R³
- on three CG research topics -

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Goals and Motivation

- Present Trends in Graphics & Vision
- Review State-of-the-Art
- Report Current Efforts at VISGRAF Lab
- Discuss Research Directions
- Entice Prospective Students / Collaborators

Outline

- Common Ground
- 3D Photography
- Omnidirectional Video
- High Dynamic Range Imaging
- Conclusions

Common Ground

- Same Basic Scenario
  - Data Capture
  - Model Estimation
  - Visualization
- Needs Special Hardware!
- Integrates Analysis and Synthesis
- Many Interesting Applications…

Part I:

3D Photography

Demo
Scanning Studio

- Stage
- Lighting
- Turntable
- Minolta VIVID 910

Pipeline

- Scan
- Align
- Merge
- Texture
- Post

- Model
  - Shape (points, normals)
  - Attributes (color, materials, etc...)

Data Capture

- PET / Stripe
- Photo
- Depth Map

Align

- MeshAlign / Scanalyze / (PET)

Merge

- VRIP / MPU / Poisson

Unshade

- VG Suite
Texture

- Projective

Post-Process

- Smooth / Simplify / Etc…
- Render

Research Directions

- Visualization for the Web
- Generalized Acquisition
- Alternative Model Editing
- Super-Resolution
- and Beyond…

3DP on the Web

- Progressive Visualization / Streaming

Unconventional Editing

- Attribute to Geometry
Super Resolution by Example

Beyond Super Resolution
- Model Hierarchy
  - Macrostructure
  - Mesostructure
  - Microstructure

Part II: Omnidirectional Video

Demo

Hardware Set-Up

Overview
- Capture
- Integrate
- Process
- Display

Spherical Camera
Panoramic Projection
Capture

- Image Processing
  - Demosaicing
  - Devignetting
  - Retification

- LadybugCap

Integration

- Construction
  - Stitching
  - Deghosting
  - Etc...

- Model

Processing

- Non-Linear Projective Geometry
  - Point Tracking
  - Optical Flow
  - Etc...

Display

- Immersive Curved Projection

Research problems

- BG / FG Extraction
- View Stabilization
- Warped Display
- Non-Linear Narratives

BG / FG Extraction

- Static Camera / Moving Subjects

OBS: Applications …
View Stabilization

- Moving Camera
  - Ego Motion
  - Orientation Estimation

[Szeliski 05]

Expressive Viewing

- Fragmentation / Distortion

[Offenhuber 06]

Non-Linear Narratives

- Movie Maps …

[Aspen, 78]

Seeing It One More Time

Part III:

High Dynamic Range Imaging

Demo
Equipment

- High-End Camera
- Tripod
- Light Probe
- Etc.

Overview

- Shooting
- Reconstruction
- Mapping
- Encoding

Shooting

• Multiple Exposures
  - -2 EV
  - -1 EV
  - +0 EV
  - +1 EV

• Assumptions
  - Static Camera / Scene
  - Fixed Illumination

Reconstruction

• Response Curve Estimation
• HDR Image Integration

Encoding

• Image Formats
  - Radiance RGBE (.hdr)
  - SGI LogLuv (.tiff)
  - IEEE 96-bit (.tiff)
  - ILM OpenEXR (.exr)
  - Brightside JPG-HDR (.jpg)

• Video Formats
  - HDR-MPEG

Mapping

• Tone Reproduction
  - Display Range
  - Visual Perception

• Methods
  - 30+ papers
  - No Ideal Solution…
Research Problems

- Video HDR
- Artistic Tone-Mapping
- IBL / Rendering

Video HDR

- Acquisition / Reconstruction
- Compression
- HDR Playback
- Panoramic Video / Light Probes

Artistic Tone-Mapping

- Interactive
- By Example

IBL and Rendering

Conclusions

- Other Research Areas
  - Geometric Modeling
  - Character Animation
  - Physical Simulation
  - Etc…