Current Topics in the Field of Virtual Reality

Torsten W. Kuhlen, Jonathan Wendt
Agenda

• Presentation of the Virtual Reality Group
• Seminar organization
• Seminar topics
Virtual Reality Group
The Visual Computing Institute @ RWTH

- Founded in October 2015 within the Fachgruppe Informatik
  - Creation ...
  - Processing ...
  - Presentation ...

... of visual (or visualizable) information

Computer Graphics Group
Prof. Leif Kobbelt

Computer Vision Group
Prof. Bastian Leibe

VR & Immersive Visualization Group
Prof. Torsten Kuhlen

Mesh Generation Group
Prof. David Bommes

Computer Animation Group
Prof. Jan Bender

≈ 60 scientists
≈ 25 students
What is Virtual Reality all about?

- Immersion
- Interaction
- Imagination

IMMERSED

IMAGINATION

INTERACTION

... in real-time!

- Navigation
- Manipulation

- 3-D & multimodal
  - visual
  - acoustic
  - haptic/tactile
  - proprioceptive

Seminar: Current Topics in Virtual Reality
Prof. Dr. Torsten W. Kuhlen | Jonathan Wendt
Winter Term 2017/2018 | 2017-10-16
Seminar Organization
All details given on the seminar’s web page
http://www.vr.rwth-aachen.de/course/16

• 3 weeks time to drop out without consequences (2017-11-06)
• All templates on web page
• All dates on web page
• Failing a deadline = failing the seminar
• Written and oral part need to be passed

• Do not hesitate to contact your advisor!
Process

• Literature research and Outline
• First submission
• Final submission
• Rehearsal talk
• Final presentation
Literature Research & Outline

- Primary paper handed out by your advisor
- Self-responsible investigation of this material and background information
  - Training „Literaturrecherche“
  - Sources: Internet, Library, ..

- **List of references & outline (deadline: 2017-11-06 8:00am)**
  - Key to getting your thesis set up
  - Fill the given template:
    - List all related papers that you deem relevant
    - Add a short explanation
    - Give an outline with short explanations
Writing the Seminar Paper

• Prepare a detailed discussion of your topic
  – Methods, techniques, and algorithms presented in the primary paper
  – Work closely with your advisor

• The paper
  – Includes: figures, tables, references, …
  – LaTeX template on web page (DIN A4, 12pt font size, single-spaced line pitch)
  – 16-21 pages (text)
Writing the Seminar Paper

• Citations and Plagiarism
  – All external, i.e., not your own results must be labeled correctly
  – Applies for seminar paper and the presentation

• First submission:
  – **Complete** submission of your paper
    • 16-21 pages
    • Figures, references
    • Understandable and complete content
    • Minimum grade 4.0
  – Not fulfilling **any** of these conditions = failing the seminar

• Deadlines:
  – **First version:** 2017-12-18 8:00am
  – **Final submission:** 2018-01-22 8:00am
Presentation

• Present your topic for your peers
  – Introduction to problem domain
  – Introduction to problem itself
  – Solutions for the problems
  – Concentrate on the „nuggets“ of your paper

• 20min presentation + 5min discussion

• Deadlines:
  – Rehearsal talk till: 2018-01-29
  – Final presentation: 2018-01-31 12:30pm - 4:30pm
Deadlines

• Deadlines are hard
• Failing one deadline = failing the seminar

• Literature research/Outline: 2017-11-06 08:00am
• First submission: 2017-12-18 08:00am
• Final submission: 2018-01-22 08:00am
• Rehearsal talk till: 2018-01-29
• Final presentation: 2018-01-31 12:30pm - 4:30pm

Also on: [https://www.vr.rwth-aachen.de/course/16/](https://www.vr.rwth-aachen.de/course/16/)
VR Lab Demo

- **2017-10-24 9:30-11.30am**: in the VR Lab at Kopernikussstr. 6
- Demo in aixCAVE and on other devices
- Register: [https://doodle.com/poll/73kvasm4xr6g6tyy](https://doodle.com/poll/73kvasm4xr6g6tyy)
- optional
Seminar Topics
1. Shader Components: Modular and High Performance Shader Development

He et al. (NVIDIA) 
SIGGRAPH 2017

- Present a shading language which compiles to both GLSL (OpenGL) and SPIR-V (Vulkan).
- Rendering features are isolated into small modules.
- Shaders are composed of these modules and their mappings.
- Open source: 
  https://github.com/csyonghe/Spire

Advisor: Ali Can Demiralp
2. Real Time Polygonal-Light Shading with Linearly Transformed Cosines

Heitz, Dupuy, Hill, Neubelt (Unity3D, Ubisoft)
SIGGRAPH 2016

• Represent polygonal lights as spherical distributions.

• Estimate Physically Based BRDFs using linear transformations on the sphere.

• Code, detailed presentations and demos available:
  https://github.com/selfshadow/ltc_code
  http://blog.selfshadow.com/ltc/webgl/ltc_quad.html

Advisor: Ali Can Demiralp
3. Streamline Variability Plots for Characterizing the Uncertainty in Vector Field Ensembles

Ferstl, Bürger, Westermann, TUM
IEEE VIS 2015

• Present a method to visualize the statistical properties of streamlines.
• Use Principle Component Analysis (PCA) to cluster streamlines into major trends.
• Estimate the streamline-median of each trend.
• The seminar content should particularly focus on steady flows.

Advisor: Ali Can Demiralp
Kwon et al.
TVCG ‘16

(a) 120° × 67.5° FOV  
(b) 180° FOV  
(c) 360° FOV

Advisor: Daniel Zielasko
5. Putting the fish in the fish tank: Immersive VR for animal behavior experiments

Sachit Butail, Amanda Chicoli and Derek A. Paley

Robotics and Automation ‘12

Advisor: Daniel Zielasko


Passive haptics in VR
- Increases presence
- Hard to realize for changing environments

Retarget haptic feedback
- Use the same proxy for different virtual objects (or at different locations)
- (related to Redirected Walking)
7. A Virtual Reality Visualization Tool for Neuron Tracing

Will Usher, Pavol Klacansky, Frederick Federer, Peer-Timo Bremer, Aaron Knoll, Allessandra Angelucci, and Valerio Pascucci

IEEE VIS ‘17

Advisor: Bernd Hentschel
8. Synthesizing Obama: Learning Lip Sync from Audio

*Supasorn Suwajanakorn, Steven M. Seitz, Ira Kemelmacher-Shlizerman*

**SIGGRAPH 2017**

- Synthesize Speech-Video using Audio and a Target Video
- Use Neural Networks
- Blend Learned Mouth Movement into Video

Original video for input speech

Our result

Advisor: Jonathan Wendt
Choose Your Topic

• Fill form
  – 3 prioritized choices
  – 1 no-go

• You’ll get an e-mail with your topic and your advisor within the next couple of days
• Get back to your advisor ASAP!
• Talk to her about the topic, the focus of your work, and how to proceed…
Choose Your Topic (3 prioritized, 1 no-go)

1. Shader Components: Modular and High Performance Shader Development
2. Real Time Polygonal-Light Shading with Linearly Transformed Cosines
3. Streamline Variability Plots for Characterizing the Uncertainty in Vector Field Ensembles
4. Layout, Rendering, and Interaction Methods for Immersive Graph Visualization
5. Putting the fish in the fish tank: Immersive VR for animal behavior experiments
7. A Virtual Reality Visualization Tool for Neuron Tracing
8. Synthesizing Obama: Learning Lip Sync from Audio