Virtual and Augmented Reality
VO, UE – Vorbesprechung

Introduction

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Khrystyna Vasylevska
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Interactive Media Systems Group (IMS)
Institute of Visual Computing & Human-Centered Technology
Interactive Media Systems Group

Head: Prof. Dr. Christian Breiteneder

Virtual & Augmented Reality

Hannes Kaufmann

- Collaborative Shared Environments
- Large Optical 6DOF Localization
- 3D HCI, incl. Haptics and Locomotion,
- High Quality Rendering for Mixed Reality

Media Processing

Christian Breiteneder
Horst Eidenberger

- Human-like understanding of multimedia content
- Pattern recognition (audio, images, text, video, bio-signals)
- Intelligent categorization

Image and Video Analysis & Synthesis

Margrit Gelauz

- Image and video analysis & synthesis
- Stereo processing, image matting, high dynamic range imaging
- 3D scene reconstruction
VIRTUAL & AUGMENTED REALITY

Key Researcher:
PD. Mag. Dr. techn. Hannes Kaufmann

Research Staff

Postdocs: Peter Kán, Min Kyung Lee, Annette Mossel, Christian Schönauer
PhDs: Georg Gerstweiler, Emanuel Vonach, Khrystyna Vasylevska, Iana Podkosova, Mohammad Mirzaei, Soroosh Mortezaapoor

Students: 25 graduate and undergraduate students involved in research
Tracking Technologies

- **iotracker**
  Low-cost infrared optical tracker for room-sized VR environments

- **Tunnel Measurement (RTMIOT)**
Medical & Biosensor Applications

• Virtual Reality Training for Upper Limb Prosthesis Patients
  Training for amputees with EMG sensors
Medical & Biosensor Applications

• **PLAYMANCER**
  
  3D-Serious Game Environment with real-time motion capturing and bio-signal feedback for physical rehabilitation

• **ProFiTex**
  
  Support fire fighters with mission-relevant information based on various sensor data
Real Walking through Large Virtual Environments

ImmersiveDeck
Spatial Perception in Virtual Reality

- **Self-overlapping rooms**
  - Simple layouts prevent spatial compression
  - Less virtual space fits in the real room

- **How people perceive the space?**
  - Where is the room you came from?

- **What parameters/layouts are more efficient?**
  - Same arrangement of rooms
  - Different corridors
  - Multiple parameters: corners, distances, curvature, walking direction...

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K. Vasylevska, H. Kaufmann, Towards Efficient Spatial Compression in Self-Overlapping Virtual Environments, IEEE Symposium on 3D User Interfaces (3DUI), March 2017, Los Angeles, CA, USA, *Best Paper Award*
Real-time Ray Tracing in AR

Virtual glass
Virtual Architect
Automated Architectural 3D Model Generation and Interaction

Aim: Visualize apartments in VR
- Automatic generation of geometry out of 2D floor plans
- Generation of interior design

Peter Kán & Hannes Kaufmann (2017), Automated interior design using a genetic algorithm. 23rd ACM Symposium on Virtual Reality Software and Technology (VRST ’17), pp. 1-10, ACM, New York, NY, USA

Virtual Architect
Automated Architectural 3D Model Generation and Interaction

- Automatic model generation
  - 2D floor plan conversion to BIM Format
  - 3D Visualization (Unreal)

- Automatic furnishing
  - Automatic furniture placement
  - Furniture cost functions
  - Material optimization

- Interaction in VR
  - Interaction with furniture
  - Moving
Virtual Architect
Automated Architectural 3D Model Generation and Interaction
VROnSite
Virtual Simulation and On-Site Training for First Responders

- Mobile immersive virtual reality training platform
  - On-site squad leaders of disaster relief units
  - Train *Plan-Do-Act-Check* command cycle
- Save cost and time, increase training time

Exchangeable Haptic Feedback in VR

- Robot actuated physical props for haptic feedback
- Infinite virtual environments with close-to-natural walking
- Research tool for studying haptics in VR

Exchangeable Haptic Feedback in VR
Virtual Reality VO – Dates

• VO 2.0 SwS, 2.0 ECTS, LVA 188.369
• Location: Zemanek
• blocked

• MO 1.10. 11:00 - 13:00  Zemanek
• DI  2.10. 13:00 – 16:00  Zemanek
• MI  3.10. 10:00 – 13:00  Zemanek
• DO  4.10. 13:00 – 16:00  Zemanek
• FR  5.10. 10:00 – 13:00  Zemanek
• MO  8.10. 13:00 - 16:00  Zemanek
Exam

• Written Exam (next 3 Dates)
  – MI 17.10.2018, 14:00 - 16:00, EI 9 Hlawka HS
  – DI 30.10.2018, 14:00 – 16:00, EI 9 Hlawka HS
  – DO 21.2.2019, 14:00 – 16:00, HS 7 Schütte-Lihotzky

• Contact:
  – Tel.: 01/58801 18860
  – Email: Hannes.kaufmann@tuwien.ac.at
  – Favoritenstr. 9-11; 4. Stock; Stiege 3; HD 04 05
Content

- Introduction, Applications
- Input Devices & Tracking
- Output Devices – Displays, Haptics,...
- 3D Graphics Hardware
- AR/VR Framework & Scene Graphs
- 3D Interaction
- Usability, Evaluations
- Current Research
Questions?

VO – Website with all materials (slides) in TISS!
Virtual Reality Übung 2018
VRUE‘18

LVA-LeiterInnen:
Khrystyna Vasylevska
Iana Podkosova

TutorInnen:
Philip Krachler,
Wassily Bratuska
VRUE 2018 (188.913)

• Value: 3.0 h, 4.0 ECTS
• Duration: 05.10.2018 – 19.12.2018

• Calendar (VRUE)
  – [https://calendar.google.com/calendar/embed?src=hfbkjq0e5gdtcac9ibgoveoi8s%40group.calendar.google.com&ctz=Europe/Vienna](https://calendar.google.com/calendar/embed?src=hfbkjq0e5gdtcac9ibgoveoi8s%40group.calendar.google.com&ctz=Europe/Vienna)

• Materials (TUWEL)
  – [https://tuwel.tuwien.ac.at/course/view.php?id=12052](https://tuwel.tuwien.ac.at/course/view.php?id=12052)

• Help & Communication
  – Course leaders: [vrue@list.tuwien.ac.at](mailto:vrue@list.tuwien.ac.at)
  – Tutors: TUWEL Forum
Anmeldung

- In TISS until Thursday, 05.10.17 23:59
  - 188.913: Virtual and Augmented Reality
  - De-registration 10.10.17 23:59!

- Prerequisites
  - Masterstudium
  - Basic knowledge in Programming (C#, C++)
Goals & Contents

TRACKING
- Device Tracking
- VR View
- Virtual Hand
- 3D Interaction Metaphors

VISUALIZATION (Rendering)
- 3D Virtual Scene
- Physics

INTERACTION (HCI)
- Multi User
- Collaboration
- Networking

DISTRIBUTION
- 3D Virtual Scene
- Physics
VRUE Dev Environment

• Game Engines
  – Unity
  – Unreal

• 3D Tracking and Input
  – HTC Vive
  – Leap Motion

optionally
VRUE Software

- Unity3D (optionally Unreal)
  - Installation: apply for free license

- HTC Vive SDK
  - Steam
  - Steam VR

- Leap Motion SDK
Preparation & Assignments

• Preparation before 5.10.18
  – Form groups of two!
  – Prepare your hardware contracts & scan your Student ID
    • If you would like to use Unreal Game Engine – let us know!

• Assignments
  – Assignment 1 Basics: Unity, Physics, Hand gestures
  – Assignment 2 3D Interaction, advanced Physics
  – Assignment 3 Networking, Collaboration, Distribution
  – Project phase make your own game with prerequisites

  – timing #1 - 12d, #2 - 12d, #3 - 18d, #4 - 1month
Tutorials & Abgaben

- **Four Tutorials**
  - Days & time (auch im Google Calendar and TISS):
    - Tutorial 1 5.10.18 @14:00
    - Tutorial 2 16.10.18 @12:30
    - Tutorial 3 30.10.18 @12:30
    - Tutorial 4 13.11.17 @12:30
  - Location: Zemanek Hörsaal

- **Submissions: Data upload in TUWEL**
  - Abgabe 1 17.10.18
  - Abgabe 2 30.10.18
  - Abgabe 3 18.11.18
  - Project phase 16.12.18
VRUE Hardware Requirements

• You need 2 PCs per Group of two
• At least 1 HTC Vive compatible PC
  – **GPU**: GeForce GTX 970 / AMD Radeon R9 290
  – **CPU**: Intel i5-4590 / AMD FX 8350
  – **RAM**: >= 4 GB
  – **Video Output**: HDMI 1.4

If your group does not have an HTC Vive compatible PC
– Try to find another group partner
– otherwise, contact us **vrue@lists.tuwien.ac.at**

Work in the lab space is possible only for max. 2 groups
VRUE Hardware Hand-Out

Only for the groups registered in TUWEL!

Every Group gets:
- 1 HTC Vive
- 1 Leap Motion

• Each person brings:
  - Student ID + its photocopy (NO passports, please!)
  - Two copies of contract for the chosen hardware
  - No substitute signatures allowed
  - 1 person = 1 piece of hardware (Leap OR Vive)

• Location: HG 04 06 (Favoritenstr. 9-11, 4. Stock)
• Hand-out after Tutorial #1 on 05.10.18
• Contracts are in TUWEL
Los geht’s ..

- Preparation tasks **till 05.10.18**
  - Finding a Partner and Group registration in TUWEL
  - Confirm at least one HTC Vive compatible PC
  - Prepare and fill in the documents for the hardware

- 1. Tutorial:
  - **Fri, 05.10.18**, 14:00 – 15:00 - Zemanek Hörsaal
  - Afterwards Hardware hand-out
    - *Only for the registered Groups of two!*
    - Bring your Student ID + its copy, two contracts for the piece of hardware that you will take

- 2. Tutorial
  - **Tue, 16.10.18**, 12:30 – 13:30 - Zemanek Hörsaal

- 1. Assignment submission
  - Assignment : Wed, 17.10.18 (in TUWEL)
Multimedia Interfaces LU

• Task: Extending of the project task of the lecture (UE) Virtual and Augmented Reality with a custom Hardware interface

• Hardware
  – Arduino WiFi, multiple Sensors

• Schedule
  • Tutorial: 24.Oct 2018 – 16:00-17:00 – Sem 188-2
  • Concept hand-in 20.November
  • Final Hand-In: 25.Jan.2018
  – Registration in Tiss
    • (1.10.2018 – 24.10.2018)

• Contact
  – mmilu@list.tuwien.ac.at
Topics in the Area

- Multimedia Interfaces; 188.461; 1.5 ECTS
  - Incl. Praktikum topics

- Virtual Reality Advanced Topics; 188.456; 3 ECTS

- Praktikum
  - Praktikum aus Visual Computing; 188.938; 9 ECTS
  - From Design to Software 1; 188.934; 6 ECTS
  - From Design to Software 2; 184.743; 6 ECTS

- Diplomarbeiten

Betreuer direkt kontaktieren
Themen: https://www.ims.tuwien.ac.at/topics