Seminar in Visual Computing
193.199, WS 2025/26, 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 ...

- 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

- Submit 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

- Provide a way to show changes from mid-term to final report

- Submit the draft and final report in PDF format

- Draft report 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

- 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)

- 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 report!)

Important Dates

- 20.10. 23:59 Submit literature list (on TUWEL)
- 28.10. 12:00-14:00 Lecture Prof. Gröller
- 11.11. 12:00-14:00 Lecture Prof. Wimmer
- 20.11. 11:00-13:00 Lecture Prof. Kaufmann
- 15.12. 23:59 Submit report draft
- 05.01. 23:59 Submit review
- 26.01. 23:59 Submit slides
- 27.01. 12:00-17:00 (depending) Seminar talks
- 27.01. 23:59 Submit final report

- Now 15 topics will be presented

- Please mark down at least 3 in order of preference (1, 2, 3, …) and post your preferences in the TUWEL 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

Conduct a survey of recent advances in the representation and application of measured materials

Christian Freude
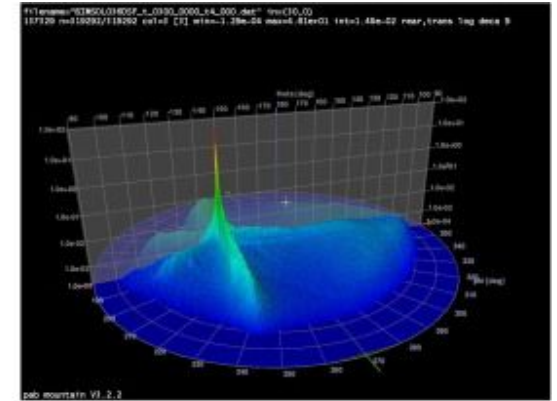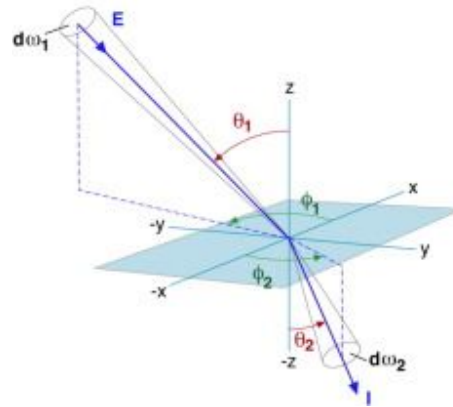
Representing Surfaces and Volumes in one Unified Model

- ### Stochastic Geometry

$$f \sim GP(\mu, k)$$

$$\mathcal{L}\langle f\rangle_{GP} \quad \neq \quad \langle \mathcal{L}f\rangle_{GP}$$
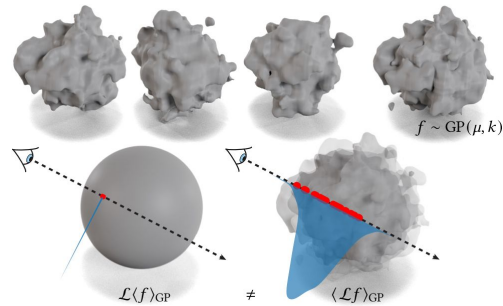
Seyb, et al. "From microfacets to participating media: A unified theory of light transport with stochastic geometry." *ACM Transactions on Graphics (Proceedings of SIGGRAPH)*. Vol. 43. No. 4. ACM, 2024.

- ### Non-Exponential Transmittance Model
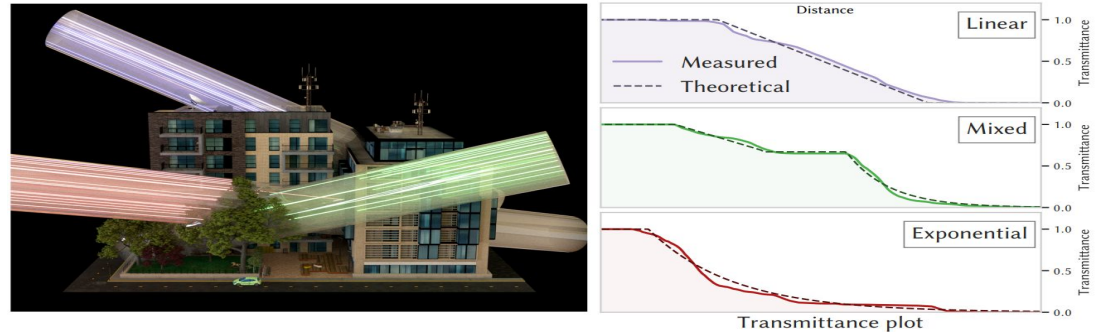
Vicini, et al. "A Non-Exponential Transmittance Model for Volumetric Scene Representations." *ACM Transactions on Graphics (Proceedings of SIGGRAPH)*. Vol. 40. No. 4. ACM, 2021.

3 Real-Time Super Resolution and Frame Generation

- Super resolution and frame generation allows games to be rendered at lower spatial and temporal resolution, and then upsampled for better performance.
- Solutions like DLSS, FSR and XeSS are already put into production, but there is still space for improvement, for instance:
    - higher supersampling rate (higher resolution / multiple frame generation)
    - better spatio-temporal stability in predicted frames
    - compatibility with low-end hardware/mobile devices

Chuyan Zhang
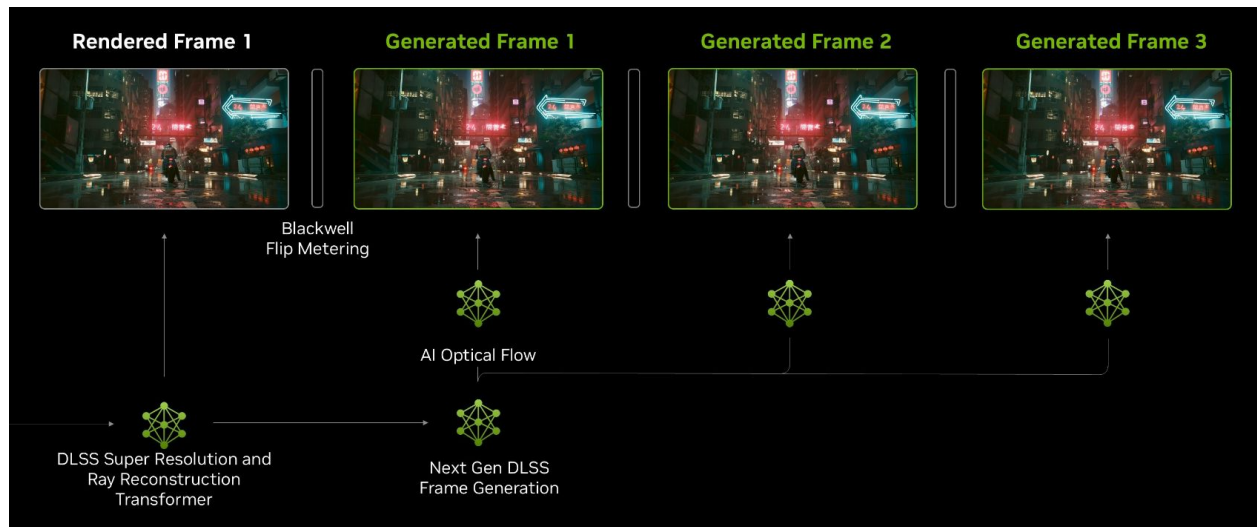
- stroke-based
- mesh-based
- time-reversed
- …
- character animation

https://diglib.eg.org/server/api/core/bitstreams/5a2348b1-93e2-4d6d-ad03-0a3feabc4448/content

https://graphics.pixar.com/library/ElementalAir/paper.pdf

Annalena Ulschmid

https://diglib.eg.org/server/api/core/bitstreams/ff65f713-b902-4b79-a6bf-43dbc4eabf42/content
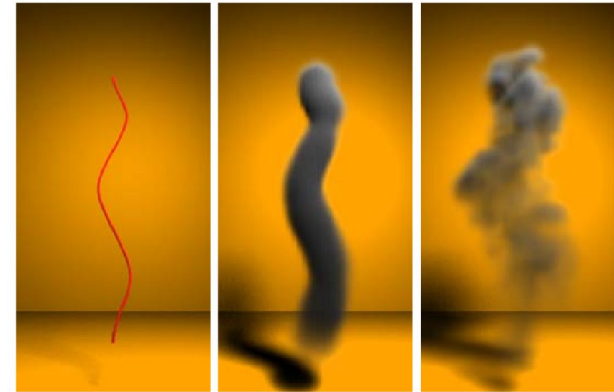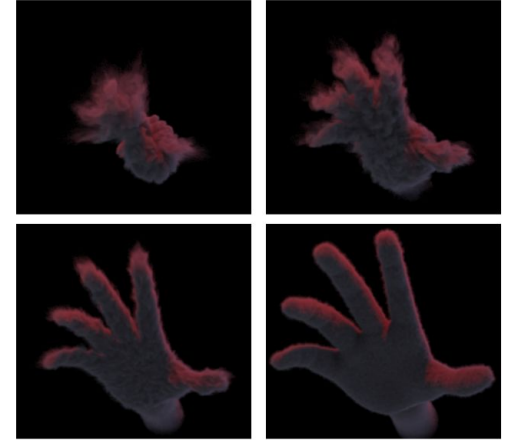
- particle-based
- mesh-based
- …
- character animation

https://dl.acm.org/doi/pdf/10.5555/2422356.2422393

https://onlinelibrary.wiley.com/doi/epdf/10.1111/cgf.14103

Annalena Ulschmid

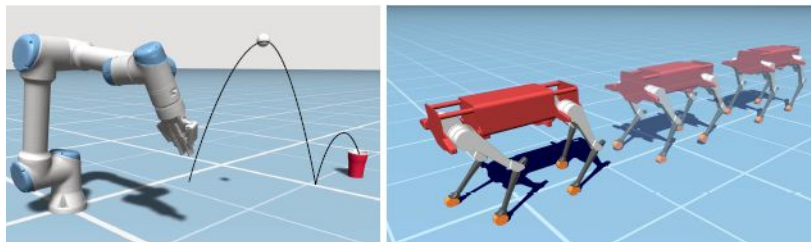https://graphics.pixar.com/library/ElementalShaping/paper.pdf
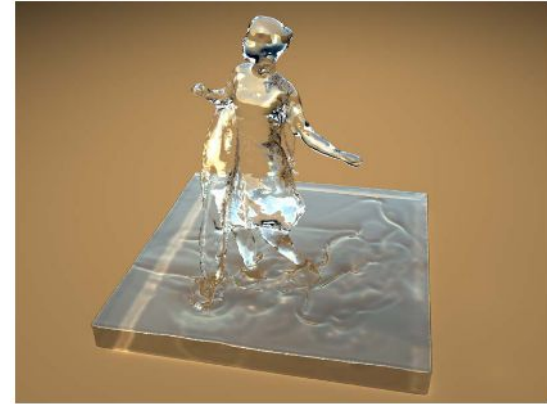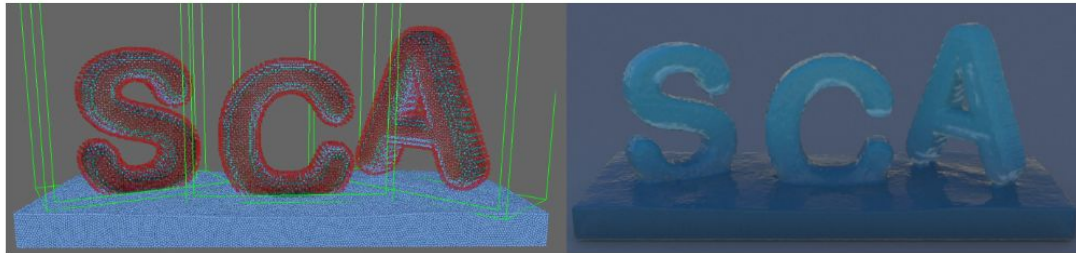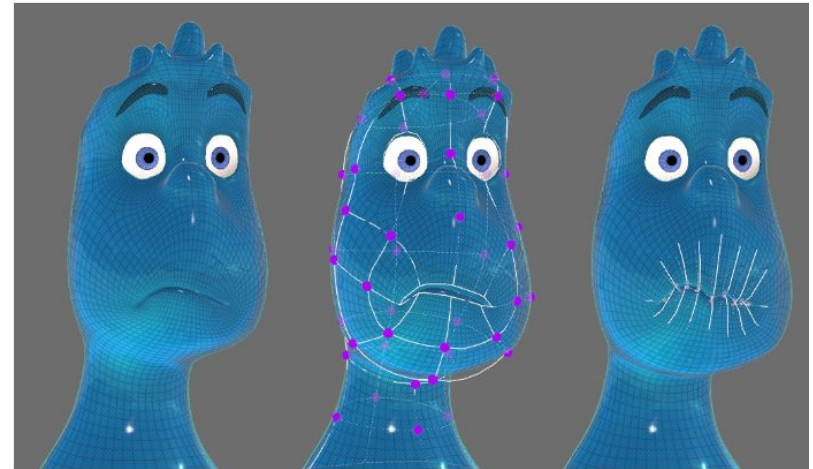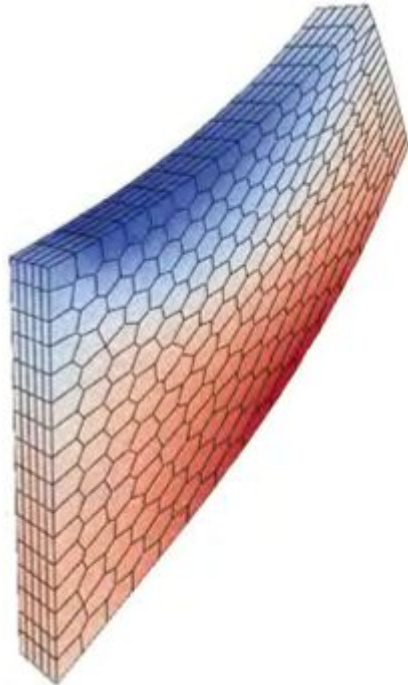
Stabilization-free virtual element method for 3D hyperelastic problems Xu et al, Computational Mechanics (2025) 75:1687–1701
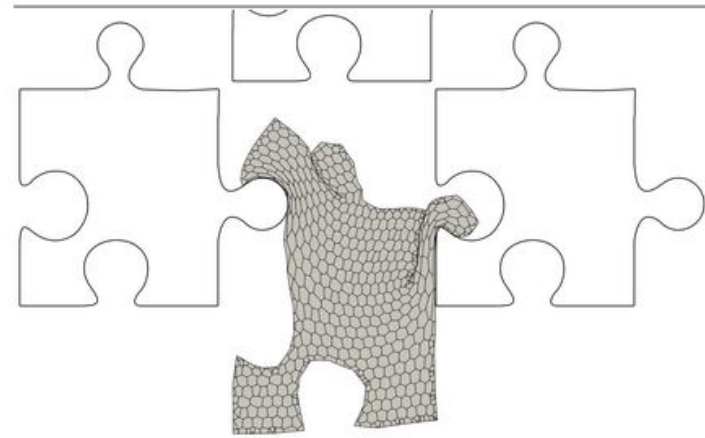
Polyhedral Discretizations for Elliptic PDEs, Liu et al., https://arxiv.org/pdf/2412.06164v1
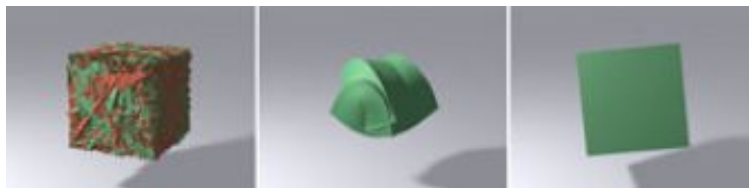
David Hahn
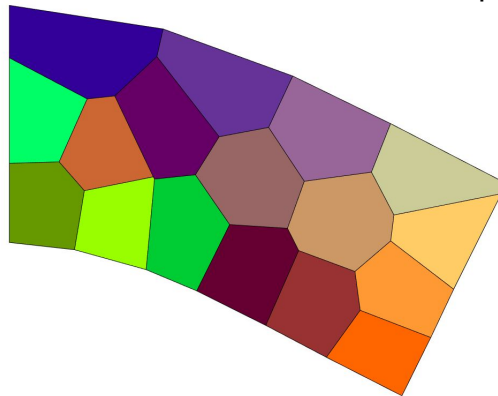
7 Non-linear Optimization in Computer Graphics

ADD: Analytically Differentiable Dynamics for Multi-Body Systems with Frictional Contact, Geilinger et al., SIGGRAPH Asia 2020
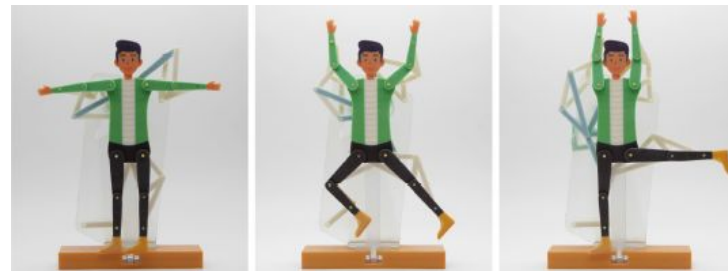

Computational Design of Planar Multistable Compliant Structures, Zhang et al., SIGGRAPH Asia 2021

$$\min \ f(\mathbf{x})$$
$$\text{s. t.} \ \ \mathbf{g}(\mathbf{x}) = 0$$

Real2Sim: Visco-elastic parameter estimation from dynamic motion, Hahn et al., SIGGRAPH Asia 2019

Optimization Integrator for Large Time Steps, Gast et al., TVCG 2015
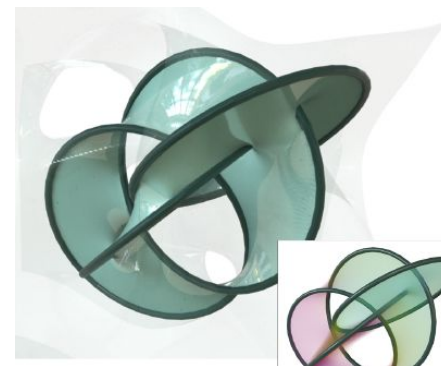
Computing Minimal Surfaces with Differential Forms, Wang and Chern, SIGGRAPH 2021

David Hahn

- Discontinuity on geometry edges makes it hard to differentiate the rendering process.
- Multiple methods can be used to address this problem, maintaining unbiased gradient estimation while reducing variance:
  - Addition sampling on edges
  - Reparameterization into a different sampling space

Chuyan Zhang
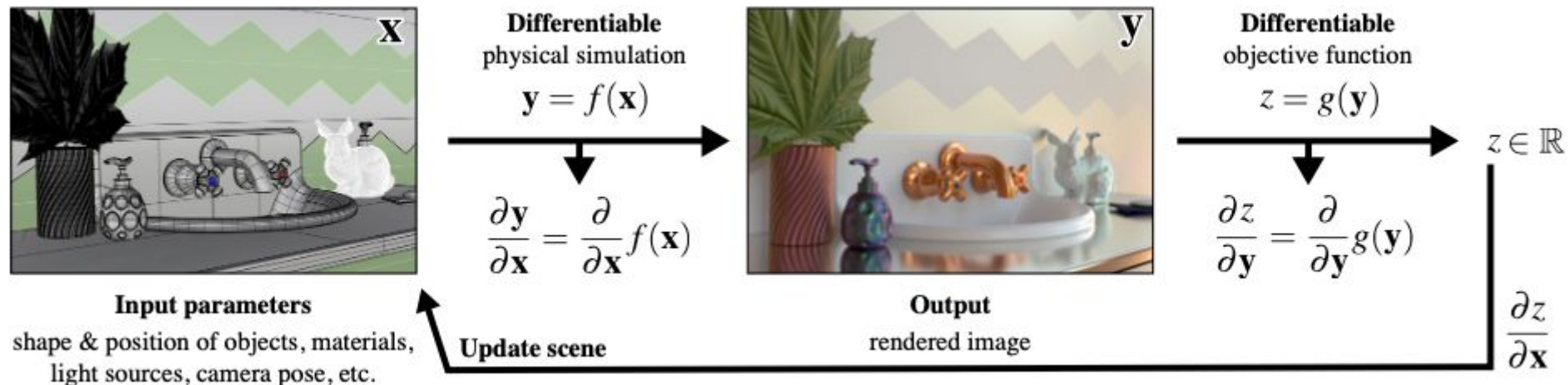
- Normalizing flows are machine-learned probability distributions, useful for CG methods such as path guiding
- Provide an overview of the theoretical background and the current methods

$$z_0 \xrightarrow{f_1(z_0)} z_1 \cdots \xrightarrow{f_i(z_{i-1})} z_i \xrightarrow{f_{i+1}(z_i)} z_{i+1} \cdots \xrightarrow{f_k(z_{k-1})} z_k = x$$

$$z_0 \sim p_0(z_0) \qquad z_i \sim p_i(z_i) \qquad z_k \sim p_k(z_k)$$

Hiroyuki Sakai
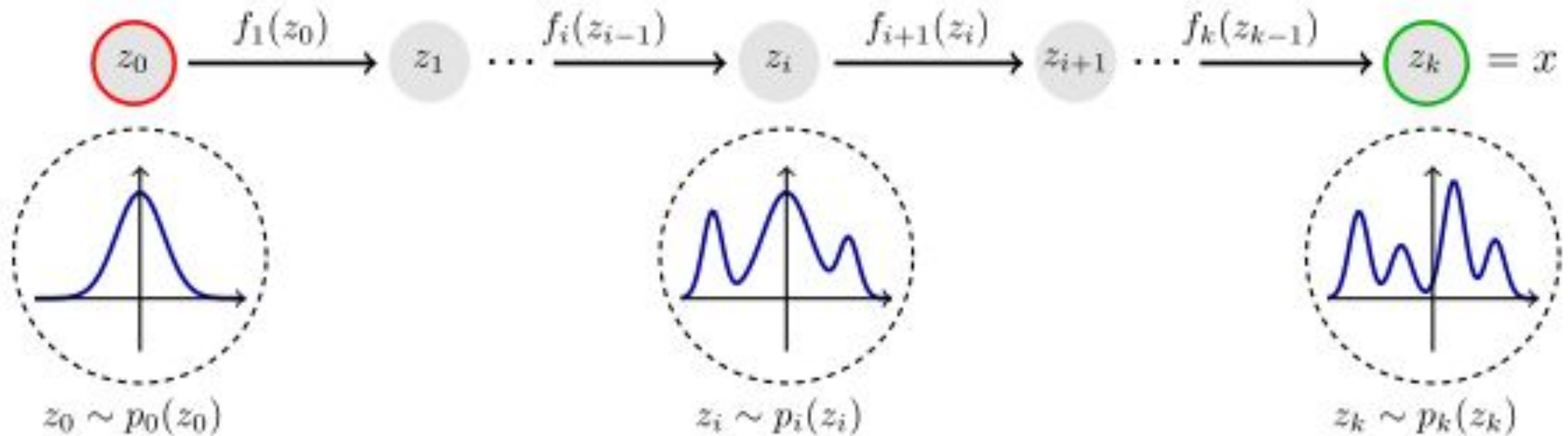
How do Lidar rays interact with materials?
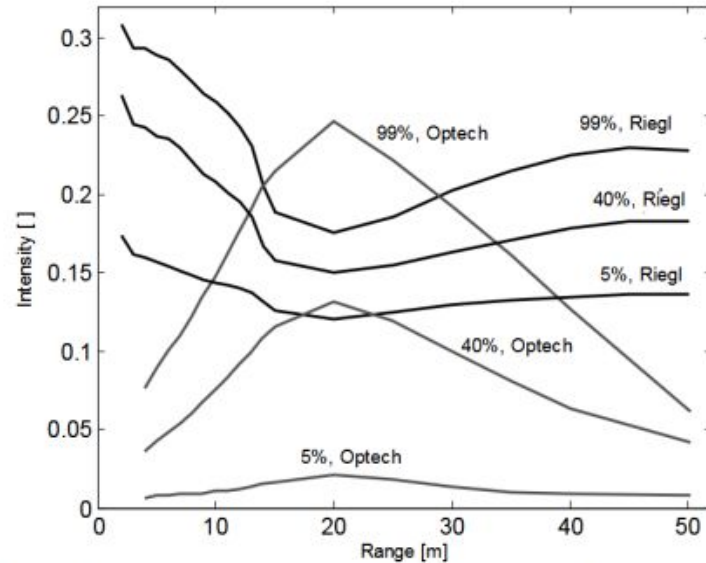
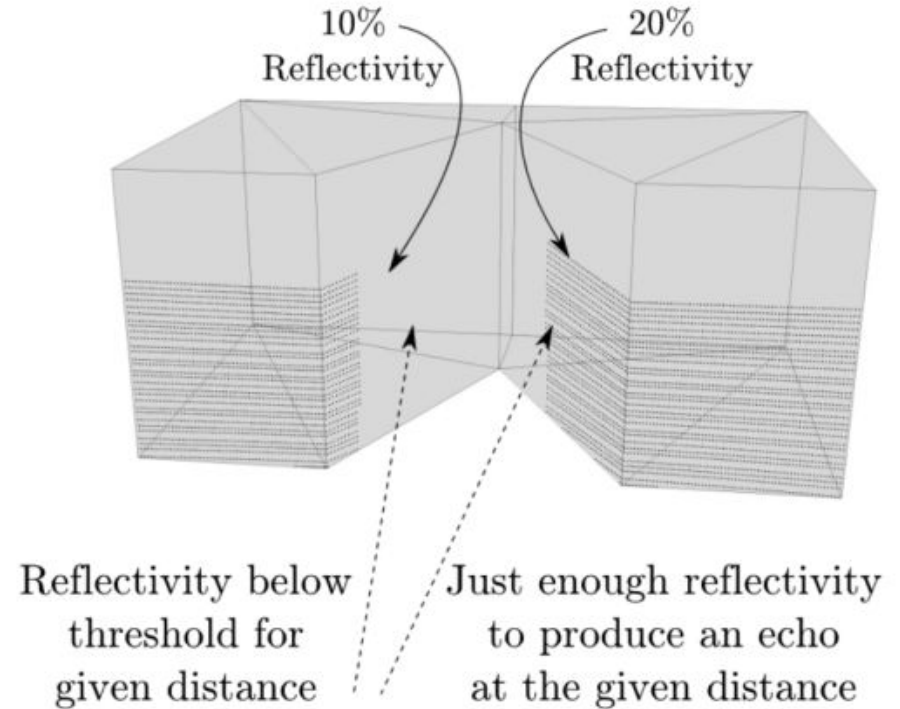

Figure 3: Mean intensities for the Riegl and the Optech laser scanner for three targets (99%, 40%, and 5% reflectivity) at different distances.
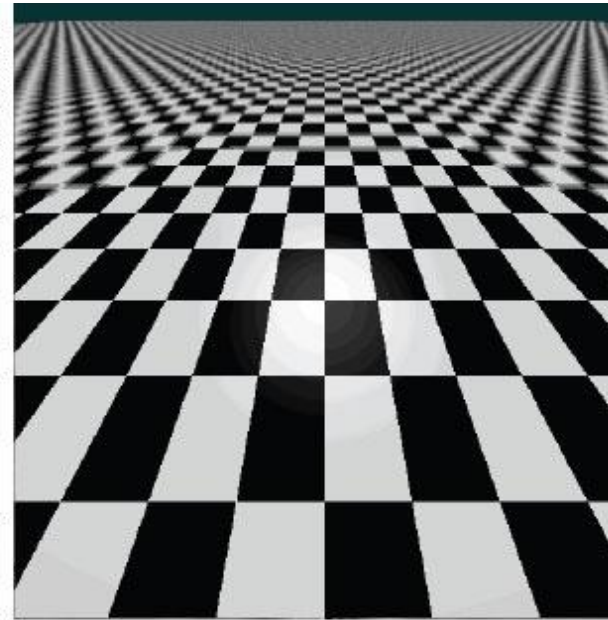

10% Reflectivity   20% Reflectivity

Reflectivity below threshold for given distance

Just enough reflectivity to produce an echo at the given distance

Philipp Erler

- Old and new techniques
- Aliasing in texture sampling, ray-tracing, rasterization, etc.
- What do current games use?
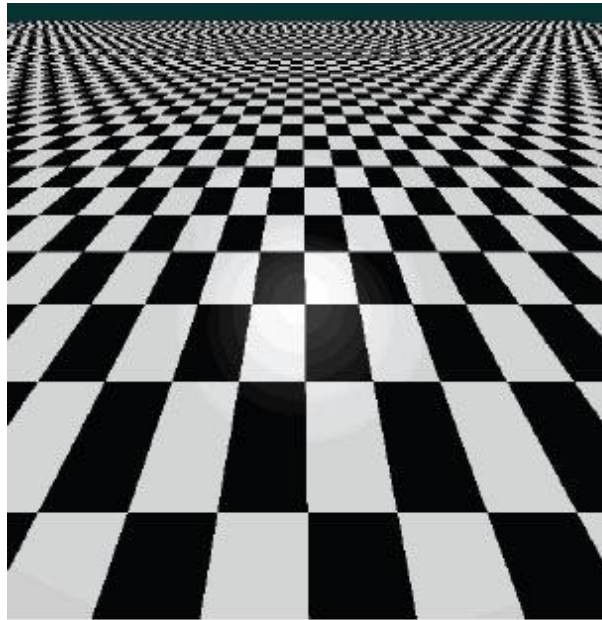
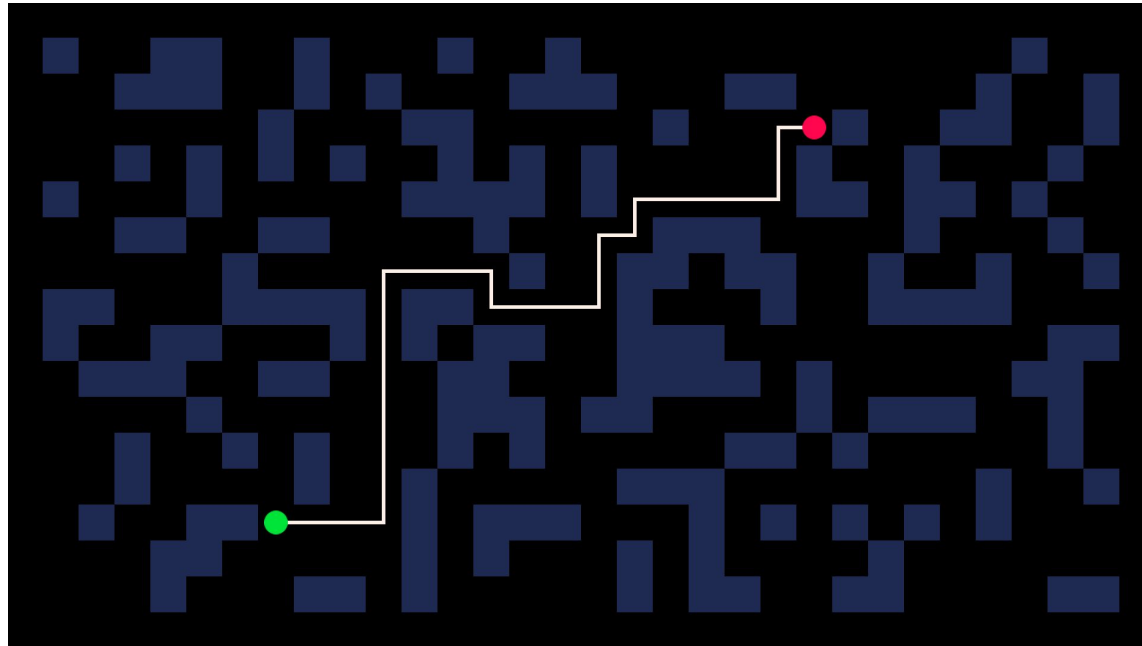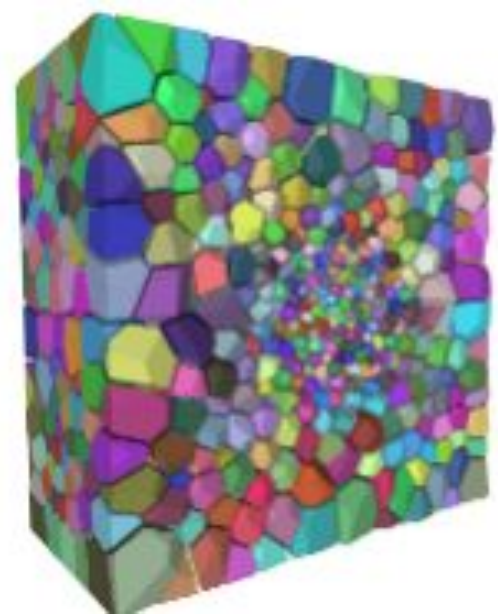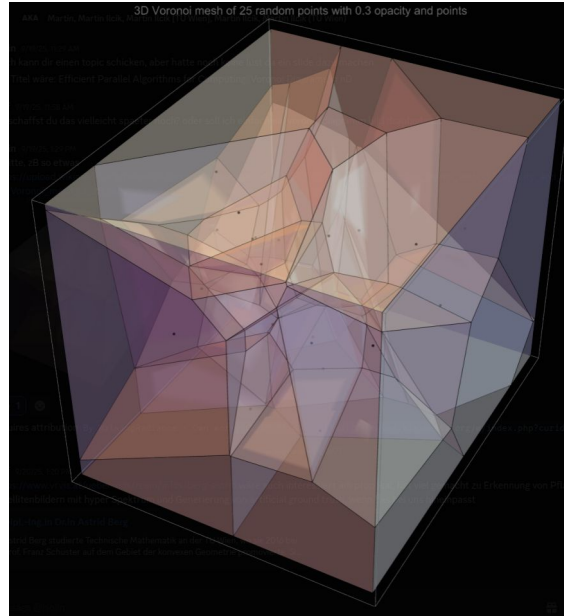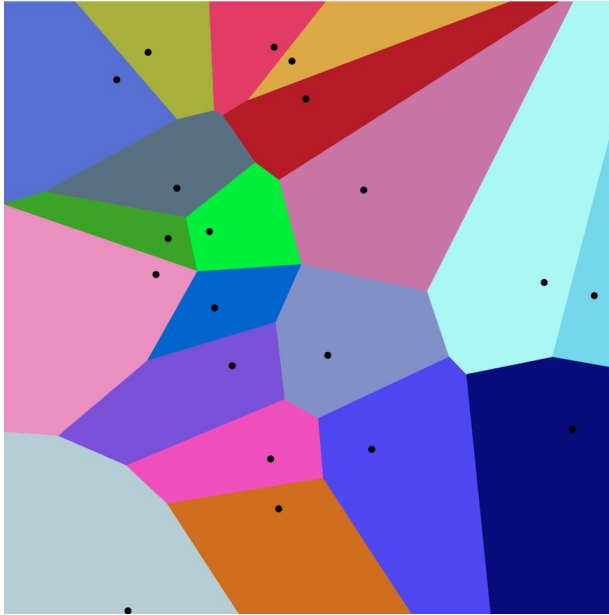aliasing effects   anti-aliasing by over-sampling

Markus Schütz

- How do entities quickly navigate from A to B?
- Investigate various algorithms and their trade-offs
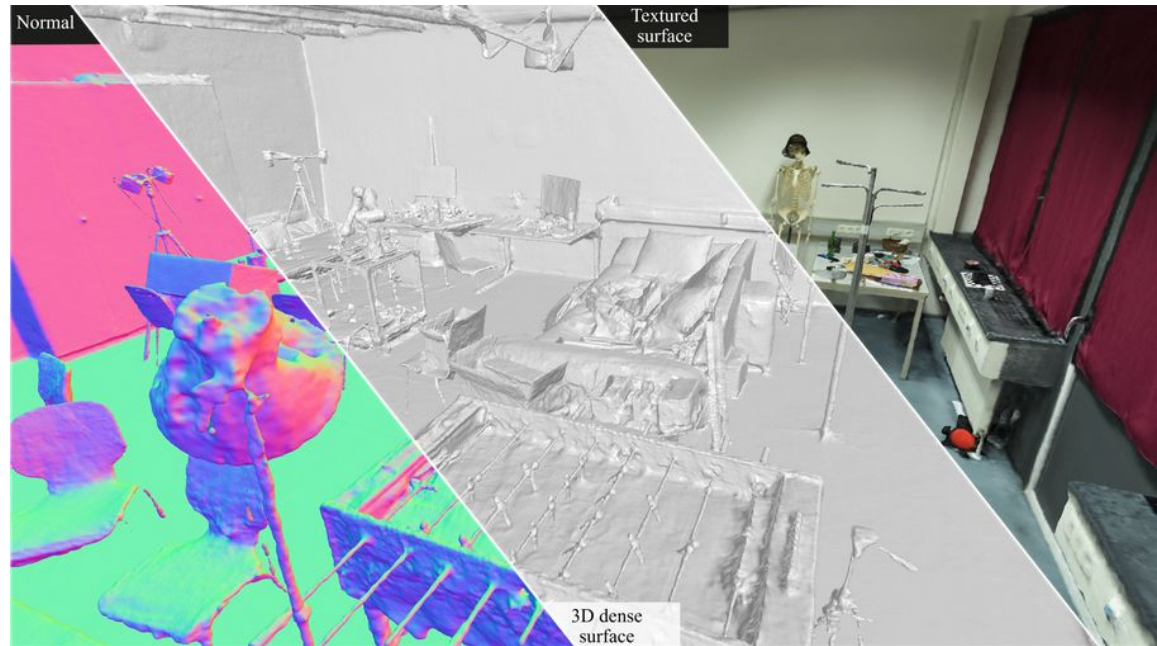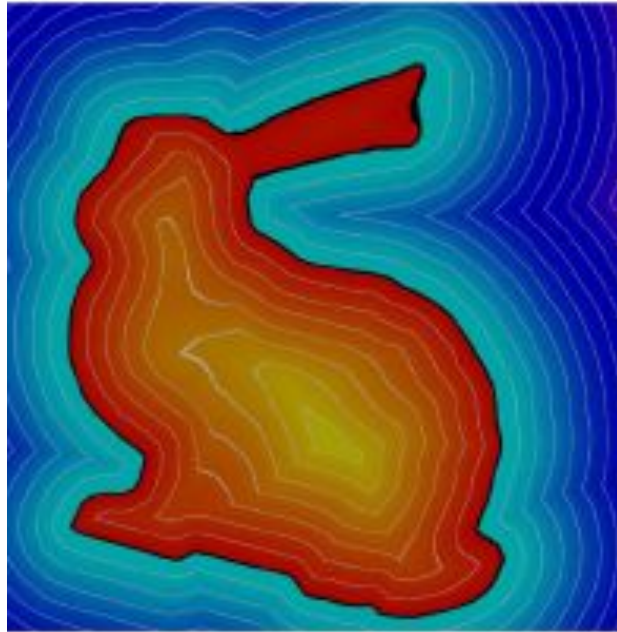- What do games use? (e.g. Factorio)

The Voronoi diagram is the dual of the Delaunay triangulation


Martin Ilĉik

In 3D: https://arxiv.org/pdf/2509.07175

- Signed Distance Fields (SDF) can be used to represent a surface
- Compare methods inferring SDFs from 3D Scans and reconstructing surfaces

Stefan Ohrhallinger

Methods for detecting traffic violations from video:
- Speed limits
- Traffic lights
- Traffic signs
- Keeping inside lanes
- Analyze state in successive frames

Stefan Ohrhallinger
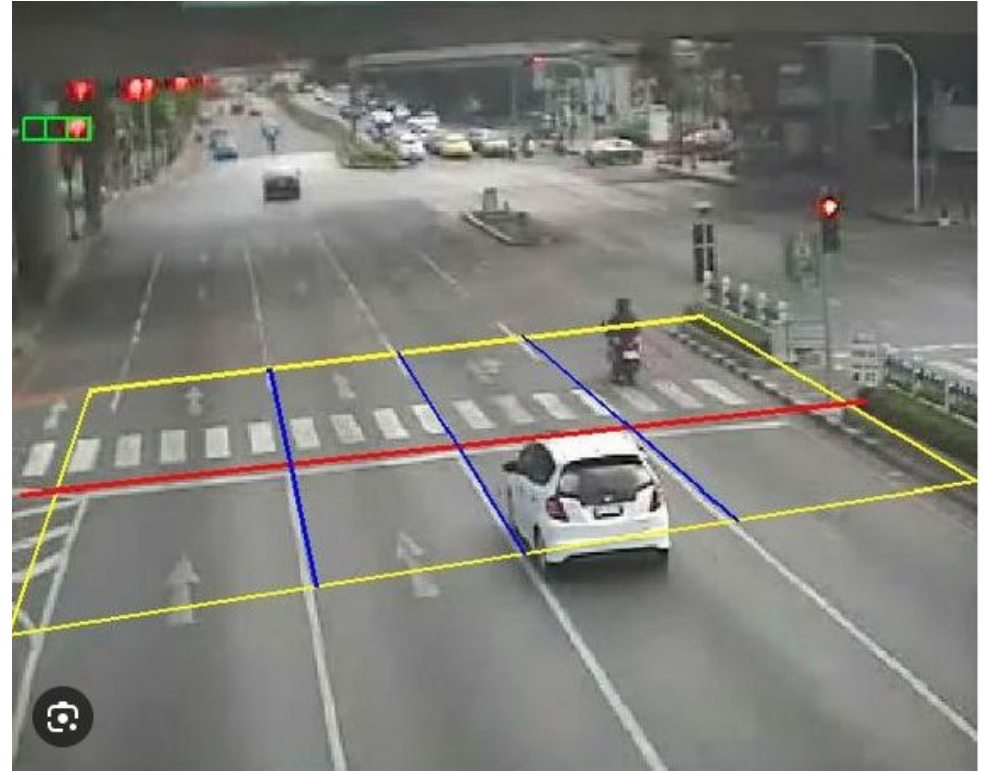
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- I will try to make a fair assignment of topics and post them in forum "Announcements" tomorrow

Questions?

- Get in contact with your supervisor ASAP

- Discuss literature list with your supervisor

- Submit the list to TUWEL by 20.10.