Applications of Image-Based Modeling and Rendering in Art and Cinema

Paul Debevec

Overview

- Image-based techniques are used in many ways; for each we can ask:

  What is the model?
  \[ \text{How are images used?} \]

  What is the rendering method?
  \[ \text{How are images made?} \]

  What is the effect?
  \[ \text{Is what we see what is really there?} \]
Aspen Moviemap
(MIT, 1978-1980)

- Vehicle-mounted camera filmed driving down all streets of downtown Aspen
- Video transferred to random-access videodisc
- User interface allows real-time photorealistic exploration of the space

Golden Gate Moviemap
Michael Naimark, Exploratorium 1987

- Helicopter flown in 2D grid pattern over Bay Area
- Camera kept pointed toward Golden Gate Bridge
- Film transferred to videodisc
- Trackball interface allows real-time fly-over of San Francisco
Matte Painting

- Instead of building a set, just create an image!
- Used since the early days of the film industry
  - Gone With the Wind (1939)
- Matting allows actors, etc. to be added
- Can pan and zoom to simulate motion
- Now done digitally

Star Wars Trench Sequence
Industrial Light and Magic, 1977

Images courtesy of Lucas Digital, Lucasfilm, and Industrial Light and Magic
**Tour into the Picture**  
(Horry, Anjyo, Araï, Hitachi SIGGRAPH 97)

- **An approximate 3D model** is constructed interactively with easy-to-use tools
- **Foreground objects** modeled as flat cut-outs
- **User fills in the occluded areas**
- **Animations from the single photograph** reveal depth as well as visual detail
- **Software at:**  
  http://koigakubo.hitachi.co.jp/little/DL_TipE.html
Displacements
Michael Naimark, San Francisco Museum of Modern Art, 1984

- Image-based modeling and rendering with real geometry and real light
- Living room filmed with rotating movie camera
- Room painted white
- Film reprojected with rotating movie projector

“Interface”
Lance Williams, Carter Burwell, Ned Greene
SIGGRAPH 85 Film Show

- First use of Image-Based Reflection Mapping in an Animation

http://www.CS.Berkeley.EDU/~debevec/ReflectionMapping/
Reflection Mapping in Films

Flight of the Navigator
Randal Kleiser
1986

Terminator II
James Cameron
1991

http://www.CS.Berkeley.EDU/~debevec/ReflectionMapping/

Rouen Revisited

(Golan Levin and Paul Debevec, SIGGRAPH 96 Art Show)

Synthetic View: 1996
Synthetic View: 1896
Synthetic View: Monet Painting

Session #8: Paul Debevec – Applications of IBMRL in Art and Cinema
Like a Rolling Stone
Buf Compagnie, SIGGRAPH 96 Electronic Theatre

- View interpolation based on stereo reconstruction between two views of the same scene (Software by Arnauld Lamorlette)
- Free-style morphing between sparsely sampled frames - Artifacts serve artistic effect

3D computer effects: Buf Compagnie
Producer: Partizan-midi-minuit
Director: Michel Gondry
See Also: City of Lost Children, commercials for Reebok, Chanel, Gap

Mona Lisa View Morph
Steve Seitz, SIGGRAPH 96

**Mona Lisa View Morph**
Steve Seitz, SIGGRAPH 96


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**The Prince of Egypt**
IBR for NPR!

“Exposure”
- Geometry constructed in 3D
- Shaded renderings given to artists to paint
- Digital paintings used as 3D textures

Video courtesy of Dreamworks, LLC
More use of IBR for NPR in Films

- *Tarzan* – “Deep Canvas”
- *What Dreams May Come*
  Pierre Jasmin and Pete Litwinowicz, RE:Vision

Related Sketch Session: Dimensional Painting
Wednesday 11 August, 5:25pm - 6:00pm, Room 151 / 152
Deep Canvas in Disney’s “Tarzan”
The Making of the Painted World: “What Dreams May Come”
The Making of “Fiat Lux”

Image-Based Modeling, Rendering, and Lighting in “Fiat Lux”
Friday 13 August, 11:40am - 12:15pm, Room 408AB

Dayton Taylor’s Virtual Camera
http://www.virtualcamera.com/

- Array of pictures taken onto same roll of film
- Playback achieves “frozen time” effect
The Campanile Movie
(SIGGRAPH 97 Electronic Theatre)

- Model of Campus Built from 20 images
- Real-time virtual animation created w/ projective texture-mapping

The Matrix

www.mvfx.com

Courtesy of George Borshukov and John Gaeta, MANEX Entertainment
**Conclusion**

IBMR in Art and Cinema

- Image-based techniques have a long lineage
- Allow reinterpretation of existing imagery
- Enable many new effects
- Artifacts can be interesting
- IBMR techniques will likely become standard tools in filmmaking

**Thanks**