Linear Models of Different Light Source Spectra

by

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ABSTRACT

Computer vision techniques have been widely used in color reproduction, object identification, and high quality imaging applications. An important requirement in these applications is to identify the color of the light source. Traditional light sources for imaging are daylight and incandescent lamps. Today other light sources are being more and more widely used in imaging applications, such as fluorescent lamps, high intensity discharge lamps, and light emitting diode lamps. To achieve accurate color analysis under these light sources, estimation of the spectra of different light sources becomes imperative. This paper introduces linear models of different light source spectra, which can be used to estimate the spectra by calculating the coefficients for the linear model components. Using principal component analysis, we analyzed the linear models for spectra of different type of light source technologies. The light sources studied in this paper include daylight and artificial light sources such as incandescent lamps, fluorescent lamps, metal halide lamps, and light-emitting diode (LED) lamps. It is found that the spectra of different light source technologies require different dimensions for their linear basis, and the dimension ranges from 2 to 5, with the exception that LED lamps' spectra may require more dimensions. LED lamps that emit narrow band lights are more difficult to represent by linear models. It is also found that the linear basis for daylight spectra can not be used to represent spectra of the artificial light sources. A universal linear model for representing spectra of all different light sources would require the dimension of linear basis greater than 10.