Seminar in Computer Graphics
186.175, WS 2021/22, 2.0h (3 ECTS)

Stefan Ohrhallinger
Institute of Computer Graphics and Algorithms (E186)
TU Wien
http://www.cg.tuwien.ac.at/staff/StefanOhrhallinger.html
Important!

Register to course in TISS and TUWEL: to get news & updates

These slides will on TUWEL and institute website after this meeting

Official registration: by submitting the literature list

Topics are presented and chosen today, assigned tomorrow
Seminar Goals

Practice selecting, reading and understanding
- Search and select papers relevant to your topic
- Summarize them as a state-of-the-art report
- Prepare a talk about your topic in the seminar

This permits in-depth familiarization with the topic

More in-depth/specialized than Bachelor seminar!
If well done → can continue to master thesis ...
Tasks

- Submit a literature list (chosen with supervisor)
- Attendance of 3 lectures
- Meetings with supervisor: paper selection, discussion of papers, preparing talk slides
- Alternative: evaluate and compare algorithms
- Write a report
- Review a report from a colleague
- Final talk in seminar
Literature List

• Analyze recent papers (select with supervisor)
• Study secondary literature to understand topic
• How to find relevant papers:
  • SIGGRAPH Proceedings
  • Google Scholar: find the right key words
  • Survey papers, often-referenced papers
• Submits a list of 10+ papers to TUWEL → official registration
State-of-the-Art Report (STAR)

- 8 pages per student, must be in English
- Format in the style of a scientific paper
- Use LaTeX template on course website, can use Overleaf
- LaTeX tools and guides also on the website
- Submit the draft in PDF format
- Draft has to be complete and minimum 8 pages!
Scientific Review

- You will get a draft of another student to review
- Typical conference review form (Eurographics)
- This helps author to improve the manuscript
- Guides on review writing on course website
- You will receive 2 reviews (student, supervisor)
- Improve final report according to reviews
Seminar Talk

- Prepare slides in advance, using template
- Each student talks for 15 minutes, in english
- 5 minutes discussion after each talk
- Focus is on overview/comparison of methods
- Present so that other students will understand it
- Active discussion is mandatory and is graded
- Slides presentation from your device on Zoom
Grading

- Lecture attendance 5%
- Review: 15%
- Seminar slides+talk: 30%, discussion 5%
- Final report: 45%

- Late submission: 15% off task per day, so no points after 1 week (this also concerns the draft!)
Important Dates

- 25.10. 23:59 Submit literature list (on TUWEL)
- 11.11. 13:00-15:00 Lecture Prof. Wimmer
- 17.11. 13:00-15:00 Lecture Prof. Kaufmann
- 24.11. 13:00-15:00 Lecture Prof. Gröller
- 13.12. 23:59 Submit report draft
- 10.01. 23:59 Submit review
- 24.01. 23:59 Submit slides
- 25.01. 13:00-18:00 Seminar talks
- 25.01. 23:59 Submit final report
Topic Presentation

• Now 20 topics will be presented
• After the presentation, please mark down at least 3 in order of preference (1, 2, 3, …) and post your preferences in forum “Discussions” until the end of the day
• I will try to make a fair assignment of topics in case of conflicts and post them in forum “Announcements”
1 Generic Skeleton Extraction From Point Clouds

- Extract skeletons from point clouds for generic objects
- Recover occluded parts from time-varying series
- Recover fine-grained parts


Stefan Ohrhallinger
2 Action Learning with Context Objects

- Learn Actions from Human Skeletons
- Use Labeled Objects as Context


Stefan Ohrhallinger
3 Modeling and Simulation of Plants

- Generate 3D geometry for single plants
- Explore dynamic growth, physical models, etc.

4 Interactive Lighting Design

- Explore interactive and artistic approaches to lighting design
- Sketch-based, interactive exploration, indirect manipulation...

5 Camera Pose Estimation

Figure 1. (a) A section of the 3D point cloud from Shop Facade dataset [10]. (b) An RGB query image to be localized in 3D point cloud (c) Visualization of the area of the 3D point cloud, identified by our technique as the location of the query image.


Philipp Erler
6 Denoising Point Clouds

Investigate denoising techniques for point clouds

Noisy input reconstructed with Poisson

Denoised result reconstructed with Poisson

Ground truth surface

7 Shape and Topology Optimization

Narrow-Band Topology Optimization on a Sparsely Populated Grid, Liu et al., ACM Transactions on Graphics (SIGGRAPH Asia 2018)

via Wikimedia
User:Meenakshsundaram
A System for High-Resolution Topology Optimization, Wu et al., TVCG 2016

Potential MSc thesis project:
Shape / Topology Optimization of Light Sources
(w/ global illumination / ray tracing)
A Massively Parallel And Scalable Multi-GPU Material Point Method
Wang, et. al (SIGGRAPH 2020)

Implicit FEM and fluid coupling on GPU for interactive multiphysics simulation, Allard et al., SIGGRAPH 2011
Provide an overview of techniques that leverage machine learning for rendering.
Provide an overview of global illumination rendering techniques for virtual and augmented reality.
Pick a game with high-end 3D graphics and analyze how a frame is rendered!

**Warning:** This seminar topic will involve hands-on work, because *you* are supposed to do the frame analysis!

- Use a frame debugging tool like [NVIDIA Nsight Graphics](https://developer.nvidia.com/nsight) or [RenderDoc](https://renderdoc.org/)
- You **may** choose a game that has been analyzed before by others to make better progress (see, e.g., [Adrian Courrèges’ Graphics Studies Compilation](http://www.fly3d.com/graphics-studies), or similar sources)

In your seminar paper, describe the results of your frame analysis, **and** describe rendering techniques used by the game in-depth!

- It is not always easy to figure out which technique a game uses exactly. Therefore, research the state of the art of a specific effect (e.g., ambient occlusion, or shadows) and make an educated guess which variant the analyzed game might have used!
- Perform this in-depth effect analysis for multiple (at least 2) effects!

This topic is offered **twice**. Different games and effects must be analyzed.
Generating mesoscale structures with target elastic properties

Panetta et al., 2017

Martínez et al., 2016

Panetta et al., 2015
As an intermediate stage in piece-wise planar reconstruction, one extracts a cellular complex – intersection of all planes with each other.

Given such complex, how to label cells or facets to extract a polygonal mesh?

14 Compute Shaders

- Investigate a mix of several different uses for compute shaders
- Sorting, Rendering, Processing, etc.

Markus Schütz
15 Compression

- Present modern compression techniques for geometry and textures
- Differences between compression for disk-storage and rendering?
- Perf of encoding and decoding; Compression ratio; ...

Markus Schütz
16 Neural Representation of 3D Data

Implicit Neural Representations with Periodic Activation Functions
Figure 7. Plume simulation with “Arch” geometry. Left: PCG. Middle small-model Right: this work.

Jonathan Tompson, Kristofer Schlachter, Pablo Sprechmann, Ken Perlin. Accelerating Eulerian Fluid Simulation With Convolutional Networks
Conduct a survey of the state-of-the-art in Real-time Physics Simulation
Conduct a survey of the state-of-the-art in Physically Based Rendering
Calculating the illumination from area lights is a non-trivial problem in real-time rendering and requires thought-out solutions.
• Please please mark down at least 3 topics in order of preference (1, 2, 3, …) and post your topic preferences in forum “Discussions” until the end of the day

• I will try to make a fair assignment of topics and post them in forum “Announcements”
Questions?

- Get in contact with your supervisor ASAP
- Discuss literature list with your supervisor
- Submit the list to TUWEL by 25.10.