Analysis of the Impact of Front and Back light on Image Compression with SPIHT Method during Realization of the Chroma Key Effect in Virtual TV Studio

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Abstract: In this paper analysis of the impact of front and back light on compression of static image necessary for realization of the chrome-key effect in virtual TV studio is presented. For image compression SPIHT method is used. The analysis is performed for the fixed value of front light and variable values of the back light. Compression is applied to different values of the bit per pixel (bpp). The quality of compressed images is rated based on the values MSE, SNR and PSNR. The obtained values are displayed in tables and graphics. Based on these graphics a comparison between compressed images with different levels of front and back lights was made and it is given a level of image brightness produces the best results. It was found how the quality of compression varies with the changing brightness of images at different bit per pixel.

Keywords: chroma key; front light; back light; SPIHT method; bit per pixel (bpp); mean square error (MSE); signal to noise ratio (SNR); peak signal to noise ratio (PSNR)

1 Introduction

Chroma key process in television replaces studio set design and reduces the overall costs of the production of the program. It is a way of mixing two video signals, in which the solid background color of a video signal (signal with the live picture from the scene) is replaced by another video signal. Replacement is done by a fast switching circuit that alternately turns on and of a video signal from foreground (FG) and a video signal of the new background (BG). The process of changing the background is called keying [1, 2]. Inserting a video signal of the new background in a monochrome background of the foreground, is made at the time of scanning, on the border between the object or the participants in the foreground and the background. In this way it creates the impression that the objects of the foreground are in a scene that comes from some other source. One color background can be of any color, provided that the color is not on objects or participants in the front of the stage [3]. Today, blue or green color are used for the background.

Chroma key procedure gives satisfactory results for static scenes (news programs, panel discussions, weather, etc.), but when it comes to shooting scenes with dynamic movements of participants, it does not follow changes in the of angle of shooting, the transition from zoom to the total, or movement from one camera to another, and it is disturbing the real relationship between the participants and the objects of the scene and the sense of space and depth in images is lost.

Because of this, the range of chroma key effect is limited to static relationship with the foreground. Therefore, when a natural relationship of the background and foreground in television production is desired, producers are using a virtual studio [4, 5].

2 Virtual TV Studio

Virtual TV studio provides a natural relationship between the participants and the scenery. Therefore, real-time corrections of the scenery can be generated from computers and coordinates obtained depending on the position of the camera, and ultimately result in the creation of the foreground. In this way the logical relationship between the set and the participants is preserved, and there is also a sense of depth in the images. In virtual studio it is possible to generate scenery that is in the foreground, and that can be opaque or translucent (transparent). Computer-generated scenery has the visual appearance of real decor in the background, and in this way it is possible to create a variety of decors, even surreal decors, so there is a visual impression that the TV studio is a lot larger than it is. Software packages 3D Studio Max, Maya, SoftImage and LightWave are used when we want to create a computer-generated scenery [6, 7].

Virtual studio technology is based on an already described chroma key procedure. In chroma key procedure static two-dimensional computer generated graphics are used for scenery, and those graphics are inserted as a background image. But it does not follow the changes of angle of shooting, transition from zoom to total or movement from one camera to another, and results in a disruption of the real relationship between the participants and the scenery. In virtual studio, data on the position of the camera are processed in the computer and real-time adjustments on the position of the generated 3D graphics and animations are made, based on the data from the camera. Therefore, the naturalness is retained, there is an illusion of spaciousness and logical relationship between participants and objects in the video signal of live image and scenery is reatined [8].

A studio which implements virtual studio is generally L-shaped or U-shaped, and the newest studios are circular. Scene (walls and floors) should be uniformly colored blue or green while the side walls and places where the wall crosses into the floor should be rounded, to avoid creating unwanted shadows. Blue or green screen can also be used. Diffuse lighting is mostly used, to awoid creation of create shadows. Participants are in nearly empty space, usually with no or only a few real elements in the studio, and the other scenery is generated in a pre-production by a computer and is then combined with the video signal from the camera.

Main equipment of the virtual television studio consists of a camera with CCU (Camera Control Unit), sensors for determining the position of the camera, a computer with high processing power, a chroma keyer and a delay line. Block diagram of a virtual studio with three cameras is shown in Figure 1.

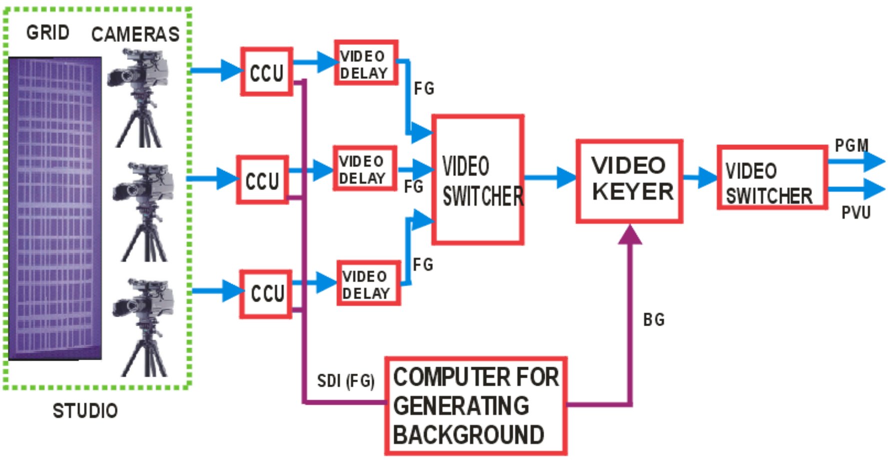

Figure 1
Block diagram of a virtual studio with multiple cameras

The video signal from the camera that captures the foreground, through delay lines is fed to chroma keyer. Information from sensors that determines the position of the camera is fed to a computer with large processing power, on the basis of which real-time correction of the generated scenery is done, and then the corrected information is transmitted to chroma keyer where the two images are combined. The computer has a video output for preview, a video input, an audio input and output, a delay-line for video and audio signals. Supports SD and HD standards, PAL and NTSC formats. The computer is controlled by a software suite that consists of an active relational database for fast and easy visualization (rendering) of the graphics. All individual set designes have their own separate database. Data on the position of the camera during shooting allows computers to, after data processing, adjust the position of the generated graphics for scenery, so you can maintain the illusion of spaciousness and naturalness.

Manufacturers have developed various methods for determining the position of the camera and the measurements of basic movements that each camera can make (pan, tilt, displacement along the x, y, z axes, zoom and focus). Pan sets the horizontal movement, tilt determines the vertical movement, zoom enlarges or reduces the actual size of the image or the frame and the focus determines the sharpness of the image.

In Pattern System (recognizable grid), a grid is drawn (network) in blue or green chroma key background that lies behind the performers (Figure 1). The grid is drawn in a lighter shade of blue or green. The video signal from the camera is led to the computer with a special video processor and sophisticated software that determines the exact location and orientation of the camera from the video signal, including settings for zoom and focus. Depending on the system, the process of re-calculating the position of the camera lasts from 1 to 3 frames.Chroma key process insertion of a new signal can be done with any color in the background, provided that the color is not on the objects and the participants in the front of the stage. For the background color saturated blue and saturated green are used, and, in special cases, pink [9].

3 Lighting

The biggest challenge when setting up a scene (bluescreen or greenscreen) is setting the light and avoiding shadows because we have to achieve a uniform new color of the background. Shadows can cause appearance of the darker background color, which will not be registered when the background is changing. In order to obtain a better quality of recording it is necessary to make a difference in color (in color coordinates) between the subject and the background, so as to increase the difference between the color of the background or subject. For lighting it is usually the same setting as the default setting for the recording that includes three lights (front, side and back) [10].

Front (direct, main, critical) light is set in the direction of the camera, in the angle of 0° - 30° on each side, with vertical angle of approximately 45°. This angle highlights the greater part of the face, the smaller part remains in the shadows. It should be somewhere between hard and soft light. Too strong or too soft light is generally undesirable for most subjects. In the studio this "golden mean" is achieved by a Fresnel light [11] [12].

For the side light, the supplementary light is placed at angles from 45° to 90° on either side of the camera, or 90° from the main light, but the safest place to be is at 45° from the camera. It needs to be less saturated than the main light and softer. The main and supplementary light should be in the ratio 2:1 (2000 lx : 1000 lx). It eliminates shadows that come from the main light.

Background sidelight is placed on the side of the subject to be shot, from 90° to 135° on each side and is used to illuminate the space background and to get the depth and separation. The intensity of the background light should be about 2/3 of the intensity of the main light elements in the scene. This ensures that the central subject is separated from the background [11] [13].

In Figure 2 types of lights in the implementation of the virtual TV studios are shown.

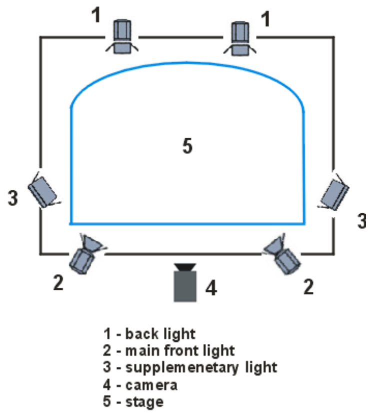

Figure 2

Types of lights in the implementation of the virtual TV studios

The light sources are characterized by the color temperature. Color temperature (°K) is the temperature to which the black body should be heated - (a light source) so its color is colorimetric most similar to the color of the secondary sources of daylight.

The intensity of light (luminous intensity I) falling on a surface depends on the strength of the light source, and the distance between the source and the area to be illuminated.

Luminous intensity (intensity of the light source, cd, I) is the amount of light energy that a point source of light emits per second in one direction given by unit of spatial angle.

Brightness (luminance intensity, lx, E) is the amount of light energy that per second falls on a unit area. Units are lux (lx) and foot-candle (fc). Lux and foot candle are units of volume illumination. The difference is that the lux is metric and foot-candle Saxon measure [14].

4 Realization of the TV Studio

Analysis compression is performed over images obtained in the TV studio with area of 12x8 = 96 m^2 and a height of 4.5 m. Dimension of the blue background is 8 x 3,5 m. Disposition of the lights in relation to the object in the scene is shown in Figure 3.

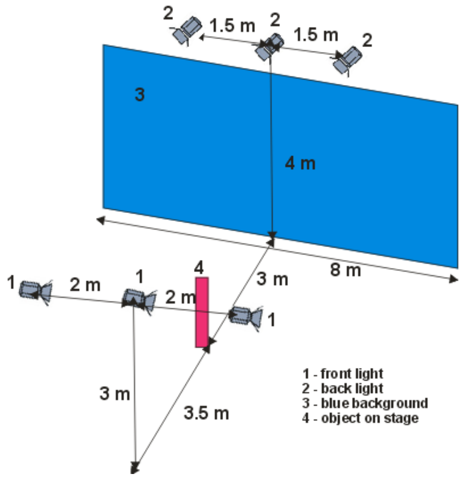

Figure 3
Disposition of the lighting in TV studio

Number of the front and the back lights is 3, and all lights are set at an angle of 45° to the horizontal plane. Horizontal distance between the front and back light is 6.5 m. The spacing between the back lights is 1.5 m and they are placed at a height of 3 m in relation to the scene. Devices for the formation of the back lights Reflector. Flourescent soft lights 2 lamps 55 W, 3200 K were used. The front lights are mounted at a height of 3 meters in relation to the scene, and the spacing between them is 2 m. As a devices for the formation of the front light Fresnel Reflectors lens (150 mm Fresnel lens and G22 lamp holder, halogen lamp 1000 W, 3200 K) were used.

For the color temperature control an instrument was used to measure the color temperature Minolta Color Meter II. For the control of the light intensity digital luxmeter VDVM1300 was used.

In this analysis, the object that is being filmed is at a distance of 3 m from the background (and the back light) and 3.5 m from the front light. For filming the object in the scene a digital camera Canon EOS 550D was used. It is set at a distance of 2 m from the object.

In practical cases the object in the scene can be placed at any distance between the front and the back lights.

5 SPIHT Compression Algorithm

Development of digital images led to the appearance of several methods to store digital pictures. In order to reduce the size of storage needed for high resolution still digital images, it is necessary to perform compression and thus reduce the file size. Compression is the process of eliminating data redundancy or converting data into a form that occupies less storage space.

The JPEG (Joint Photographic Experts Group) method is a standard procedure for image compression. It is an established method for the compression of both B/W and coloured images in real (natural) scenes. It is used for the compression of natural images and paintings, but it is not efficient for the compression of text images, freehand and technical drawings. Together with GIF, JPEG is the most popular format for transferring images over the Internet due to a satisfactory compression ratio and support by all web browsers for these file formats.

EZW (Embedded Zero-tree Wavelet) algorithm enables the progressive transmission of a compressed image. By using this algorithm, it is possible to stop the encoding process at any moment when the desired bit-rate is achieved. In the wavelet decomposition, the image is divided into sets of frequency/spatial hierarchical sub-bands. The important premise of the zero-tree algorithm is that substantial redundancy exists between the "parent" and "child" samples within the sub-band hierarchy [15].

EZW algorithm has very good performance (peak signal to noise ratio - PSNR) compared to other compression algorithms with low bit-rates. It keeps significant coefficients in all levels. The main drawback of the EZW algorithm is its complexity which impacts calculation resources [16, 17].

The EZW algorithm is used as a base for development of large number of similar compression methods. One of the most popular methods is SPIHT (Set Partitioning In Hierarchical Trees). In the original EZW method, arithmetic coding of the bit streams was essential to compress the ordering information as conveyed by the results of the significance tests.

Unlike the EZW, SPIHT doesn't use arithmetic coding. The subset partitioning is so effective and the significance information so compact that even binary un-coded transmission achieves similar or better performance than EZW. The reduction in complexity from eliminating the arithmetic encoder is significant.

The algorithm is introduced by Said and Pearlman [18] for the compression of still images. This method gives better results for larger compression ratios than EZW. The term "Hierarchical Trees" points to quad trees that consist of "parent" and "child" nodes as defined in EZW. Set Partitioning is the operation that divides wavelet coefficients from quad trees into partitions.

The algorithm selects the coefficients $c_{i,j}$ such that, with n decremented in each pass, the coefficients are distributed into three ordered lists - List of Insignificant Sets (LIS), List of Insignificant Pixels (LIP) and List of Significant Pixels (LSP).

After initialization, the following steps are iterated: sorting pass, refinement pass and quantization step update. Through those steps the appropriate significance, sign and most significant bits are sent to the decoder or stored on file.

6 The Measures of Compression Quality

Three of the most used measures for the comparison of image quality are the mean square error (MSE), signal to noise ratio (SNR) and peak signal to noise ratio (PSNR).

A method for the estimation of image quality is needed in order to give a view about how "lossy" compression methods modify image quality. We may treat an image as a matrix whose elements are image pixels.

The estimation process is then based on the calculation of distances between appropriate elements of input and output matrices. In this way, not only comparison of quality of different compression methods is enabled, but also comparison of the results of the same method using different compression ratios.

We denote the matrix A at the input of the compression system with elements a_{ij}, with i∈{1...M}, j∈{1...N}, where M is the number of image elements in the vertical and N is the number of image elements in horizontal direction [19]. MxN is the total number of image elements.

The output of the compression system is the matrix A' with elements a'_{ij}. The distance between the elements of matrices A and A' represents the error or the loss of image quality. Usually, the error is larger for higher compression ratios. A user can set the compression ratio according to the desired image quality, and hence directly influence the data size of the compression image [19].

The total reconstruction error is defined as:

$$E=\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}\|a_{ij}-a'_{ij}\|^2 \tag{1}$$

The distance between matrices A and A' is frequently calculated using the Mean Square Error:

$$MSE=\frac{E}{MxN}=\frac{1}{MxN}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}\|a_{ij}-a'_{ij}\|^2 \tag{2}$$

where MxN is the total number of image pixels, and the sum is applied to all image elements.

The amplitudes of image elements are in the range $[0,2^n\text{-}1]$, where n is the number of bits needed for binary representation of amplitude of each element in the original image. MSE does not consider amplitudes of image elements (it only considers differences between amplitudes) and it is the reason for introducing the Peak Signal to Noise Ratio:

$$PSNR = 10\log_{10}\left(\frac{MAX_I^2}{MSE}\right) = 20\log_{10}\left(\frac{MAX_I}{\sqrt{MSE}}\right) \quad (3)$$

The variable MAX_I is the maximum amplitude value of image element (pixel). When the amplitude of the image pixel is represented by B bits, MAX_I is $2^B\text{-}1$

7 System Model

For the analysis we have used uncompressed images with original resolution of 1600x1200 pixels, and analysis was carried out in the previously described virtual studio.

The images are illuminated with different lighting intensity of front and back studio lights. Image analysis is divided into three blocks. The first is for the case of fixed front light at 200 lx, the other for a fixed at 800 lx, and the third for the fixed at 1400 lux. For all three cases the back light is changed in the range of 200 to 1400 lx. In Figure 4, Figure 5 and Figure 6 are given the appearance of images that have been subjected to compression.

Figure 4

Appereance of images obtained for front light at 200 lx and back light: a) 200 lx, b) 400 lx, c) 600 lx, d) 800 lx, e) 1000 lx, f) 1200 lx, g) 1400 lx

Figure 5
Appereance of images obtained for front light at 800 lx and back light: a) 200 lx, b) 400 lx, c) 600 lx, d) 800 lx, e) 1000 lx, f) 1200 lx, g) 1400 lx

Figure 6
Appereance of images obtained for front light at 1400 lx and back light: a) 200 lx, b) 400 lx, c) 600 lx, d) 800 lx, e) 1000 lx, f) 1200 lx, g) 1400 lx

Figure 7, Figure 8 and Figure 9 shows the appearance histograms of images obtained in a Virtual TV studio.

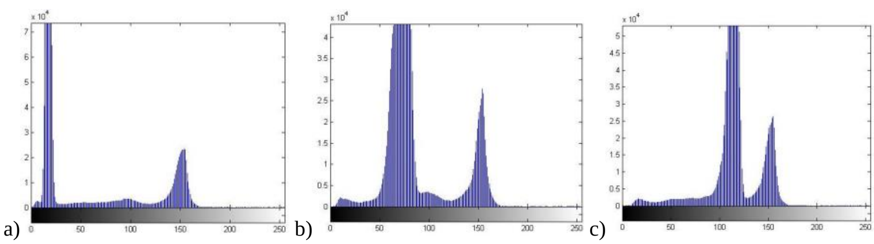

Figure 7
Histograms of images obtained for front light at 200 lx and back light: a) 200 lx, b) 800 lx, c) 1400 lx

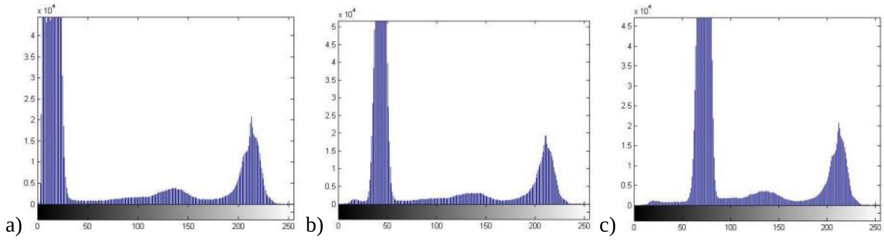

Figure 8

Histograms of images obtained for front light at 800 lx and back light: a) 200 lx, b) 800 lx, c) 1400 lx

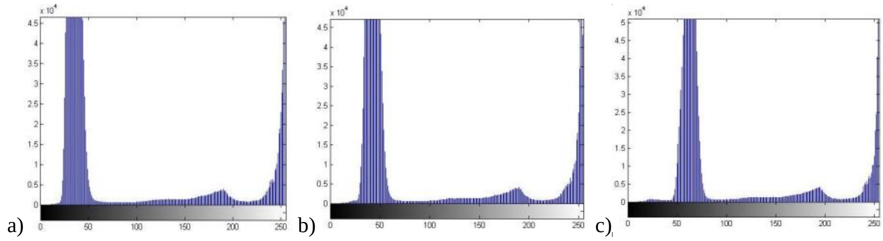

Figure 9

Histograms of images obtained for front light at 1400 lx and back light: a) 200 lx, b) 800 lx, c) 1400 lx

Figure 10 shows an example of the realization of chroma key effect in the case of the front and back lighting with intensity of 1400 lx.

Image compression is performed in the software package Matlab 7.0 using module for compression with SPIHT algorithm. Ten transfer rates are applied: 0.05 0.1, 0.2, 0.3, 0.4, 0.5, 0.7, 1.0, 1.5 and 3.0 bits / element images (bpp). Based on the differential between the original and reconstructed images, following values were computed: middle squared error (MSE), ratio signal / noise (SNR) and peak signal / noise ratio (PSNR).

Figure 10

An example of the realization of chroma key effect with the front and back light of 1400 lx

8 Analysis Results

The values of MSE, SNR and PSNR for different speeds of transfer and for different degrees of studio lighting for front and back lights are given in Table 1, Table 2 and Table 3, respectively.

Table 1
MSE values for compression images with different values of the front and back lights

front light [lx]	back light [lx]	bpp									
		0.05	0.1	0.2	0.3	0.4	0.5	0.75	1	1.5	3
200	200	4.6	2.9	2.1	1.7	1.4	1.2	0.8	0.5	0.3	0
	400	5.9	4.6	3.5	2.9	2.4	2.1	1.5	1	0.5	0.1
	600	6.4	4.8	3.6	3	2.5	2.1	1.5	1	0.5	0.1
	800	7.3	5.9	4.6	3.9	3.4	2.9	2	1.5	0.7	0.1
	1000	8	6.4	5	4.3	3.7	3.1	2.2	1.6	0.8	0.1
	1200	8.5	6.7	5.3	4.4	3.8	3.3	2.3	1.7	0.8	0.1
	1400	8.9	7.2	5.7	4.8	4.2	3.6	2.5	1.9	0.9	0.1
800	200	5.8	3.2	2.1	1.6	1.3	1	0.7	0.5	0.2	0
	400	6	3.4	2.3	1.8	1.5	1.3	0.8	0.6	0.3	0
	600	6.1	3.9	2.8	2.3	1.9	1.6	1.1	0.7	0.4	0.1
	800	6.7	4.2	3	2.5	2.1	1.8	1.2	0.8	0.4	0.1
	1000	6.5	4.3	3.1	2.5	2.1	1.8	1.3	0.8	0.4	0.1
	1200	6.8	4.4	3.2	2.6	2.2	1.8	1.3	0.9	0.5	0.1
	1400	7	4.6	3.3	2.7	2.3	1.9	1.4	0.9	0.5	0.1
1400	200	6.1	3.4	2.3	1.8	1.4	1.2	0.8	0.5	0.3	0
	400	6.1	3.6	2.4	1.9	1.5	1.3	0.9	0.6	0.3	0
	600	6.6	3.7	2.4	1.9	1.6	1.3	0.9	0.6	0.3	0
	800	6.2	3.7	2.6	2.1	1.7	1.4	0.9	0.6	0.3	0
	1000	6.3	3.9	2.7	2.2	1.8	1.5	1	0.7	0.3	0
	1200	6.7	4.2	2.9	2.4	2	1.7	1.1	0.7	0.4	0
	1400	6.7	4.3	3	2.4	2	1.7	1.2	0.8	0.4	0

Table 2
SNR values for compression images with different values of the front and back lights

front light [lx]	back light [lx]	bpp									
		0.05	0.1	0.2	0.3	0.4	0.5	0.75	1	1.5	3
200	200	27.9	29.9	31.3	32.3	33.1	33.8	35.7	37.2	40.3	48.4
	400	25.7	26.9	28.2	29	29.8	30.5	32	33.6	36.4	45.3
	600	22.6	23.6	24.7	25.4	26.1	26.7	28.3	29.6	32.9	41.3
	800	21.1	22	23	23.7	24.4	25	26.6	27.8	31.1	39.5
	1000	20	21.2	22.3	23.1	23.8	24.5	25.9	27.5	30.4	39.2
	1200	20.2	21.1	22.2	22.9	23.6	24.3	25.8	27.1	30.3	38.9
	1400	19.9	20.8	21.9	22.6	23.3	24	25.4	26.8	30	38.6
	200	30.4	33.1	35	36.2	37.1	38	39.9	41.5	44.7	52.6
	400	29.7	32	33.6	34.7	35.6	36.3	38.1	39.7	42.7	51

800	600	28.7	30.7	32.1	33	33.8	34.5	36.1	37.9	40.6	49.1
	800	28.3	30.3	31.7	32.6	33.4	34.1	35.7	37.4	40.2	48.8
	1000	27.9	29.8	31.2	32.1	32.8	33.5	35.1	36.8	39.6	48.2
	1200	27.3	29.2	30.6	31.5	32.3	33	34.5	36.2	39.1	47.8
	1400	26.6	28.4	29.8	30.7	31.4	32.1	33.7	35.3	38.2	46.9
1400	200	31.1	33.6	35.3	36.4	37.3	38.1	40	41.7	44.9	53.2
	400	30.8	33.2	34.9	35.9	36.8	37.5	39.4	41.1	44.2	52.6
	600	30.6	33.2	34.9	36	36.9	37.6	39.4	41.2	44.2	52.7
	800	30.5	32.8	34.4	35.4	36.2	36.9	38.7	40.5	43.5	52.1
	1000	30.1	32.2	33.8	34.7	35.6	36.3	38	39.9	42.8	51.5
	1200	29.9	31.9	33.5	34.4	35.2	35.9	37.6	39.5	42.4	51.2
	1400	29.4	31.3	32.8	33.7	34.5	35.3	37	38.8	41.8	50.6

Table 3

PSNR values for compression images with different values of the front and back lights

front light [lux]	back light [lux]	bpp									
		0.05	0.1	0.2	0.3	0.4	0.5	0.75	1	1.5	3
200	200	41.5	43.5	44.8	45.9	46.7	47.4	49.3	50.8	53.8	62
	400	40.4	41.6	42.7	43.5	44.3	45	46.4	48	50.8	59.7
	600	40.1	41.3	42.6	43.4	44.2	44.9	46.4	48	50.8	59.7
	800	39.5	40.4	41.5	42.2	42.9	43.5	45	46.4	49.5	58.1
	1000	39.1	40.1	41.1	41.8	42.5	43.2	44.7	46	49.2	57.8
	1200	38.8	39.9	40.9	41.7	42.3	43	44.5	45.8	49.1	57.5
	1400	38.6	39.6	40.6	41.3	41.9	42.5	44.1	45.4	48.7	57.1
800	200	40.5	43.1	44.9	46.2	47.1	47.9	49.9	51.4	54.7	62.6
	400	40.3	42.8	44.4	45.5	46.4	47.1	49	50.5	53.5	61.8
	600	40.2	42.2	43.6	44.5	45.4	46	47.6	49.4	52.1	60.6
	800	40	41.9	43.3	44.2	45	45.7	47.3	49	51.8	60.4
	1000	39.9	41.8	43.3	44.1	44.9	45.6	47.2	48.8	51.7	60.3
	1200	39.8	41.7	43.1	44	44.8	45.5	47	48.7	51.6	60.2
	1400	39.7	41.5	42.9	43.8	44.5	45.2	46.8	48.4	51.3	60
1400	200	40.3	42.8	44.5	45.6	46.5	47.3	49.2	50.9	54.1	62.4
	400	40.3	42.6	44.3	45.4	46.3	47	48.8	50.5	53.6	62
	600	40.2	42.5	44.2	45.3	46.2	46.9	48.7	50.5	53.5	61.9
	800	40.1	42.4	44.1	45	45.9	46.6	48.4	50.2	53.2	61.8
	1000	39.9	42.2	43.8	44.8	45.6	46.3	48.1	49.9	52.9	61.6
	1200	39.9	41.9	43.5	44.4	45.2	45.9	47.6	49.5	52.4	61.2
	1400	39.8	41.8	43.3	44.3	45.1	45.8	47.5	49.3	52.3	61.2

In the given tables it is shown that the MSE values decrease and the values of SNR and PSNR increase with increasing bpp for all images with different lighting conditions.

Graphic display of changes PSNR with increasing speeds of transfer due to compression in the case of fixed front light at 200 lx, 800 lx to 1400 lx are shown in Figure 11, Figure 12 and Figure 13, respectively.

From the graphics shown in Figure 11, Figure 12 and Figure 13 it can be seen that the PSNR increases with increasing bpp. At lower values of bpp, PSNR values for different intensity of brightness are approximately the same. With increasing intensity of front light PSNR is also increasing. Growth of the PSNR for increasing intensity of back light is much more pronounced than for the lower value of fixed front light. At higher values of fixed front light, difference between PSNR for different values of the intensity of the back light is smaller.

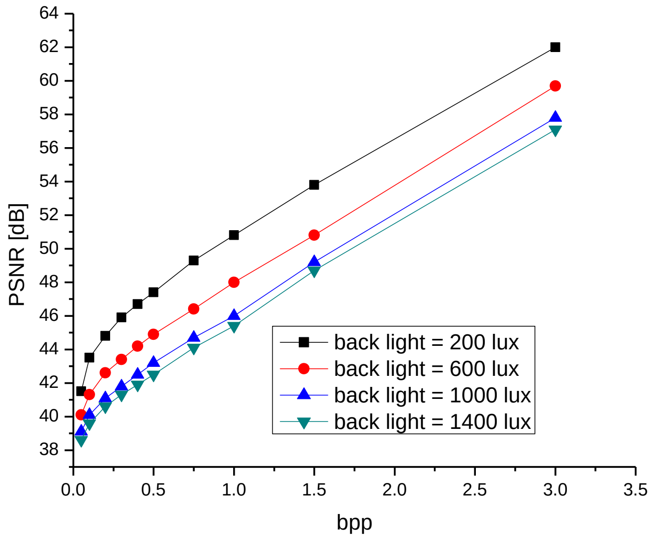

Figure 11
Change of PSNR for different values of bpp with fixed front light = 200 lx

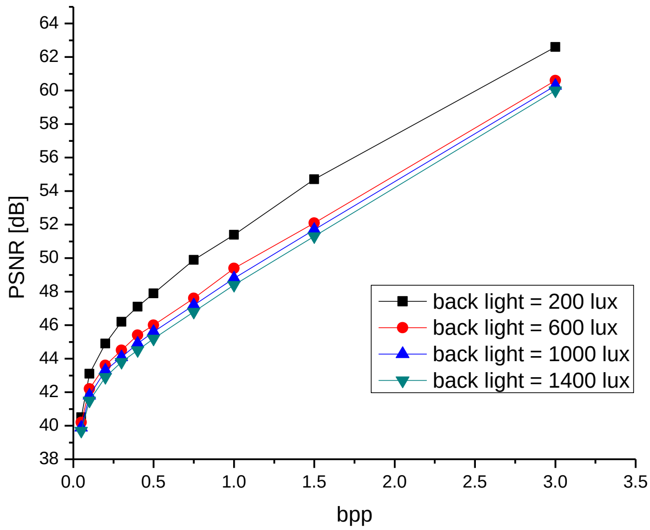

Figure 12
Change of PSNR for different values of bpp with fixed front light = 800 lx

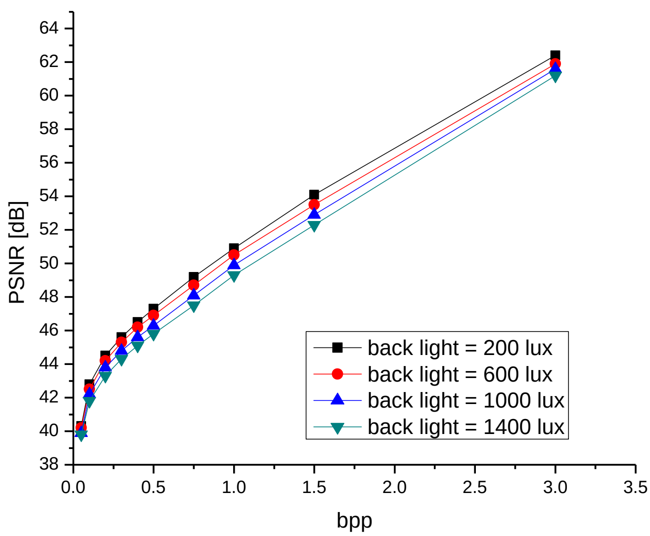

Figure 13
Change of PSNR for different values of bpp with fixed front light = 1400 lx

Figure 14 shows the change of PSNR with increasing intensity of the back light, for different intesities of the front light and the bit per pixel image (bpp).

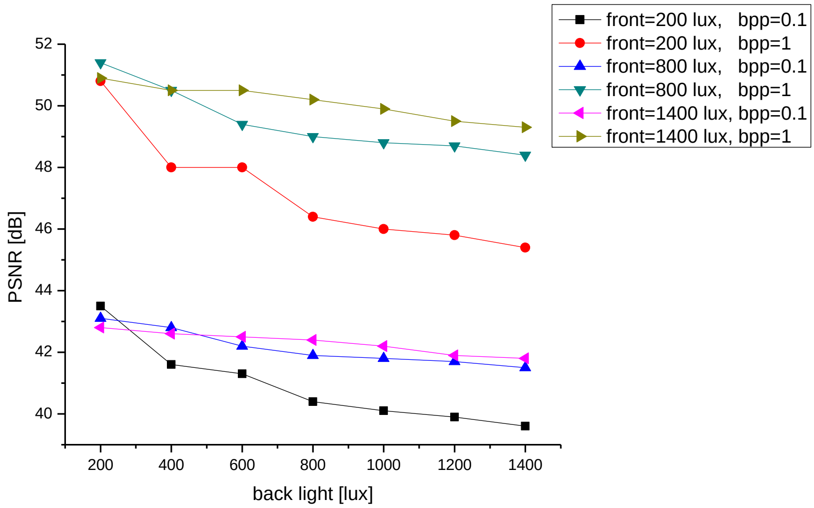

Figure 14
PSNR change for different strengths of the front ligh

Figure 14 shows that with increasing intensity back light PSNR is decreasing for any value of bpp and front light. Fastest decrease is achieved with lower values of the front light, while for the biggest values decrease of the PSNR is less pronounced. Higher PSNR values are obtained for higher values of the front light, while lower values of the front light give a lower PSNR values.

Conclusions

The quality of compressed images needed for the realization of the effect of chroma key is a very important feature, because its quality, depends on successful realization of chroma key effect. One of the most important factors in the realization of chroma key effect in virtual TV studio is disposition of spotlights and intensity of studio lighting.

Based on the obtained results it can be concluded that the quality of the images compressed with SPIHT method is better for higher values of bpp (bit per pixel image) than for the lower. With increasing intensity of front light the quality of compressed image increases. Quality improvement of compression is much more pronounced with higher intensity of back light than at lower levels of fixed front light. With increasing intensity of the back light quality of compression decreases for any value of bpp and front light. Better quality of compression is obtained at higher values of the front light. Applied analysis and obtained results can be used in the realization of virtual digital multimedia TV studios to obtain quality compressed images.

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