Course Notes: Deep Learning for Visual Computing

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Contents

1 Syllabus

1.1 Class times and location

- Times: Sunday, Wednesday 14:30 - 16:00
- Room: Classroom 4125 / Building 9
- Start Date: 27.08.2020
- End Date: 06.12.2020

1.2 Who is teaching the class?

- Instructor: Peter Wonka
- Office: building 1, 2nd floor, sea side
- Email: peter.wonka@kaust.edu.sa
- Office hours: please send an email to setup an appointment
- This list is only tentative, there will most likely be fewer TAs.
- Organizing TA: Michael Birsak
- Other TAs will be determined later

1.3 What are my research topics?

- Deep Learning
- Computer Vision
- Computer Graphics
- Machine Learning
- Occasionally: Remote Sensing, Image Processing, Visualization
- Research Keywords: deep learning, 3D computer vision, machine learning for visual computing, generative modeling, generative diffusion models, generative adversarial networks, variational autoencoder, flow models, auto-regressive models, network architectures, 3D reconstruction, depth estimation, NeRF-based reconstruction, 3D shape analysis, 3D shape segmentation, vision and language, graphics and language, laser scanning, urban modeling, urban reconstruction, urban planning, computational design, procedural modeling, layout synthesis, shape modeling, interactive editing, geometry processing, architectural geometry, geo-spatial visualization, surface sam-

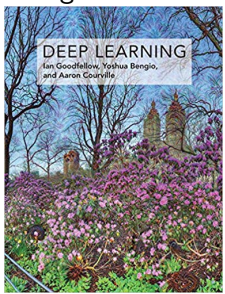
pling, surface remeshing, image editing, image analysis, image segmentation, texture synthesis, texture analysis, lighting design.

1.4 Where can I find information about the class?

- Blackboard, Slack, Webpage
- We try to publish everything online: syllabus, slides, assignments, projects, announcements, ...

1.5 Is there a textbook for the class?

- Unfortunately not
- Deep Learning, Goodfellow et al.
  - Very good description of several basics
  - Outdated with respect to state-of-the-art research
  - Not good for learning how to program



- The following are easy, practical introductions, code examples, ...
  - I do not know these books well
  - I recommend reading implementation-heavy literature first (such as these books)
- Deep Learning with PyTorch, Stevens
- Hands-on Neural Networks with PyTorch, Vihar Kurama
- PyTorch Pocket Reference, Joe Papa
- PyTorch Computer Vision Cookbook, Michael Avendi

- Deep Learning with Python, Chollet
  - Easy, practical introduction, many code examples
  - Code is in TensorFlow rather than PyTorch
- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Geron
  - General machine learning and deep learning
  - Practical book, TensorFlow rather than PyTorch

1.6 What are the learning goals for the class?

- Learning to implement deep learning algorithms for visual computing applications
- Improving your **Python** and **PyTorch** implementation skills
- Learning the state of the research in selected topics in visual computing

1.7 How is the grade determined for the class?

- Projects (90%)
  - Each student has to work on 5 projects
  - All 5 projects have the same weight
  - The correctness of the program is 50% and the remaining 40% is your ability to answer questions either in person with a TA or an in-classroom test.
- Assignments and Quizzes (10%)
  - About 10-20 smaller assignments, projects, quizzes, reading assignments
- Participation
  - If you do not attend class or in extreme cases disturb the classroom experience for other students your grade can change downwards
  - This generally does not happen

1.8 What is the late policy?

- If you miss a deadline with justification:
  - If you have a **very important** reason not to be here we can certainly find a solution
  - You need **written documentation(!)** to state your case
  - You need to notify me as soon as possible
- Otherwise:
  - Late projects and assignments get a penalty of one grade step (e.g. A- becomes B+) if you submit within 2 weeks after the deadline.
  - If you submit more than 2 weeks late you get **0 points!**
- Note: not replying to TAs to schedule a demo can also incur a late penalty or result in 0 points awarded for a project.

1.9 Project Grading Procedure?

- After submitting a project you have to send an email to the corresponding TA to setup a grading appointment as soon as possible.
- Last possible appointment for grading a project is the last day of classes!
- During the grading appointment, the grader will ask questions about the project, including the provided code. You should be prepared to explain / reconstruct every line of code.

1.10 Ethics?

- It is unethical to bring to your instructor's attention the possible impact of your course grade on your future plans, including graduation, scholarships, jobs, etc. and argue for grade improvements without merit
- Violations of academic integrity include (but are not limited to) cheating, fabrication, tampering, plagiarism, or facilitating such activities
- **We plan to use automatic plagiarism checks!**
- It is **forbidden** to
  - post project code online
  - share your project code with other students
- You may discuss concepts at a higher level, but you cannot directly give project solutions to other students.

1.11 What is the attendance policy?

- Attendance is required
  - Announcements are made in class
  - Announcements might not be on the web pages, but I will try to post all important information on blackboard
- If you come to class you are expected to participate
- You can occasionally decide to skip class without notifying me if you have important work in other courses
- Attendance is not going to be monitored and it is not part of the grade

1.12 What are required skills?

- Programming skills (most important)
  - Python (or the ability to learn quickly)
  - Some initial experience with deep learning packages such as PyTorch, Keras, Tensorflow (or the ability to learn quickly) is helpful but not required
  - **Ability to write medium size programs**, debug, analyze the results, ...
- Machine Learning and Mathematics
  - It would be good to have background knowledge in Multi-variate Calculus, Linear Algebra, Probability, and Machine Learning
  - Optimization is beneficial for a minor part of the course
  - Example concepts that are used in class: functions, least squares, regression, validation set, loss function, ...