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# Radiometric Invariant Dense Disparity Estimation for Real Time Stereo Correspondence

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**Abstract:** Computer stereo vision tries to mimic human vision by grabbing multiple views of the same scene and cognizing it. The stereo correspondence will find out the matching pixels between the two views based on the Lambertian criteria, which results in disparity. The distance of the objects from the camera can be calculated using this disparity. But in the real world scenario, this Lambertian assumption may not work always due to the radiometric variation between the image pairs and the conventional approaches results in erroneous disparity. In this work, for doing the radiometric invariant stereo matching, the simple local binary pattern is used. The correspondence is done by using semi global block matching method, which can handle the depth changes of curved surfaces and slanting surfaces by adding suitable penalty terms. The performance evaluation of the proposed shows lesser error rate in the range of 0.14% - 0.3883% and run time requirement of 0.20 milliseconds only. This radiometric invariant stereo correspondence attains accuracy as that of global method with run time speed as that of local method and is suitable for most of the real time stereo vision applications.

**Keywords:** Radiometric Invariant, Stereo Matching, Local Binary Pattern, Semi Global Block Matching, Dense Disparity

## Introduction

In recent years, binocular stereo vision a has been playing a major role in computer vision applications such as robotic vision, medical imaging, autonomous vehicles and augmented reality. Stereo vision tries to achieve the abilities of human vision by electronically grabbing and cognizing the images (Szeliski, 2010). By measuring the difference in relative positions between the matching pixels, the stereo correspondence can infer depth of the objects from two views of a scene. The matching is done based on a cost function that gives the similarity measure between the conjugate pairs. The aggregation of this cost results in the Disparity Space Image (DSI). Using this DSI, the depth of objects from the camera can be calculated with the help of triangulation. The correspondence can be of either local methods or global methods (Scharstein and Szeliski, 2002). Often, the real time applications in computer vision faces the trade-off between speed and accuracy, hence they usually rely on local area based correspondence. The crux of stereo correspondence always lies in finding the similarity between two images under challenging conditions such as high dynamic range imaging (Park *et al*., 2017), radiometric variations, occlusions, textureless regions and repetitive patterns. The radiometric variations can be due to the change in illumination conditions or the camera exposure time variations. In such real world scenerio, the traditional approaches for the stereo correspondence will result in increased error. The common non-parametric approaches to tackle these radiometric variations are Census and rank transforms (Ramin and Woodfill, 1994) followed by a window based cost aggregation. Most of the approaches suggested by the stereo vision researchers to handle these kinds of challenges are done at high computational expense. In single view still image applications, a number of binary operators are used to handle non-uniform texture regions that arises from the sudden illumination changes. Of these the Local Binary Pattern (LBP) operator transforms these images captured under radiometric variations to an illumination invariant one in a better