Hands-on AI based 3D Vision Summer 25

Lecture 1_0 – Organization

Prof. Dr.-Ing Gerard Pons-Moll
University of Tübingen / MPI-Informatics

EBERHARD KARLS
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Team

Lecturer

Prof. Dr.-Ing. Gerard Pons-Moll
2nd floor Mvl 6, room A19

Teaching assistants

Niklas Berndt
2nd floor MvL 6, room A14

Andrea Sanchietti
2nd floor MvL 6, room A12

Eyvaz Najafli

Team

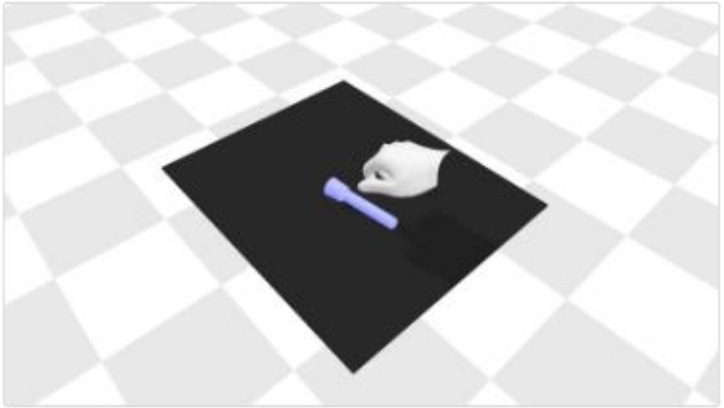
- I am a Professor in Computer Science at the University of Tübingen and the Tübingen AI center
- My group focuses on 3D computer vision and graphics
- Special focus on Virtual Humans – making machines human-like
- *I want to teach machines to see, perceive and act on the 3D world like humans do*

Lecturer

Prof. Dr.-Ing. Gerard Pons-Moll
2nd floor Mvl 6, room A19

Team

- I am a first year PhD student supervised by Prof. Dr. Pons-Moll
- Studied computer science and mathematics at RWTH Aachen
- Interested in analysis and synthesis of realistic and plausible human-object interactions



Teaching assistant

Niklas Berndt
2nd floor MvL 6, room A14

Team

- I am a first year PhD student in the Real Virtual Humans group
- Studied Computer Science at University of Rome La Sapienza
- My research topic concernes garment representation and reconstruction

Teaching assistant

Andrea Sanchietti
2nd floor MvL 6, room A12

Team

- Graduated from Master of Science in Machine Learning at the University of Tübingen
- Starting Ph.D. student in RVH
- Intersted in 4D reconstruction & generation

Teaching assistant

Eyvaz Najafli

Organization

- **Course webpage:**
  - https://virtualhumans.mpi-inf.mpg.de/3DVision25/
- **Lecture**
  - Tuesday 12-14, Sand
  - Tutorials on Tuesday 14-16, Sand
  - The course is 6 ECTS
- **Grade**:
  - 50% exam, 20% exercises, 30% project

- **ILIAS and Website**
  - Announcements, discussion forum on ILIAS
  - Exercises will be made available on ILIAS
  - Slides will be available from the course webpage
- **Work in teams**
  - Form teams up to 2 people
    - Add your team names on google docs (link)
    - Deadline: **April 21th 23:59PM CET**.
  - Exercises: Only 1 report per team

About Lectures and Tutorials

- Lectures and Tutorials will be in presence.

- It is really important that you **participate in class**. Any question is welcome. For example, *"I didn't understand slide XX"* or *"I'd like to know more about these type of models"* etc.

- Classes **will not** be recorded.

Tutorial / Exercises

- The exercises will consist of **theoretical questions** and also **programming exercises**
- The final exercise (project) will consist of a mini research project
- You can complete the exercises in teams of **2 people**
  - Form a “team” until next week Apr 21 23:59PM CET.
  - Add your team names on this google doc.
  - We will remove you from the course if your name is not there to leave slots for waiting list students.

Evaluation criteria

- Exam (Oral or written) 50 %:
  - Depending on the number of students exam will be oral or written
  - You need to pass the exam to pass the course
- Exercises (20%) + project (30%):
  - Exercises:
    - Evaluation of theoretical exercises is based on correctness and clarity
  - Project (mini-research project ~6 weeks) – we will evaluate
    - Completeness of the report, including motivation, prior work, methodology, evaluation, and limitations/discussion.
    - Whether the developed methods are substantial (not a small addition).
    - Robustness of the final result in the scale and scope it was developed.
    - We will have different TAs read the reports so that grading is unbiased.
- To pass the course, you need to pass the exercises, project and exam

Goal

After this course, students should be able to:

- Understand research papers related to 3D vision and be able to assess how they fit within the state of the art
- Develop classical and modern algorithms
  - camera parameters estimation, Structure-from-Motion, pointcloud processing, Neural Rendering techniques, Generative models

Requirements:

- Master course. Knowledge of linear algebra, probability theory and programming skills are required.

Lectures & Tutorials Schedule

Location:

- **Lectures:** A104, Sand
- **Tutorials:** A104, Sand

Lecture	Lecture Date & Time	Tutorial Date & Time	Lecture Title
Lecture 01	April 15, 12-14PM	April 15, 14-16PM	Introduction to 3D Computer Vision
Lecture 02	April 29, 12-14PM	April 29, 14-16PM	Camera Models and Coordinate Systems + **First exercise**
Lecture 03	May 06, 12-14PM	May 06, 14-16PM	Classical 3D Reconstruction Techniques
Lecture 04	May 13, 12-14PM	May 13, 14-16PM	Stereo Vision and Depth Estimation + **Second exercise**
Lecture 05	May 20, 12-14PM	May 20, 14-16PM	Surface reconstruction and Procrustes alignment
Lecture 06	May 27, 12-14PM	May 27, 14-16PM	Neural Fields and Point Based Representations + **Third exercise**
Lecture 07	June 03, 12-14PM	June 03, 14-16PM	Neural Radiance Fields (NeRF)
Lecture 08	June 10, 12-14PM	June 10, 14-16PM	Gaussian Splatting and Point Clouds + **project proposal**
Lecture 09	June 17, 12-14PM	June 17, 14-16PM	Advanced Methods in Learning-Based 3D Reconstruction
Lecture 10	June 24, 12-14PM	June 24, 14-16PM	Generative models
Lecture 11	July 01, 12-14PM	July 01, 14-16PM	SDS based methods
Lecture 12	July 15, 12-14PM	July 15, 14-16PM	Recap of concepts
Lecture 13	July 22, 12-14PM		Project Presentation. DEADLINE July 22 00:00 CET