

2017 Spring Digital Visual Effects

Project #3 — MatchMove

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Github: <https://github.com/awinder0230/2017-Spring-Digital-Visual-Effect>

Youtube Demo: https://youtu.be/xq_q9xUNSGA

Introduction:

Matchmove is a technique to insert computer generated imagery (CGI) into a video sequence seamlessly by estimating camera parameters from the sequence. In this project, we first shoot a video sequence, and apply some tools to estimate camera parameters, then insert some CGI into the sequence, and finally add some sound effects to it.

Submission Files:

- Artifact Video
- Raw Video
- Report.pdf

Principle:

There exist several tools for matchmove, and each tool may involves different steps to accomplish the task; however, the process of matchmove can be broken down into five steps in general.

1. Feature Tracking

The first step in matchmove is to select several points in the video sequence as tracking features. Usually these features are spots with distinct color from its surrounding backgrounds for the tracking algorithm to track along the sequence. To further stabilize the tracking algorithm, we even put several white paper shreds on the ground, so that we could later select these shreds as features while editing.

2. Calibration

This step is aimed to solve for the 3D motion of the camera. The process derive the 3D motion from 2D projected feature points. There are several algorithm for solving this process, and it is also the key step in matchmove.

3. Point-cloud Projection

After solving the 3D motion of the camera, we then derive the 3D position of feature points, so that we are able to place CGI objects inside the scene.

4. Ground-plane Determination

Once defining the 3D motion and position of the camera and feature points, we are able to define a ground plane if needed. This step simply makes the process of inserting CGI easier, user may also define walls or origin for convenience.

5. Reconstruction

Based on all the processes done above, we are able to create any CGI we want, and insert objects into the scene seamlessly.

Implementation:

In this project, rather than simply following the instructions by the TA, we tried several tools and methods by ourselves. Here are several ways that we've tried, and also some useful reference links for someone in who may be interested.

1. Blender

The first approach that we've tried was to do all the work in blender — from camera tracking to CGI insertion. The camera tracking tool as well as movie editor and CGI modules are all available in blender with version 2.62 and after. Here^[1] is a great tutorial by Blender Guru sharing about how to place a CGI hole on the ground by camera tracking technique. The step-by-step tutorial is clear and simple; however, the camera tracking tool did not work in our video sequence since we move the camera drastically in a scene, and so we turned to the next approach.

2. After Effect

First, we use the 3D camera tracker in After Effect to set up the 3D scene. Then, we can place the 3D hole model in the 3D scene so that the virtual camera can move along the path like the real camera in the video. Finally, applying the material to the 3D model makes the visual effect much more realistic.

Reference:

[1] Blender Guru, Introduction to Camera Tracking in Blender

[2] RossArnoldSanEXTRA, After Effects Tutorial - Element 3D - Hole in the Wall - Man of Steel Heat Vision