Environment Matting

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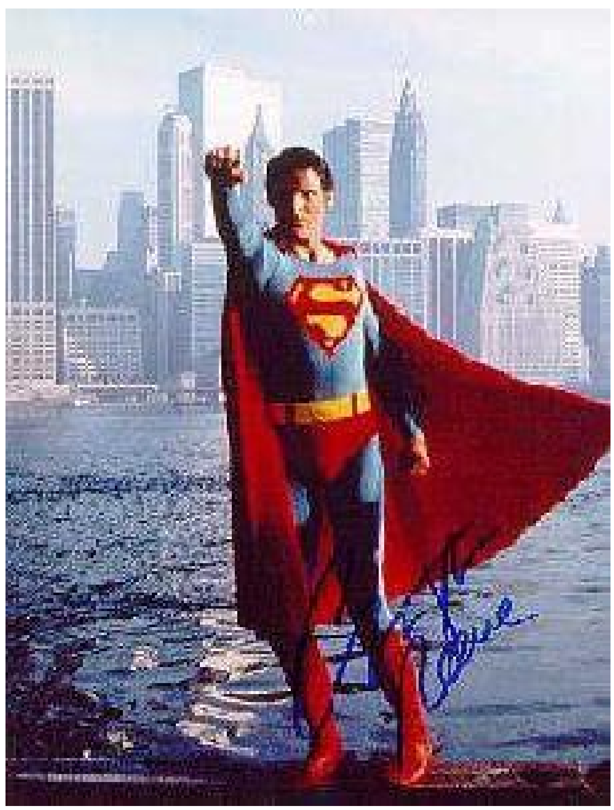
Blue Screen Matting

- Composite images with novel backgrounds
- Eliminate outlines around composited objects (think the original Superman movie)



Yes, I'm really in front of a city...

Blue Screen Matting Procedure

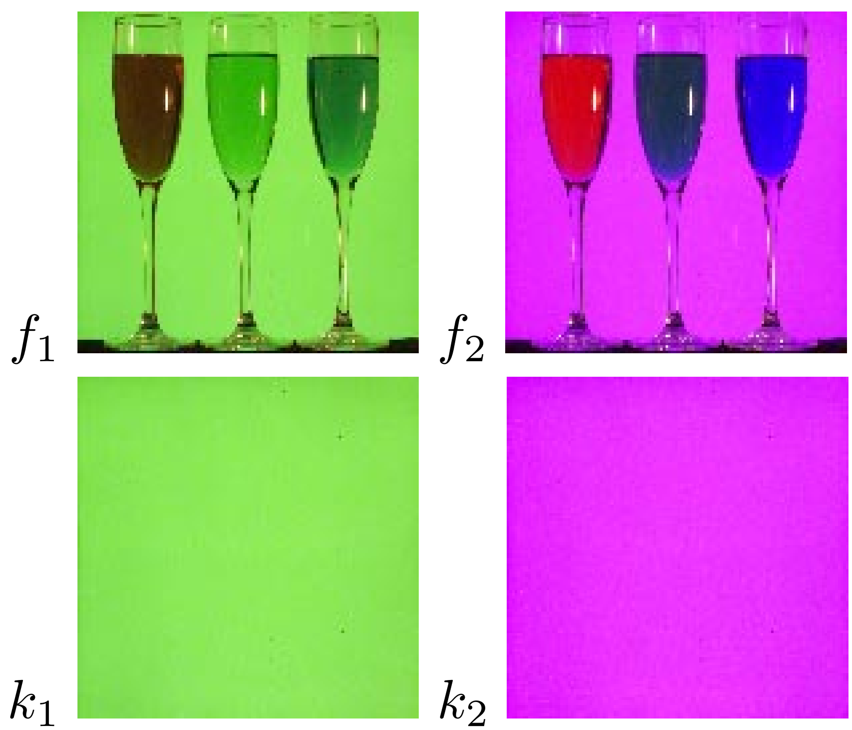
Blue Screen Matting is fairly straightforward:

$$C = F + (1 - \alpha)B$$

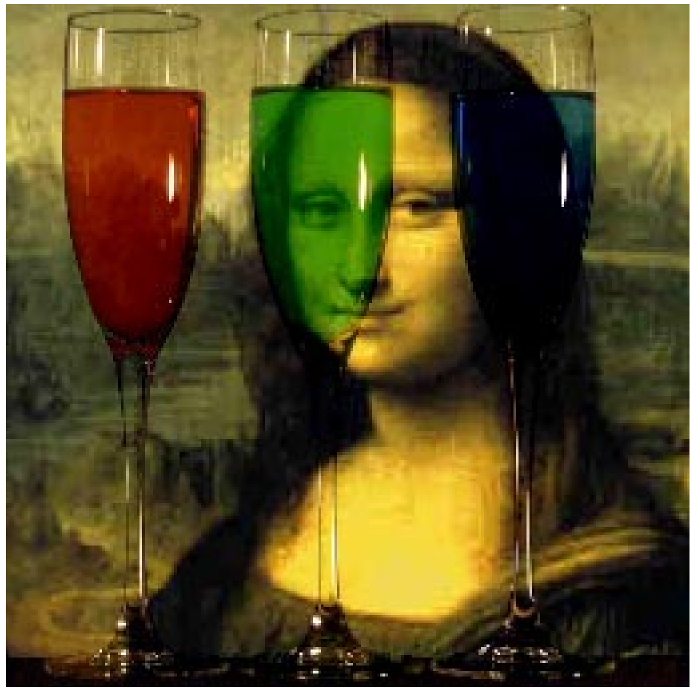
- C – final color
- F – color of the object
- B – color of the new background pixel
- α – amount of background light that filters through

Blue Screen Matte Pulling

- Must compute F and α
- First, take four pictures of the object:



- Solve for F and α



Enter Environment Matting

Environment Matting addresses the problem of translucent and reflective objects.

Check it out:

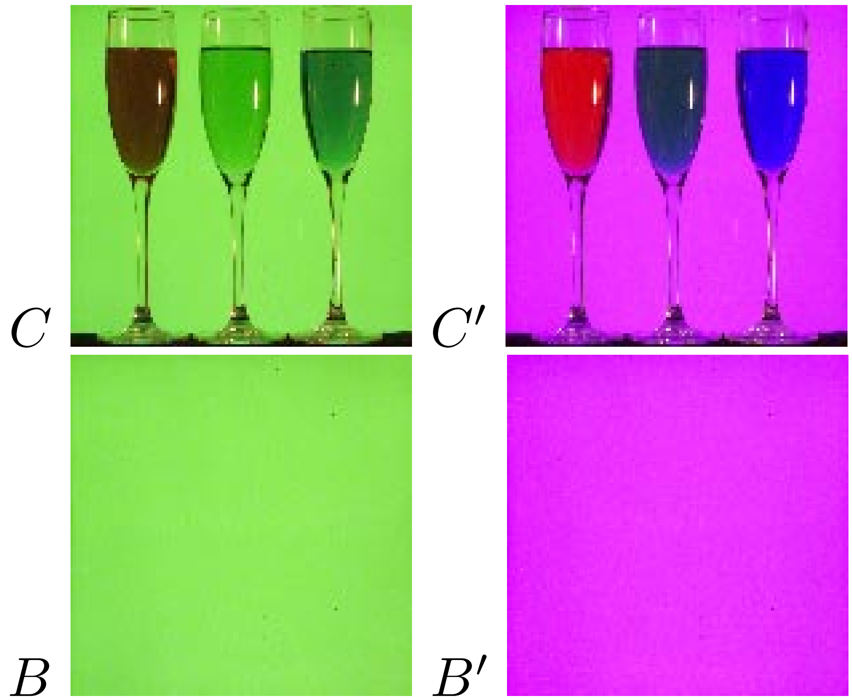
More pictures...

Environment Matting Overview

$$C = F + (1 - \alpha)B + R_1\mathbb{M}(T_1, A_1)$$

- Goal the same — calculate C
- α and B same as before
- Model transmission with axis-aligned box, A_1
- R_1 represents the transmission coefficients
- Demo...

Remember Blue Screen Matting?

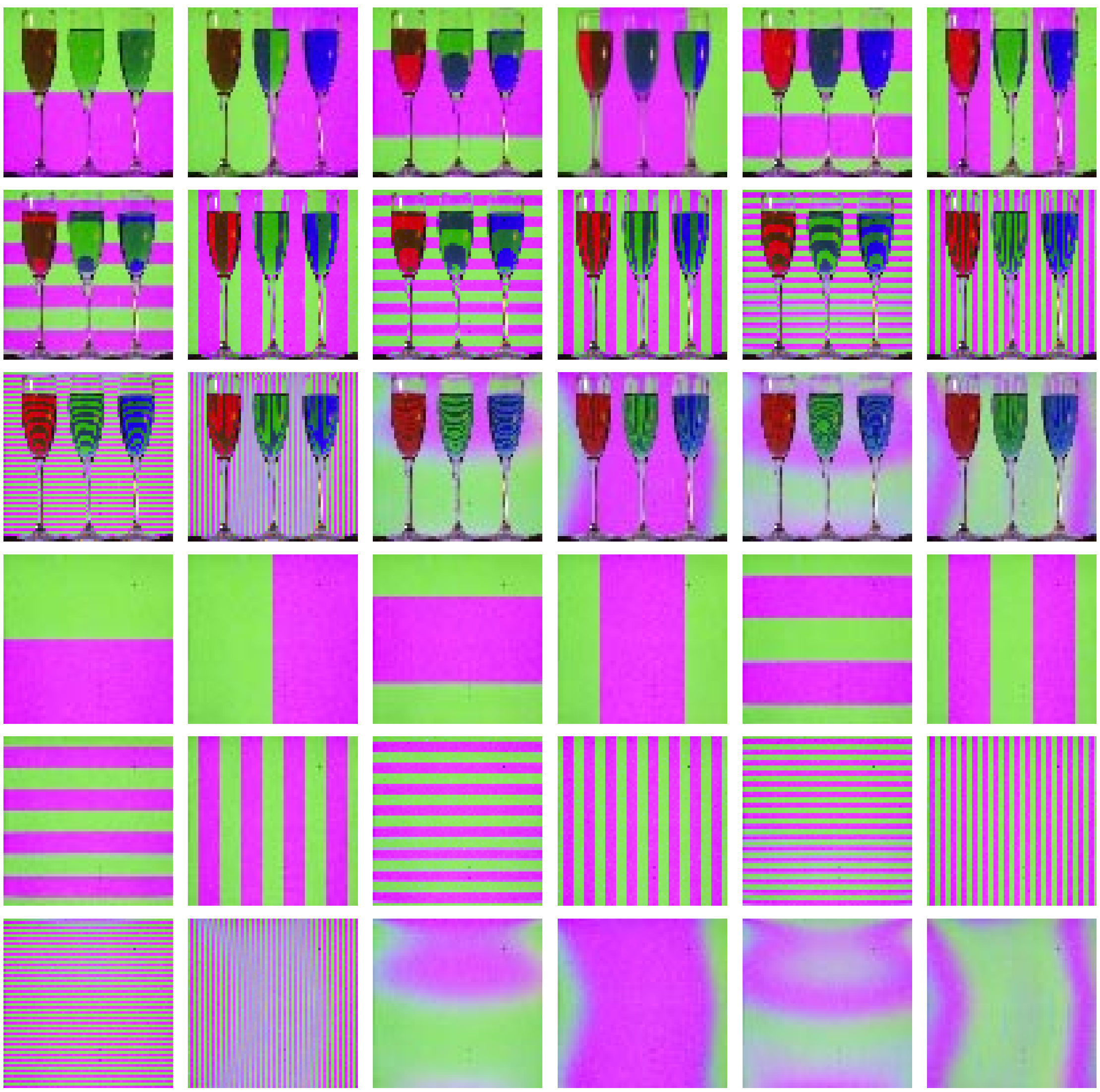


$$
\begin{aligned}
R_1(\alpha) &= (C - C')/(B - B') - (1 - \alpha) \\
F(\alpha) &= C - (1 - \alpha + R_1(\alpha))B
\end{aligned}
$$

Two relatively orthogonal backgrounds give us formulas for $R_1(\alpha)$ and $F(\alpha)$. This is a similar step as in Blue Screen Matting.

Environment Matting Setup

- Capture object on series of structured backgrounds



Environment Matte Pulling

- Goal now to find axis-aligned box, A_1
- Choose A_1 to minimize error between captured and generated values
- Use a *multi-resolution search*
  - Search first at course intervals
  - Refine the search
- Must also search for best α at boundary pixels
- Note $\alpha = 1$ for internal (covered) pixels

The Hard Part

- Real Photographs = Noise
- Compositing in real time is tricky
- Multi-resolution search is subtle

Demo...