conclusions
 - Probably 20min presentation + 10min Q&A
 - Groups can learn from each other and discuss
 - Presentation dates will be determined by voting (end of semester)

Next Steps

- Apply for a place at https://matching.in.tum.de/
- There are many applicants
- Additional info about yourself helps us for two reasons:
 - Matching
 - Assignment of projects with appropriate difficulty
- Feel free to email us until February 12:
 - Your programming skills
 - Your interests
- If you want to propose own projects ideas, they should be discussed with us until February 13
- Places in the course will be assigned on February 15

After February 15

- If you get a place in matching system, you have two options:
 - Either form a group of two and submit project preferences together
 - Or submit your individual project preferences and we assign you a partner
- Projects will be announced, discussed and assigned as soon as possible
- Example of project preferences that a student or group sends us:
 - 1. Project "C" (most preferred)
 - 2. Project "T" or "U"
 - 3. Project "A"
 - 4. Project "G"
- We will consider your preferences, and also our knowledge about which of your preferred projects match your programming skills
- If you don't get a place:
 - Enter the waiting list
 - Email us
 - Apply in subsequent semesters
 - Also consider applying for interdisciplinary project, guided research, thesis

Prerequisites

- Good programming skills
 - Python
 - Array programming in NumPy (or Matlab or similar)
- Curiosity
- Time for regular hard work

Literature

- Christopher M. Bishop: "Pattern Recognition and Machine Learning", Springer, 2006.
- <u>http://www.deeplearningbook.org/</u>
- <u>http://neuralnetworksanddeeplearning.com/</u>
- NumPy: Advanced Array Indexing
 https://docs.scipy.org/doc/numpy/reference/arrays.indexing.html

FAQ – Answers

- You will get access to appropriate computers and GPUs

 in Garching and remotely
- Registration on matching.in.tum.de is crucial
- Sending us info is extremely beneficial
- If you require project details in advance, feel free to contact us
- Prior knowledge (deep learning, computer vision, biomedicine) is not required
 - You will learn from your supervisors
- But good programming skills are important to be able to do deep learning