Hidden in plain sight: Camera tracking markers for virtual productions

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1 Introduction

• **Virtual production** has seen a rise in popularity for movie/tv productions. Use real time rendering to create breath-taking scenes.
• Positional Tracking of cameras for virtual production is necessary to accurately place real actors in virtual scenes.
• Infrared tracking systems are used in the industry however the technology is very expensive to setup.
• **Visual tracking markers** (tags) can be used but they are visually obstructive in the scene.

"Can camera tracking fiducial markers (tags) be blended into the background to reduce their visibility whilst still being tracked?"

2 Method

1. Finding suitable position to place tag
    - Use edges of screen to place tag
    - Randomly sample regions until **color difference (ΔE)** is sufficiently low within region
2. Blend tag onto scene
    - Apply **blending method** on tag and background
    - Overlay, Photoshop Soft-Light, W3C Soft-Light, Pegtop
    - Combination of Photoshop & W3C
3. Find tags in scene for identification
    - Post process to enhance edges
    - Find square-like objects
    - Check if a tag is present
4. Fading tags
    - Tags can be slowly faded in and out
    - Higher chance for viewer to not notice it when focussing on the main action

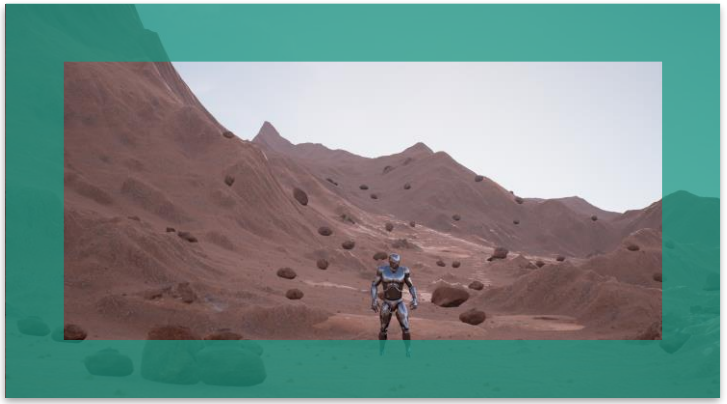
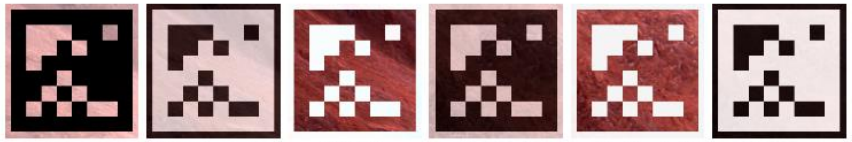


Figure 1: Suitable positions for tag placement highlighted in green

Figure 2: Tag applied to scene with W3C soft-light blending method



(a) Overlay (b) Photoshop (c) W3c (d) Combo (e) Combo2 (f) Pegtop

Figure 3: Close-up of tags blended onto test image.

3 Results & Discussion

• Color Difference (ΔE) below 22.5 on test scene using w3c and combo method
• W3C, Combo and Combo2 perform well in the test scene
• For each scene there may be a different optimal method
• Tag finding performs well when tag is viewed straight on

Marker Size (px)	Method					
	Overlay	Photoshop	w3c	combo	combo2	Pegtop
100	32.13	32.65	35.69	29.22	35.45	36.81
150	31.99	32.62	32.33	29.39	32.97	36.96
200	31.43	30.31	28.94	25.98	29.29	35.64
250	29.56	27.80	21.62	22.39	19.92	35.76

Table 1: Average ΔE values over 1000 runs of each method. Repeated for marker sizes in increment of 50 pixels.

4 Future Work

• Test more blending methods and in different scenes
• Improve tag finding when tags are skewed
• Optimize performance of algorithm with GPU processing

5 Conclusion

• Tags, easier to setup and cost effective
• **Partially hidden** in scene with reduced visibility
• Blending method w3c and combo work well in some scenes. **Tag positioning** very important
• With GPU optimizations can be run in real time