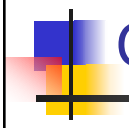


Shadow Matting and Compositing

Presented by Yunjun Zhang

How to write a paper for SIGGRAPH

- The applications are plentiful and the result is amazing.
- Idea could be simple but it really works and it is robust.
- The method is explained in good detail without too much fancy formulas.

Notations used in paper and this presentation

f : frames in a video sequence

C : observed color image

L : lit image $L = \max_f C_f$

S : shadow image $S = \min_f C_f$

L', S', C' : lit image , shadow image,
and calculated color image for the target.

β : it is the visability of the light source

Matting and Compositing

Contribution of this paper

- Composite the shadow without knowing the geometry and camera calibration.
- No blue screen is required for shadow matting.

Implementation

- Assumption
  - Single light source
  - Shadow should be cast on a flat ground in source video.
- Input and Output
  - Source Video (must be video to generate S and L)
  - Target Image

Implementation

- Estimating the shadow matte.
- Generate the deformed shadow matte from target image.
- Shadow compositing.

Estimating shadow matting

- Calculate shadow and lit images
- Calculate shadow matte for the selected image
- No pixel position can be covered by shadow all the time.

L : lit image $L = \max_f C_f$

S : shadow image $S = \min_f C_f$

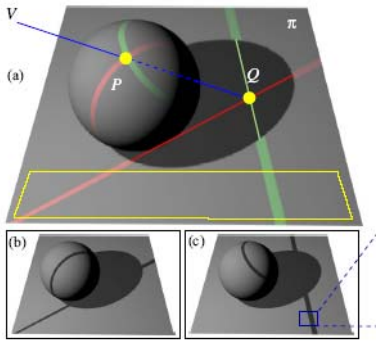
$$\beta = \frac{(C-S)\cdot(L-S)}{\|L-S\|^2}$$

Estimating shadow matting

Estimating shadow matting

Estimating shadow deformations

- Basic idea:
  - Generate displacement for each pixel for the potential shadow area.



Target background Shadow Scan Video

Estimating shadow deformations

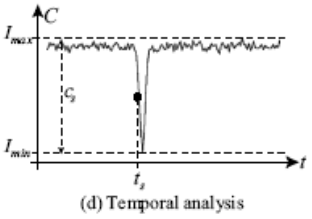
- Algorithm
  - For each directional scan s:
    - Find the first crossing time for each pixel by temporal analysis.
    - In each frame f, fit a shadow line
  - For each pixel location p:
    - For each scan s, using the two nearest line equation's parameters to generate the line equation for p
    - Compute the intersection point q of lines of all scans s
    - q-p is the displacement on point p.

Estimating shadow deformations

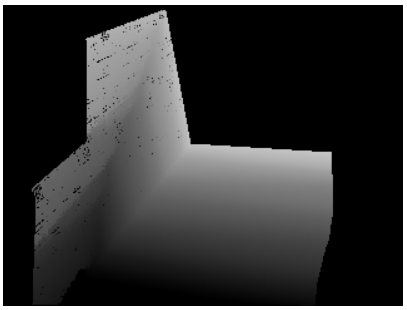
- Target background must has some region with planar surface matched to source background. This region is called reference plane.

Temporal Analysis

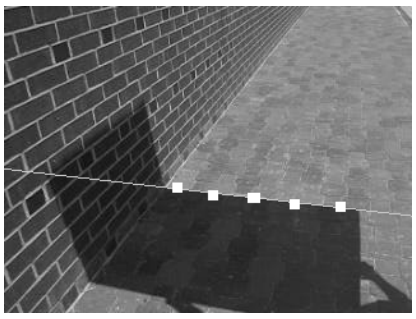
- For each Pixel position in each scan



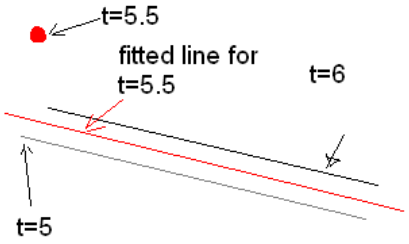
(d) Temporal analysis



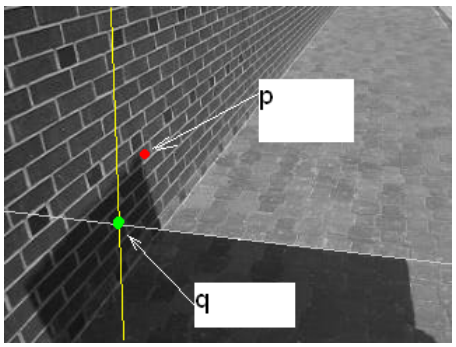
Fitting a line for each Frame in each Scan



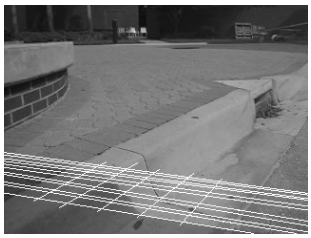
Interpolating the lines for each pixel location



Get the displacement map for each Pixel position



Result



Result

result

Discussion

- How to eliminate the planar background requirement?
- In video compositing, more interpolating methods are required.