WS 2020

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Institute of Visual Computing & Human-Centered Technology
TU Wien, Austria
Important

- Always check up-to-date information on institute webpage
  http://www.cg.tuwien.ac.at/courses/2020W/WissArbeiten/SE

- Always check up-to-date information on TUWEL page
  https://tuwel.tuwien.ac.at/course/view.php?id=31186

- If you want to participate in other seminars (e.g. Seminar aus Visualisierung),
  please contact: wu@cg.tuwien.ac.at
Seminar

- Get an idea how scientific work is carried out (in Visualization / CG)
- Practice to review literature and get familiar with a particular scientific topic
  - Selecting, reading and understanding
  - Summarizing and explaining (orally and written)
  - Comparing and discussing
- Practice to give a talk
- Active discussion participation
1. Select a topic
Topics are available at
https://www.cg.tuwien.ac.at/courses/2020W/WissArbeiten/SE

TUWEL: https://tuwel.tuwien.ac.at/course/view.php?id=31186

Important!!
Register on TU WEL
Initial Meeting: 22th October

Topic selection start:
23th October 2020, 08:00

Topic selection due to:
27th October 2020, 23:59

First come first serve
Seminar - Procedure

1. Select a topic
2. Submit a literature list
Submit a Literature List

- Meeting with Supervisor
- List of papers related to the topic
- Literature List Deadline: 05.11.2020
Seminar - Procedure

1. Select a topic
2. Submit a literature list
3. Attend 3 lectures
Attend 3 Lectures

- Video lecture
  *Wie schreibt man eine wissenschaftliche Arbeit*
  Professor Wimmer

- Video lecture
  *Forschung und wie sie funktioniert*
  Professor Gröller

- Video lecture
  *Wie halte ich einen Vortrag*
  Professor Purgathofer
Seminar - Procedure

1. Select a topic
2. Submit a literature list
3. Attend 3 lectures
4. Write a report
Write a Report

- State-of-the-Art Report
- Final Report: 6-8 pages (min. 6 pages)
- In English
- Format as for a scientific paper
  - LaTeX (Template on the webpage)
- Regular Meetings with Supervisor

Deadline Final Version Report: **15.01.2021**
Seminar - Procedure

1. Select a topic
2. Submit a literature list
3. Attend 3 lectures
4. Write a report
5. Give a presentation
Give a Presentation

- Use institute’s PowerPoint template for presentations (template is on the webpage)
- In English
- 15 + 3 minutes
- Active discussion participation

Presentation Day: **17.12.2020**

In case of too many students, an additional presentation day will be announced and/or the length of the presentation will be adjusted. This will be communicated in advance.
Seminar - Procedure

1. Select a topic
2. Submit a literature list
3. Attend 3 lectures
4. Write a report
5. Give a presentation
Grading

- Two parts
  - 1\textsuperscript{st} (central) part: 17\% of the grade
  - 2\textsuperscript{nd} part: 83\% of the grade
    - It is necessary to attend the 3 lectures to get a positive grade!
  - Grading criteria:
    - 50\% written report
    - 40\% presentation
    - 5\% attendance during the presentations
    - 5\% active discussion after the presentations
Report Grading

- Grading criteria:
  - Structure, figures,...
  - Language
  - Content
  - References

- Points will be deducted for:
  - Delayed submission
  - Page number below 6

- Plagiarism check!
“plagiarism involves the use of another person's work without full and clear referencing and acknowledgement”

http://tim.thorpeallen.net/Courses/Reference/Citations.pdf
Presentation Grading

Grading Criteria

- Content Expertise
- Didactic / Preparation
- Presentation Technique
- Overtime
Important Dates

- **23.10.2020**: Select your topic
- **05.11.2020**: Submit your literature list
- Attend 3 lectures (in ICGA seminar room):
  - **Video lecture**: Wie schreibt man eine wissenschaftliche Arbeit
  - **Video lecture**: Wie halte ich einen Vortrag
  - **Video lecture**: Forschung und wie sie funktioniert
- **06.12.2020**: Submit the report
- **17.12.2020**: Talks
- **15.01.2021**: Submit final report

All submissions are done on TUWEL [https://tuwel.tuwien.ac.at/course/view.php?id=31186](https://tuwel.tuwien.ac.at/course/view.php?id=31186)
Topics 2020/2021
1. Smart Camera Control

- Research and summarize methods used for (semi-)automated camera control in interactive applications.
- Methods which can be applied in scientific visualization and leverage specific data characteristics in a “smart” way are to be preferred.
2. Summarizing and Exploring Extremely Long Videos

- Investigate methods for gaining information from extremely long video footage, e.g., from surveillance cameras
- Focus on methods that either summarize the interesting actions captured or enable less cumbersome exploration (playback) of these media
Scientists as well as practitioners often need to compare multiple datasets, for example results of feature characteristic derived from segmented images or nD data from simulation. Current strategies typically focus on dimensionality reduction techniques (e.g., PCA, MDS, t-SNE), computing similarity metrics (e.g., Euler distance in nD) or comparing individual characteristics with each other using conventional visualization techniques (e.g., scatter plots, parallel coordinate plots). Your task is to provide an overview over the state-of-art in methods for comparing multiple high dimensional datasets.

Source: Pham et al., Quantitative Approach on Parallel Coordinates and Scatter Plots for Multidimensional-Data Visual Analytics
4. Visualization Techniques for AR/VR Applications in Material Science

Virtual and augmented reality has come to stay and is used in many application domains. AR and VR feature the potential to boost data analysis through more intuitive insights and more intuitive interactions; the transfer of the spatiality is intuitive and probably more effective than when rendering the same scene on a 2D monitor. Virtual and augmented reality have the potential to help in a variety of tasks such as quality control / parts inspection, the characterization of the micro-structure of materials, or the visualization of atomic structures. Your task is to provide an overview on the state of the art regarding methods in virtual and augmented reality: where these be used to support material science tasks, what are their benefit, what are their limitations.
When directly visualizing (potentially multi-variate) volume datasets, a transfer function is required. Current tools for this purpose are often unintuitive; its often not clear how changes in the transfer function will affect the resulting visualization; using volume visualization tools therefore first requires a certain experience by the user, as well as often a trial and error approach to color the volume in the desired fashion. Recently, methods have emerged that simplify this process, or provide guidance to the user. Your task is to provide a survey on the state of the art of methods guiding users in setting up transfer functions for volume visualization.
6. Visualization of Bipartite / k-Partite Graphs

- Graph with vertices divided into two independent sets, such as:
  - People and affiliations, genes and conditions, actors and movies
- Which visualization techniques exist?
- How to explore a k-partite graph interactively?

[Sun et al., BiSet, TVCG 2016]

[Streit et al., Furby, BMC Bioinformatics 2014]
7. Visualization of Networks in Virtual Reality

- Immersive analysis of 3D graphs in virtual reality from the 90ies to now:
  - Rendering & graph layout
  - Embodied interaction & effective locomotion

[Osawa et al., 2000]  [Drogemuller et al., 2017]  [Kwon et al., 2016]
8. Automatic Layout Generation

- Layout algorithms for computational composition of many media (text, images, etc.) into a single:
  - Magazine cover
  - Advertisement or banner
  - Poster ...

[Liang et al., BigMM 2018]

[Jahanian et al., IUI 2013]

[Yin et al., MM 2013]
9. Visualization of Dynamical Systems
10. Visualization of Text in Voynich Manuscript

Folio 68

Folio 48

Common syllables in a Roman book, showing entire volume

Some common Voynichese syllables
11. Visualization and Uncanny Valley
12. Hierarchical Aggregation for Information Visualization

Nicolas Grossmann
13. Parallel Coordinates

Can we model how humans see visualizations?
Real-time Lighting
16. Modern Particle Systems
17. Special Effects in Computer Graphics
18. Network Visualization for Biological Pathways

**Challenge:**
- Layout simplification and arrangement
- Scalability, complexity, and usability
19. Machine Learning in Graph Visualization

Challenge:

Formulation for machine learning technique
20. Data Physicalization

**Challenge:**
- Geometry
- Combinatorial complexity
- Optimization
21. HDR tone mapping techniques

- Compress HDR images/renderings to display on LDR screens
- Explain and compare different approaches and methods
  - Global vs. local
  - Perception based
  - Subjective quality
22. Interaction in Virtual Reality

- Mouse and keyboard not suited for VR input
- Evaluate input devices and interaction methods such as
  - Different controllers
  - Eye-tracking interaction
  - Locomotion methods
23. Perception in Visualization

- Better comprehension of visualized data by taking human perception into account
- Explore major influences of perception, e.g.,
  - Color schemes
  - Data representation
  - Attention cues
- ... and how they can be used to improve various visualizations
Topics 2020/2021

1. Smart Camera Control
2. Summarizing and Exploring Extremely Long Videos
3. Comparative Visualization of High Dimensional Data
4. Visualization Techniques for AR/VR Applications in Material Science
5. Guidance Methods for Transfer Function Specification
6. Visualization of Bipartite / k-Partite Graphs
7. Visualization of Networks in Virtual Reality
8. Automatic Layout Generation
9. Visualization of Dynamical Systems
10. Visualization of Text in Voynich Manuscript
11. Visualization and Uncanny Valley
12. Hierarchical Aggregation for Information Visualization
13. Parallel Coordinates
15. Real-time Lighting
16. Modern Particle Systems
17. Special Effects in Computer Graphics
18. Network Visualization for Biological Pathways
19. Machine Learning in Graph Visualization
20. Data Physicalization
21. HDR tone mapping techniques
22. Interaction in Virtual Reality
23. Perception in Visualization
Questions?

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