

boujou and SteadyMove

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***SteadyMove*: Take the shake from your shots!**

The moving camera is widely employed in the movie and TV production industry, adding interest to almost any shot. Complex mechanical systems are used to ensure that camera motion is as smooth as possible. For the great majority of video and film camera-work tracks, dollies and booms are not available. Mechanical stabilization of hand-held cameras requires the use of heavy counter-balanced rigs and specially trained operators. Without such devices, professional hand-held shots are limited mainly to news-reel footage which viewers expect to be of lower quality. Many video cameras have built-in stabilization which works by shifting the image a few pixels up/down or left/right. Such systems are able to remove small amounts of vibration from a shot, but cannot eliminate the large scale instabilities present in typical hand-held footage. With the introduction of *SteadyMove* many of these limitations are removed.

SteadyMove is simple-to-use software for shot stabilization. It uses vision science techniques to automatically produce a smooth clip from footage filmed in even the most challenging scenarios. *SteadyMove* works by studying the images to calculate the relative camera motion from one frame to the next, it then uses this to remove unwanted motion. A number of controls allow the user to specify how much movement to remove, and how smooth is the final result. *SteadyMove* automatically detects features in the image and tracks them as the camera moves. It is able to locate features in a very wide variety of scenes and lighting conditions, including snowscape, desert, and water. It also performs cut detection, allowing even pre-edited footage to be stabilized with minimal effort.

Since its release in August 2003, *SteadyMove* has shipped as part of Adobe's Premiere Pro digital video editing software. An advanced version of the software, *SteadyMovePro* is available as a plug-in for editing and compositing systems and software including Adobe's Premiere, Premiere Pro and After Effects platforms, and Discreet's Combustion.

The demo will show how the *SteadyMovePro* plug-in may be used to stabilize hand-held DV footage within Adobe's After Effects software. There will also be a rolling demo of pre-rendered before-and-after examples showing the results of *SteadyMove* stabilization applied to a wide variety of different shots.

***boujou*: An automated camera tracking product for the postproduction industry**

Matchmoving is a common requirement in the computer graphics industry. An increasing number of feature films, videos and television commercials are now made up of a combination of live action footage and computer graphics augmentations. When the footage is shot using a moving camera there is an unavoidable requirement to know the camera motion, so that the augmentations register with the live action footage.

Sufficient accuracy is required so that the viewer cannot perceive any drift or wobble. In practice this means subpixel registration. A number of products have become available since the mid 90's which address this requirement. Using the live action image sequence the user selects a number of points and supervises a correlation based tracking process throughout the sequence. These tracks are then used to compute the camera track. This is a

manually intensive process not enjoyed by the animators usually given the job. The main problem is that choosing features suitable for correlation tracking requires expertise, and frequently manual editing is required to 'correct' drifting of the feature.

boujou was the first automated product to address this market. It originates from research carried out at Oxford University in recent years. *boujou* firstly runs a feature tracking process over the sequence and generates a large number of feature tracks. Some of the feature tracks will be wrong at this stage due to features mismatched between images. The second phase of computation processes the feature tracks to recover camera motion, focal length and 3D scene geometry as a point cloud. It is also necessary to correctly handle shots as long as 1500 frames where old structure leaves the view and new structure enters. All stages are robust and modest amounts of smoke, moving objects and mismatched tracks are rejected.

The demo will comprise loading sequences, tracking the sequence, viewing the resulting 3D structure and inserting a 3D test object to verify the solve quality. All stages will be demonstrated using a production version of *boujou*.

boujou has been used extensively in many major film productions since 2001 as well as large numbers of advertisements, pop videos etc. Computation of the camera extrinsics and intrinsics purely from image sequences has long been a favorite topic in computer vision. It is now a routine part of the post production pipeline.