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A Statistical Method for SVBRDF Approximation from Video Sequences in General Lighting Conditions (Additional Materials)

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Appendix A

Let μ, m and the σ be respectively the mean, the median, and the absolute deviation of a random variable X. Then

$$|\mu - m| < \sigma.$$

Proof From the Jensen's inequality we know that if X is a random variable and φ is a convex function, then $\varphi(\mathbb{E}[X]) \leq \mathbb{E}[\varphi(X)]$. Then we have

$$\begin{aligned} |\mu - m| &= |\mathbb{E}[X] - m| \\ &= |\mathbb{E}[X - m]| \\ &\leq \mathbb{E}[|X - m|] \\ &\leq \mathbb{E}[|X - \mu|] = \sigma \end{aligned}$$

where the first inequality comes from the Jensen's inequality applied to the absolute value function, which is convex. The second inequality is true because the median minimizes the absolute deviation. $\square$

Appendix B

Given the unknown ρ_s and α the following system of equations:

$$\left\{ \begin{array}{lcl} \rho_s\, A^{\alpha} &=& L_A - L_d \\ \rho_s\, B^{\alpha} &=& L_B - L_d \end{array} \right. \tag{1}$$

can be solved by applying the logarithm to both the equations:

$$\left\{ \begin{array}{l} \alpha = \frac{(\ln(L_A - L_d) - \ln(\rho_s))}{\ln(A)} \\ \alpha = \frac{(\ln(L_B - L_d) - \ln(\rho_s))}{\ln(B)} \end{array} \right. \tag{2}$$

and by setting the equality between the two equations:

$$\frac{(\ln(L_A - L_d) - \ln(\rho_s))}{\ln(A)} = \frac{(\ln(L_B - L_d) - \ln(\rho_s))}{\ln(B)} \tag{3}$$

From equation 3 we compute the value:

$$\rho_s = e^C \tag{4}$$

where:

$$C = \frac{\ln(L_B - L_d)\ln(A) - \ln(L_A - L_d)\ln(B)}{\ln(A) - \ln(B)} \tag{5}$$

With the value of ρ_s we recover the value of α by solving one of the equation in the system 2.

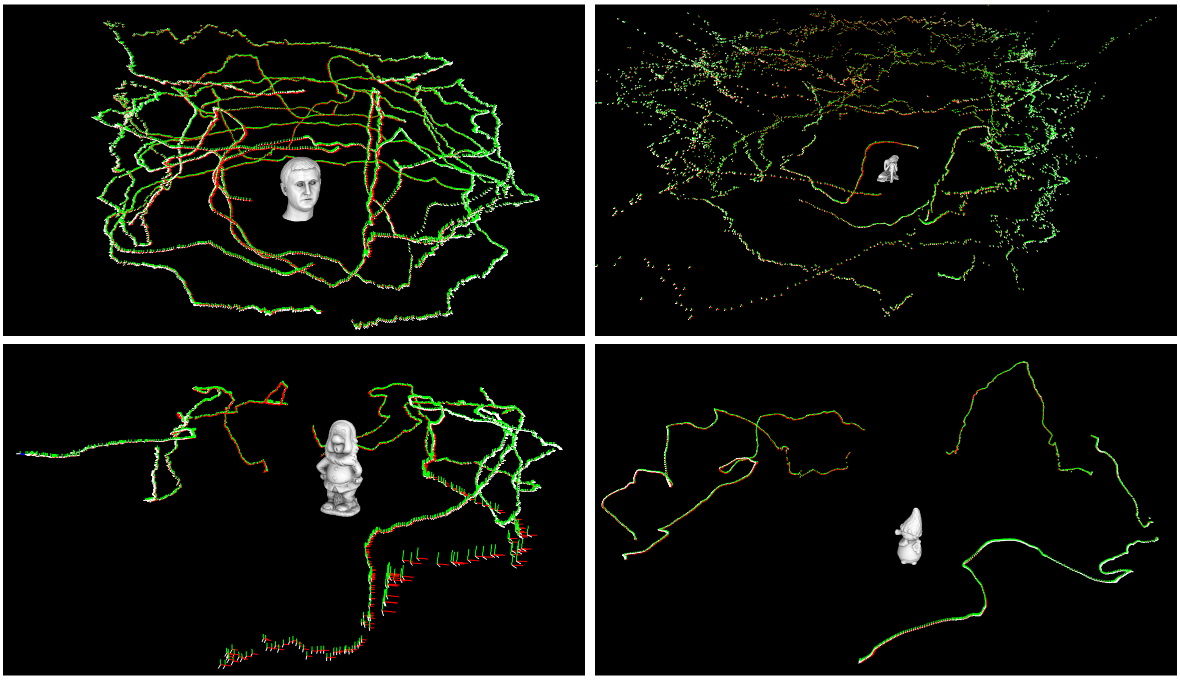

Figure 1: *Camera path reconstructed with the registration algorithm: (Top-Left) HEAD; (Top-Right) SLEEPING BUDDHA; (Bottom-Left) DWARF; (Bottom-Right) GNOME.*

Figure 2: *Quality computation: (Left) map of the border distance from the depth discontinuities; (Left-Center) depth map; (Right-Center) dot product between the normal and the view direction; (Right) final quality.*

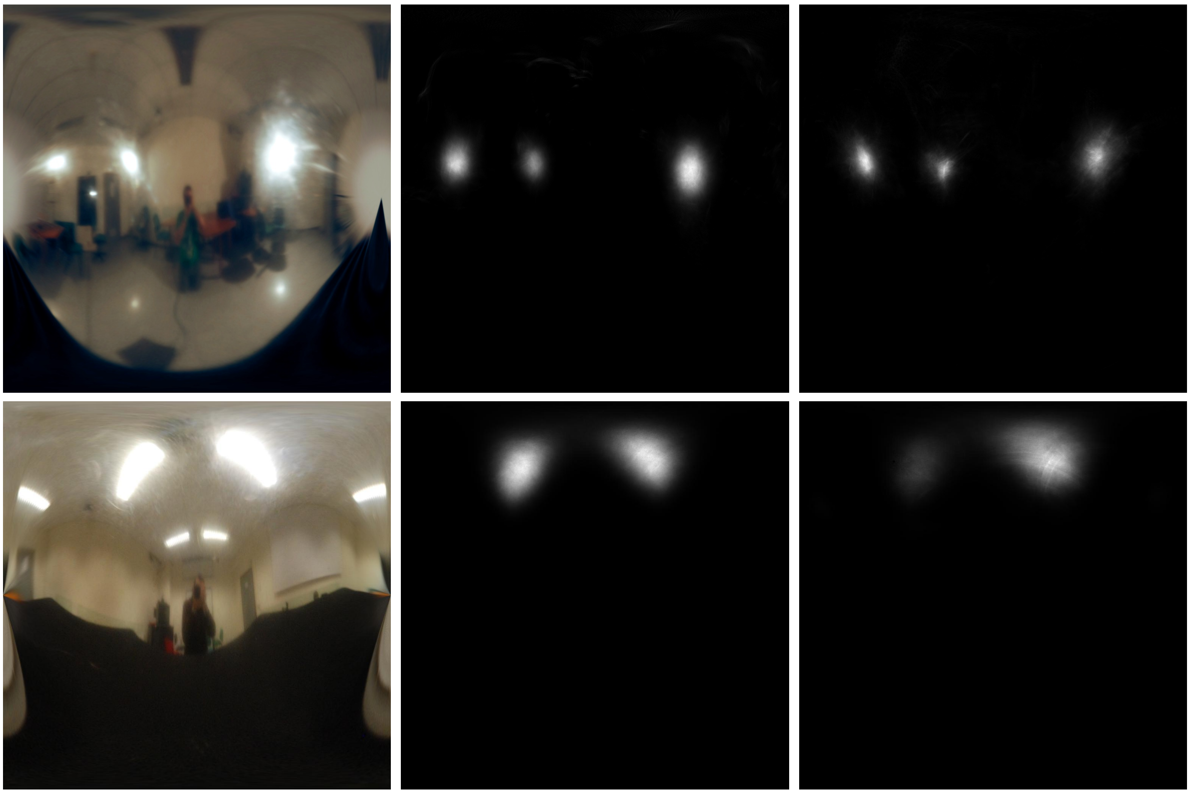

Figure 3: *Comparison of environment maps: (Top-Left) first real environment scenario; (Top-Center) first environment scenario reconstructed from the DWARF's videos; (Top-Right) first environment scenario reconstructed from the GNOME's videos;(Bottom-Left) second real environment scenario; (Bottom-Center) second environment scenario reconstructed from the HEAD's videos; (Bottom-Right) second environment scenario reconstructed from the SLEEPING BUDDHA's videos.*

Figure 4: *Segmentation of the basis materials: (Top-Left) HEAD; (Top-Right) SLEEPING BUDDHA; (Bottom-Left) DWARF; (Bottom-Right) GNOME. For each image there is the rendering of the object with the diffuse color (left) and the rendering in false color of the basis materials (right).*

Figure 5: *HEAD: (Left) rendering; (Right) original frame.*

Figure 6: *SLEEPING BUDDHA: (Left) rendering; (Right) original frame.*

Figure 7: *DWARF: (Left) rendering; (Right) original frame.*

Figure 8: *GNOME: (Left) rendering; (Right) original frame.*

Figure 9: *Rendering of the SLEEPING BUDDHA with the "Uffizi Gallery" environment map*

Figure 10: *Rendering of the SLEEPING BUDDHA with the "Dining room" environment map*

Figure 11: *Rendering of the SLEEPING BUDDHA with the "Pisa" environment map*