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信息科学

基于视觉阈值及通道融合的立体图像质量评价

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摘要： 根据人眼对彩色图像不同颜色通道的敏感度不同，利用掩蔽效应对人眼感知立体图像质量产生的影响，提出了一种基于视觉阈值分析和通道融合的彩色图像客观质量评价方法。利用人眼视觉阈值确定立体图像的失真是否在人眼可察觉的范围，若失真程度小于视觉掩蔽阈值，则认为没有失真。利用原始和失真彩色图像RGB三通道各自左视点差值图和右视点差值图的奇异值与人眼视觉掩蔽阈值图的奇异值距离来衡量失真图像左右视点图像的质量。原始和失真图像对的绝对差图之差值图像和原始图像对的双目恰可察觉失真阈值图之间的奇异值距离被用于评价失真立体图像的深度感知好坏。不同失真类型下，左右视点质量融合以及左右视点评价和深度感知评价的融合其加权权值不同。对JPEG压缩、JPEG2000压缩、高斯白噪声、高斯模糊和H.264编码5种不同程度失真的312幅退化图像进行了测试，结果显示本文方法与主观感知有较好的一致性，总体CC (Pearson Linear Correlation Coefficient)达到0.94，总体SROCC （Spearman Rank Order Correlation Coefficient）达到0.94，整体均方根误差（RMSE）控制在5.9以内。

关键词： 立体图像 质量评价 视觉阈值 奇异值分解

Stereoscopic image quality Assessment based on visual threshold and channel fusion

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Abstract: According to the different sensitivities of human eyes for different color channels of color images and the effect of tolerable perception range of human eyes on color image perception，a color image objective quality assessment method based on visual threshold and channel integration is proposed. Visual threshold characteristics of human eyes are used to determine whether the distortion of a stereoscopic image can be perceived. If the degree of distortion is within the tolerable range of human eyes, the distortion is ignored. Singular values of difference maps between original and distorted images with respect to the left and right views are compared with singular values of the visual threshold map of original images, so as to assess the quality of the left and right views, respectively. For original and distorted stereoscopic images, the difference between their left view and the right view are calculated, and the difference map of the above two differences is further calculated. The singular values of the difference map are then compared with singular value of binocular just noticeable difference to assess the quality of stereo perception. For different types of distortion, the weights for fusing the assessments of the left and right views, and the weights for fusing the assessments of the left-right views and stereo perception are different. The experimental results on 312 stereoscopic images distorted with Gaussian blur, Gaussian white noise, JPEG, JP2K and H.264 show that the proposed objective model can achieve more than 0.94 Pearson Linear Correlation Coefficient(CC) and general Spearman Rank Order Correlation Coefficient(SROCC),respectively, and the overall Rooted Mean Square Error(RMSE) is less than 5.9, which means that the assessment score obtained by the proposed model is well consistent with that obtained by human subjective perception.

Keywords: stereoscopic image quality assessment visual threshold singular value decomposition

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