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RESEARCH ARTICLE

Enhancing Image and Video Transmission by Applying Unequal Power Allocation, over MIMO OFDM System

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Abstract - Introducing multiple transceiver antennas in this generation of wireless systems, actually occurrences of image and video communication are begin to be often, as very high data rates begin to be serviceable with advanced and updated data reliableness. Imminent joint transmission and coding schemes that gives favorable multiple antenna systems matched with source informatics are begin to be applied. Based on this course of action, we can implement an unequal power allocation technique for transmission of enhancing images over MIMO (multiple-input multiple-output) systems. A video is divided into different frames i.e. images, and those images divided into different layers are transmitted concurrently from various transmit antennas using unequal transmit power, Results present that unequal power allocation technique gives significant image quality improvement as compared to different equal power allocations schemes. And this technique prevents distortion of images and videos.

Keywords - Distortion model; MIMO system; OFDM; Unequal power allocation; BER (Bit error rate)

I. INTRODUCTION

Transfer of proceeding images, such that encoded throughout division in hierarchical tree, is mostly happen, since the stored image quality should be gradually make better and is always the favorable for given no. of sequenced decoded bits which are error free. However, proceeding data is quickly detected by channel noise. An error of single bit can create the distraction of synchronization in between the encoder and the decoder and, hence, it can make the data useless completely. [1]

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JSCC is the frequently learned. Problem for joint design images and communication of video in the literature. Further valuable joint design problem is of transfer of power allocation and optimization for communication of image and video. The aim for such kind of problems is to reduce the total distortion of constraint on transmission power which is available, or to reduce the usage of power with a restriction on extent tolerable distortion. We discuss various applied joint design methodologies for convenient communication of image and video.[2][3]

The aim of all the methodologies discussed before was either the reduction of energy or power with content on allowable distortion, or the reduction of distortion with a constraint on total energy or power. These methodologies showed large amounts of energy or power savings or quality gains as compared to methodologies that transmitted the images and videos with equal power. Despite significant quality gains and energy or power savings, these methodologies have few restrictions.

A. Unequal power or energy allocation methodologies either use energy-distortion curves or simulations to approximate distortion at the transmitter at different kind of power configurations. The whole process of building energy distortion curves and estimating simulations to approximate distortion gradually maximizes the computational complexity of the optimization process, making it feasible for transmission of image and video.

B. Maximum unequal power or energy allocation methodologies for image and video communication begin to have the channel must be constant over a packet. However, in practical systems it is not essential that the channel will appear constant while transmission of an image or video packet or layer also for quasi-static channels. If the channel changes while a packet or layer, the distortion approximate so, the power allocation technique must give improper results, so, huge amounts of quality distraction. Because of this reason, the power allocation methodologies must note the effects of channel changes during an image or video packet or layer transmission

C. Maximum current power or energy allocation methodologies for wire line systems or wireless systems with single transceiver antenna. With Multiple input multiple output (MIMO) system predicted to have an integral part of the new era wireless systems, these power or energy allocation methodologies will not be very useful for transmission of image and video.[4][5][6]

II. SYSTEM MODEL FOR UNEQUAL POWER ALLOCATION

A block diagram of the required scheme is provided in Figure 1.The distinctive aspect of the image are obtained using DCT based quality layer scheme and are transmitted through a fading channel.[7] to [12]

1) Transmitter:

RGB space to YCbCr Space for visually acceptable results, it is essential to provide three samples (*color channels*) for each and every pixel, those interpreted as coordinates in some color space. The RGB color space is widely used in computer systems. The RGB color model is an additive color model in which blue red and green light are added in different ways to recreate a broad array of colors. Transformation of image from RGB space to YCbCr must be done. To transform RGB space to YCbCr space, the following equations are used.

$$Y = 0.299R + 0.587G + 0.114B \quad (1a)$$
$$Cb=-0.1687R-0.3313G+0.5B+128 \quad (1b)$$
$$Cr=0.5R-0.4187G-0.0813B+128 \quad (1c)$$

Y is the luma component and Cr and Cb are the red and blue chroma components.

2) Source Coder:

A progressive Discrete Cosine Transform (DCT) JPEG coder with spectral selection mode is used. DCT-II is performed over small 8x8 blocks according to the following equation.

$$f(x,y) = \frac{1}{4}\sum_{u=0}^{7}\sum_{v=0}^{7} F(u,v) cos\frac{[2u+1]x\pi}{16} cos\frac{[2v+1]y\pi}{16}$$

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The DCT coefficient is arranged into 64 quality layers: 1 dc layer followed by 63 ac layers. The resolution and quality of the recreated image improve when many layers are decoded.

3) Headers and markers:

In each layer, headers and reset markers are used to protect error formation between various sets of the bit stream. Headers and the markers are affected by Bit errors happen while transmission. The whole image can be damaged and cannot be recovered if there is presence of error in the header. Synchronization will be lost if error in reset markers is present. So it is adopted that reset markers and headers are transmitted error free.

4) Huffman Coding:

Huffman coding is statistical scheme that attempts to reduce the amount of bits by coding mostly frequent symbols with shorter codes and longer codes for less significant symbols.

5) Quantization:

The DCT coefficient are quantized and partitioned into sub bands that are encoded in separable passes. Quantization is compression technique applied by compressing a series of values to a single quantum value. When the number of discrete symbols in given stream is reduced, the stream appears more compressible. DCT coefficient matrix is used in combination with a quantization matrix. Quantization matrices are designed to keep frequencies in the source which avoid losing quality of image.

6) Scanning:

The quantized matrix is scanned. The use of this zigzag scan is to group top of vectors into low frequency coefficients. It maps 8x8 to a 1x 64 vector. The pattern of zigzag scanning for run-length coding was established in the original JPEG standard format. This similar pattern is used for chrominance and luminance.

7) Spatial Multiplexing (SM):

Spatial Multiplexing is a transmission scheme to transmit independent encoded data signals from each and every of the transmit antennas. If transmitter is supplied with Nt antennas and receiver has Nr antennas, the maximum spatial multiplexing order is Ns=min (Nt, Nr) This means that Ns streams can be transmitted in parallel manner. 'Ns' increase of the spectral efficiency.

8) Channel (H):

The Rayleigh channel (H) is widely used to explain multipath fading channels when there is no Line-Of-Sight (LOS) component, the number of independent copies of the signal arriving at the receiver is huge; the coherence bandwidth of the channel is larger than the bandwidth of the signal. It can be shown by central limit therom that such channel, where arriving signal is of approximately equal energy, can be represented as a zero mean circularly symmetric complex Gaussian random variable. The cover of this fading channel can be modeled using a Rayleigh distribution. For the simulation, a channel is generated as follows:

$$h = \mu + \sigma \times (N(0,1) + I \times N(0,1))$$

Where, μ is the mean of the random variable (assumed to be zero), σ is the standard deviation of the random variable (assumed as one or 0.5) and N(0,1) denotes a Normal (Gaussian) distributed random variable with unit-variance and zero-mean. The channel is assumed as slow-fading, with variations occurring at intervals equal to the symbol duration.

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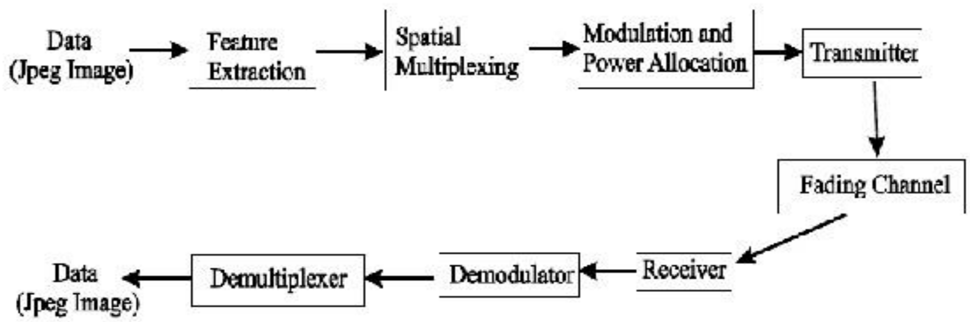
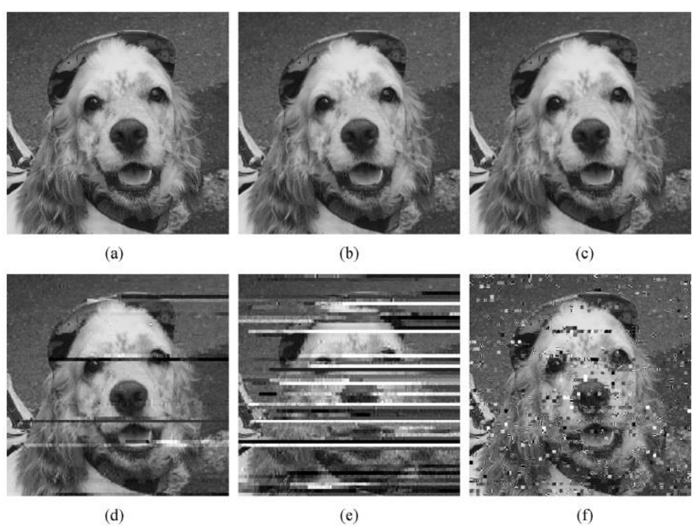


Figure 1. System Model

III. **RESULTS AND DISCUSSION**

It is evident from the following figure that the proposed unequal power allocation technique performs better than allocating power equally to different streams. At 5 dB SNR, the PSNR gain for UPA (unequal power allocation) technique has an advantage of approximately 14 dB over sequential JPEG with equal power allocation for both the images. Also, optimal power allocation scheme performs very close to the suboptimal power allocation method. The difference in PSNR between SQP performs close to the optimal method because the suboptimal method spans through the whole range of available power for the most important stream before fixing it to the power level that causes minimum distortion.[13][14]

method (MATLAB's numerical solution) and the suboptimal algorithm is within 1.5 dB at all points. The suboptimal method



Dog image results for different power allocation schemes at 10-dB SNR. (a) Original unquantized image. (b) UPA, optimal allocation. (c) UPA, suboptimal method. (d) EPA with antenna selection. (e) EPA (no antenna selection). (f) EPA with sequential JPEG.

IV. **CONCLUSION**

In this paper, we have given an unequal power allocation technique for the transmission of JPEG compressed images and videos over MIMO (Multiple input multiple output) systems gives spatial multiplexing. The image is divided into different streams with unequal contribution to total image quality. These different streams were transmitted using different antennas with unequal power which minimizes the distortion in the transmitted image. The total transmit power is kept constant at any given instant. We also presented unequal power allocation problem. Results show that our unequal power allocation scheme provides significant gains in terms of PSNR over various equal power allocation schemes. To the best of our knowledge no unequal power allocation technique exists for image transmission over MIMO systems. We can extend this work to different video coding schemes and advanced space-time coding technologies.

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