

Introduction to Computational Photography

Abstract

Computational Photography is an emerging research area which enables one to capture complex scenes using a digital camera. The typical methodology may include modification and/or re-design of camera internals such as sensor, lens, etc or development of appropriate algorithms to solve the problems in digital imaging. To illustrate, real world scenes which have both brightly and poorly illuminated regions are said to have a very high dynamic range. Due to sensor element capability and bit depth, capturing such scenes using common digital cameras seemed impossible. High Dynamic Range imaging techniques enable one to capture the complete dynamic range of such scenes by compositing multiple, differently exposed images. In this tutorial, we shall provide an overview of the common problems encountered while capturing digital image of a scene. We shall then discuss various techniques employed to solve these problems. Typical applications in Computational Photography include digital matting and compositing, high dynamic range imaging, de-ghosting, super-resolution, refocusing, morphing, etc. This tutorial would aim to provide a basic outline of all these techniques.

Biography

Subhasis Chaudhuri received his B.Tech. degree in Electronics and Electrical Communication Engineering from the Indian Institute of Technology, Kharagpur in 1985. He received the M.Sc. and the Ph.D. degrees, both in Electrical Engineering, respectively, from the University of Calgary, Canada and the University of California, San Diego. He joined the electrical engineering department at IIT, Bombay in 1990 as an assistant professor and is currently serving as the professor and Dean of International Relations. He served as the head of the department during the period 2005-2008. He has also served as a visiting professor at the University of Erlangen-Nuremberg, the Technical University of Munich and the University of Paris XI. He is a fellow of the Alexander von Humboldt Foundation, Germany, the Indian National Academy of Engineering, the Indian Academy of Sciences and the National Academy of Sciences. He is the recipient of Dr. Vikram Sarabhai Research Award for the year 2001, the Swarnajayanti Fellowship in 2003, and the S.S. Bhatnagar Prize in engineering sciences for the year 2004. He was awarded the J.C. Bose National Fellowship in 2008. He is a co-author of the books 'depth from defocus: a real aperture imaging approach', 'motion-free super-resolution', and 'ambulation analysis in wearable ECG', all published by Springer, NY. He has also edited a book on 'super-resolution imaging' published by Kluwer Academic in 2001. He is currently an associate editor for the journals IEEE Transactions in Pattern Analysis and Machine Intelligence, and International Journal of Computer Vision. He has served as the program chair for International Conference on Computer Vision (ICCV) held in Beijing in 2005. His research interests include pattern recognition, image processing, and computer vision.