

LightCraft - Extract Light Position and Information from On-Set Photography

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Figure 1: A stitched, spherical HDR image from the set of Star Wars: The Force Awakens.

Abstract

LightCraft is a system at Industrial Light and Magic that semi-automatically determines the parameters of digital light rigs using on-set imagery. It's a quick, simple, reliable, artist-friendly system that solves for the size and location of lights and creates ready-to-use emission maps and environment maps, for lighting in a variety of rendering packages.

The LightCraft system was originally developed at Industrial Light and Magic for the film version of *Warcraft*, but has since been used on *Star Wars: The Force Awakens*, *Jurassic World*, and *Teenage Mutant Ninja Turtles: Out of the Shadows*.

Keywords: Lighting, HDRI, Workflow, Automation

Concepts: •Applied computing → Media arts; •Computing methodologies → Image processing; 3D imaging;

1 Solving for Lights

Using an adjustable-height tripod, an artist on-set takes two sets of photographs a known vertical distance apart. The photos taken from each height of the tripod are stitched together into two spherical HDRI environment maps (1) which are the input to LightCraft.

LightCraft is a simplified front end to ILM's proprietary 3D application Zeno and its Academy Award winning Mars motion tracking and photogrammetry system. The interface presents an image from

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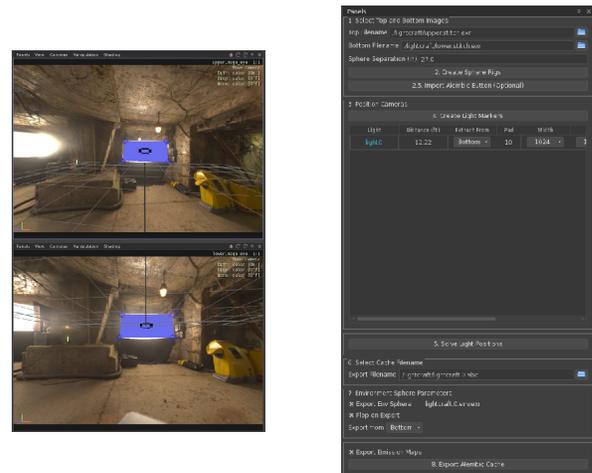


Figure 2: LightCraft panels with a single solved light

the center of each of the spheres. An artist then marks the corners of lights that are to be solved. Corresponding marks are created in the upper and lower spheres. Mars then solves the light positions, which are presented as a grid in the correct spot in 3D space.

Once solved (2), the artist then uses the light positions to automatically extract the emission map from the HDRI spheres, as well as automatically generates a new environment map by extracting and gaussian blurring out the solved lights. Finally, LightCraft exports all of this extracted information to an Alembic cache.

2 User Interface

The concepts, techniques, and systems behind LightCraft have been around for many years, but what is novel is the simplicity of the interface, the way it fits seamlessly into the artist's lighting workflow, and its accessibility to lighters who aren't familiar with motion tracking.

In the LightCraft UI (2) the artist is presented with a series of cus-

tom buttons and panels that the artist is prompted to use one at a time, from top to bottom.

2.1 BB8 Case Study



Figure 3: *BB8 with a CG head replacement.*

Although much has been made of the practical, in-camera effects in *Star Wars: The Force Awakens*, in reality, many of the props and practical characters had digital versions and freely cut between the two. In this shot (3), the practical head of BB8 filmed on set was replaced with a CG performance on top of the practical body. As BB8 is a shiny robot, the rendered look of the head had to match the body exactly. LightCraft solved the lighting rig with a minimum of fuss and ILM turned the shot around in a single day.