Seminar in Computer Graphics
186.175, WS 2023/24, 2.0h (3 ECTS)

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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
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/spezialized 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
• 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
• 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 seminar PC (ODP, PPTX, PDF)
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

• 23.10. 23:59 Submit literature list (on TUWEL)
• 09.11. 13:00-15:00 Lecture Prof. Gröller
• 16.11. 13:00-15:00 Lecture Prof. Kaufmann
• 23.11. 13:00-15:00 Lecture Prof. Wimmer
• 18.12. 23:59 Submit report draft
• 08.01. 23:59 Submit review
• 23.01. 23:59 Submit slides
• 24.01. 09:00-13:00 Seminar talks
• 24.01. 23:59 Submit final report
• Now 17 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” tomorrow
Denoising Point Clouds

Investigate denoising techniques for point clouds

2 Solving PDEs with Monte-Carlo methods

\[ \nabla \cdot (\alpha \nabla u) + \bar{\omega} \cdot \nabla u - \sigma u = -f \quad \text{on } \Omega, \\
0 \quad \text{on } \partial \Omega. \]


Fig. 5. A source term \( f \) can be approximated via a single random sample \( y_i \) at each step.

3 Surrogate-based optimization and learning

- (Lighting) Design optimization
- Expensive (differentiable) simulations
- Fit an inexpensive model
- Speed up design process
- Allow interactive editing
Some shapes can be described...
- in parametric form, e.g. \([u, v] \rightarrow [x, y, z]\)
- in implicit form, e.g. \(F(x, y, z) = c\)

Which shapes are possible?

How to render parametrically described shapes?

How to render implicitly described shapes?
- e.g. Signed Distance Fields

Properties, Restrictions?

Possible applications and usage scenarios?

Rendering performance?

State of the art? Latest advances?

Johannes Unterguggenberger
Conduct a survey of recent advances in the representation and application of measured materials.
6 Wave-Optics Rendering

- What is it all about...
  - Difference to regular ray optics

A Generalized Ray Formulation For Wave-Optics Rendering.
Steinberg et al. 2023

Lukas Lipp
7 Real-time Weather Systems

Clouds/Atmosphere

Emission: Northern Lights/Lightning

Particles: Snow/Rain

Wind


https://www.youtube.com/watch?v=d61_o4CGQd8

Annalena Ulschmid
Towards Real-time Fluid Simulations

Ocean Simulation using FFT
https://dl.acm.org/doi/10.1145/2791261.2791267

Fluid Flux 2.0 – UE5

Annalena Ulschmid
Inverse Kinematics
https://www.youtube.com/watch?v=sVntwsrjNe4

Learning-based approaches
https://github.com/sebastianstarke/AI4Animation

Complementary Dynamics
https://www.dgp.toronto.edu/projects/complementary-dynamics/

Annalena Ulschmid


Manfred Klaffenzöck
11 Mesh improvements using photos

Adam Celarek

(own work)
12 Terrain Rendering Systems

- 2.5D and 3D Terrain rendering
- Level of Detail (LoD)
- Planetary scale
Investigate different use-cases for hardware RT cores.


Lukas Herzberger
14 Datasets for Deep Learning

- Focus on 3D Reconstruction
- Sizes, Properties, Benchmarks

3D Reconstruction on DTU

https://paperswithcode.com/sota/3d-reconstruction-on-dtu

Philipp Erler
Photogrammetry: turn photos into a colored 3d model

Theory: Describe the algorithms used in AliceVision (Meshroom default pipeline) and find weak spots

Practical: Explain the influence of the many parameters and find a good setup for our test data

https://sketchfab.com/blogs/community/tutorial-meshroom-for-beginners
https://alicevision.org/#meshroom

Philipp Erler
16 Spatial Hashing

- Space Partitioning with hash maps
  - Huge ("infinite"?) "sparse grid" instead of quadtree, octree, ...
- Hash map entries for occupied space (cells)
- O(n) lookup of geometry around given world coordinate
- Investigate algorithms, use cases, etc.

Markus Schütz
17 Sorting on the GPU

- Overview over various sort algorithms
- Advantages, Limitations, Performance, ...

https://www.youtube.com/watch?v=BeoCbJPUvSE

Markus Schütz
Topic Assignment

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Questions?

- Get in contact with your supervisor ASAP
- Discuss literature list with your supervisor
- Submit the list to TUWEL by 23.10.