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Title

Images Synthesis of Arbitrary Viewpoints from Three Images based on Projective Geometry

Abstract

This paper describes a research to synthesize images of arbitrary viewpoints from three real images. In the field of computer vision, it is a common subject to reconstruct 3D shapes of objects from multiple images, which is so-called stereovision. The basic theory of stereovision is to calculate intersections of back-projection lines of matching points in each image. Thus, stereovision requires calibration for cameras, which is known to be complicated work. Stereovision also requires estimation of matching points in images, which is general issue in computer vision. When accurate 3D shapes are reconstructed, images of arbitrary viewpoints can be synthesized. However image synthesis does not require 3D shapes in practice. For example, morphing method can synthesize plausible images by interpolating matching points in images. In that case, it is not needed to calibrate input cameras.

In this paper, projective geometry is utilized. Projective geometry between cameras can be determined by easy work, which is called "weak calibration". Then, a 3D voxel space named "Projective Voxel Space (PVS)" is proposed in this paper. Although projective geometry describes only projective relation between cameras, PVS provides a framework to estimate consistent matching points and occlusions in three images. Because the geometric relations of hiding and hidden objects are acquired in PVS, synthesized images have plausible occlusions.

In morphing technique, unsuitable arrangement of input cameras will cause artificial distortion in synthesized images. In two images, this problem can be solved by a method called "view morphing", which uses projective geometry between cameras. In this paper, a technique is proposed to extend view morphing method for three images. The principle of proposed method is identical to the original view morphing method. However, the individual processes are drastically modified.

Thus, the whole methods in this paper provide plausible and un-distorted image synthesis without complicated camera calibration.