Seminar Wissenschaftliches Arbeiten
180.765, SS 2019, 2.0h (3 ECTS)

Philipp Erler
https://www.cg.tuwien.ac.at/staff/PhilippErler.html

Research Division of Computer Graphics
Institute of Visual Computing & Human-Centered Technology
TU Wien, Austria
There is a common first part – this is **second part**

- New organizer
- Switching from pure mail to TUWEL
- These slides will be on TUWEL after this meeting
- Topics are presented and assigned here today
- Organization via TUWEL
  [https://tuwel.tuwien.ac.at/course/view.php?id=17116](https://tuwel.tuwien.ac.at/course/view.php?id=17116)
- General information on LVA site
  [https://www.cg.tuwien.ac.at/courses/WissArbeiten/](https://www.cg.tuwien.ac.at/courses/WissArbeiten/)
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
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
- Final talk in seminar
Literature List

- Analyze recent papers (select with supervisor)
- Study secondary literature to understand topic
- How to find relevant papers:
  - Digital libraries: IEEE, ACM, ...
  - Google Scholar: key words and operators
  - Survey papers, often-referenced papers
- Submit a list of 10+ papers per email to supervisor & me
  \(\rightarrow\) official registration
State-of-the-Art Report (STAR)

- 8 pages per student, preferably in English
- Format in the style of a scientific paper
- Use LaTeX template on course website
- LaTeX tools and guides also on the website
- Submit the draft in PDF format, per email to supervisor+organizer
- Draft has to be complete and min. 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, pref. 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
- Submitted slides are presented on seminar PC
Grading

- First part: 17%, second part: 83%, thereof:
  - Lecture attendance 5%
  - Review: 20%
  - Seminar slides+talk: 30%, discussion 5%
  - Final report: 40%

- Late submission: 15% off per day, max. 1 week
Important Dates

- 21.03. 23:59 Submit literature list
- 11.04. 11:00 – 13:00 Lecture Prof. Wimmer
- 08.05. 15:00 – 16:30 Lecture Prof. Gröller
- TBA Lecture Prof. Purgathofer
- 23.05. 23:59 Submit report draft
- 26.06. 23:59 Submit slides
- 27.06. 08:00 – 13:00 Seminar talks
- 27.06. 23:59 Submit final report
Now, topics will be presented

Topic assignment:
- Pick 1\textsuperscript{st}, 2\textsuperscript{nd} and 3\textsuperscript{rd} choice
- I will try to assign preferences
- Double assignment or groups if more students than topics
1 Surface Representations for Machine Learning

Fixed size of input for neural networks → special data structures

Weather simulation is too complicated to compute in detail → estimate with machine learning

https://commons.wikimedia.org/wiki/File:AtmosphericModelSchematic.png

3 Surface Reconstruction

- Reconstruction from (oriented) point clouds
  - Explicit reconstruction methods
  - Implicit reconstruction methods
4 Matching in 3D Shape Retrieval

- Correspondence between 3D shapes
  - Feature based
  - Graph based
  - View based
  - ...

![Feature based](image1)

![Graph based matching](image2)
provide an overview of specialized ray-tracing hardware in research and industry
provide an overview of rendering techniques used in the film industry (and how they differ to those in research)
7 Post Process Anti-Aliasing

- "Good old" spatial anti-aliasing methods:
  - SSAA, MSAA, CSAA

- Shiny new post process anti-aliasing techniques:
  - MLAA, FXAA, TXAA, DLSS, ...
Investigate techniques for rendering reflections in real time. Focus also on recent advances!

- Env. Mapping (+Parallax Corrected Cube Maps)
- Voxel-based reflections
- Screen-Space Reflections
- Real-Time Ray Traced Reflections
Conduct a survey on applications of neural networks in computer graphics and rendering.
Conduct a survey on recent advances in inverse rendering.

Figure 1: From a single image (col. 1), we estimate albedo and normal maps and illumination (col. 2-4); comparison multi-view stereo result from several hundred images (col. 5); re-rendering of our shape with frontal/estimated lighting (col. 6-7).
Generating mesoscale structures with target elastic properties

Panetta et al., 2017
Martínez et al., 2016
Panetta et al., 2015
Which funicular forms can be achieved under given constraints?
13 Volume Rendering

Investigate state-of-the-art techniques and current possibilities & limitations
Investigate rendering techniques that focus on improving performance and quality of VR apps (e.g. Multi-Res Shading, Monoscopic Far Field, Precomputed ray-traced light-field, ...)

Markus Schütz
15 Shot Boundary Detection Algorithms

- Classic and recent advances to detect transitions in videos / movies
  - hard cuts
  - gradual transitions
Research most recent trends and developments

The survey could possibly focus on
- graph exploration
- on-site visualizations

Topic Assignment

- Topic assignment:
  - Pick 1\textsuperscript{st}, 2\textsuperscript{nd} and 3\textsuperscript{rd} choice
  - I will try to assign preferences
  - Double assignment or groups if more students than topics
- Fill in name, student number and email
- Hand in the sheet
- I will publish the assignment on TUWEL
1. Surface Representations for Machine Learning
2. Weather Forecast using Machine Learning
3. Surface Reconstruction
4. Matching in 3D Shape Retrieval
5. Ray-Tracing Hardware
6. Demystifying Computer Generated Imagery for Films
7. Post Process Anti-Aliasing
8. Reflections in Real-Time Applications
9. Neural Networks in CG
10. Inverse Rendering
11. Computational Metamaterials
12. Form-finding for Shell Structures
13. Volume Rendering
14. Virtual Reality Rendering Techniques
15. Shot Boundary Detection Algorithms
16. Immersive Data Visualization
Questions?

- Get in contact with your supervisor ASAP (when the assignments are fixed and 1\textsuperscript{st} part is passed)
- Discuss literature list with your supervisor
- Submit the list (to supervisor and me) by 21.3.