TENTACLE ASSORTMENT USING HUFFMAN CODING FOR MIMO WIRELESS COMPLEXES

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ABSTRACT

In MIMO structures, the transmit and acquire antennas can every be used for diversity benefit. Multiplexing exploits the shape of the channel benefit matrix to achieve impartial signaling paths that may be used to ship independent information. Multiple antennas on the transmitter facet may be selectively used based on the channel u . S . Statistics to beautify the functionality of the gadget. Spatial modulation does now not need channel u . S . A . Records but its performance deteriorates swiftly in the direction of unfavourable channel situations. Therefore an adaptive scheme that uses uniquely decodable Huffman codes for antenna desire is performed in this paper. Performance of this scheme is in comparison with that of traditional spatial modulation and for precise channel united states statistics remarks values. Experimental consequences display excellent development in channel capability with probabilistic choice of transmitter antennas.

Keywords: Spatial modulation, Huffman coding, MIMO, Gaussian distribution, CSI

1 INTRODUCTION

Wireless communication is the quickest going location of the verbal exchange organization. Cellular cellphone the usage of cellular wi-fi device is hastily supplementing cord line systems. Therefore, explosive increase of wireless structures has paved the way for in depth research in the subject of wi-fi verbal exchange. One such sub vicinity is artwork on dependable conversation thru the damaging wireless communique channel over which Information undergoes multipath fading. The channel suffers from fading introducing a high quality quantity of randomness-randomness in customers' wi-fi generation, randomness in clients' geographical location, randomness in pathfailure due to the bodily traits of the channel and multi route interferences, resulting in a decrease within the channel capability.These have time scale variant affecting thereliability of conversation gadget. [1, 2] Thesecan be termed as non-ergodic losses and range is one technique to fight those issues. In this records is conveyed through multiple impartial instantiations. Diversity can be received in terms of utilization of multiple antennas, a couple of customers and more than one routes. Multiple antenna spatial variety (spacetime) communication now not best provides robustness however additionally improves reliable statistics prices. This has paved manner for studies on MIMO structures-utilization of a couple of antennas on the transmitter and receiver locations. MIMO is a famous tool for developing capacity as nicely as reliability. The capacity of this MIMO gadget strongly relies upon at the energy imbalance among the more than one antennas. In this paper, Huffman code mapping is finished to pick the transmitting antennas over which indicators are transmitted, maximizing channel capability.

2 MIMO SYSTEMS

Rayleigh fading and log-normal shadowing specific a large strength penalty at the overall performance of modulation over wi-fi channels. [3, 4] One of the first-class strategies to mitigate the results of fading is range combining of independently fading sign paths. Diversity combining exploits the reality that unbiased signal paths have low possibility of experiencing deep fades concurrently. There are strategies of attaining independent fading paths in a wi-fi device. One technique is to apply multiple transmit or obtain antenna, also referred to as an antenna array, in which the factors of the array are separated in distance. Systems with a couple of antennas on the transmitter and receiver are typically known as more than one-enter more than one-output (MIMO) structures. This form of variety is known as space variety. With receiver space range, independent fading paths are discovered out without an boom in transmit signal strength or bandwidth. Coherent combining of range indicators will increase the sign-to-noise energy ratio at the receiver over the SNR that would be obtained with best a single gather antenna. This SNR will increase, known as array advantage, additionally can be acquired with transmitter vicinity variety by using because it ought to be weighing the antenna transmit powers relative to the channel profits [5]. The multiple antennas can be used to growth statistics costs through multiplexing or to enhance ordinary overall performance thru variety. In MIMO structures, the transmit and gather antennas can every be used for variety advantage. Multiplexing exploits the shape of the channel benefit matrix to gain unbiased signaling paths that may be used to ship unbiased information. The initial art work on MIMO turn out to be given thru Telatar [6] predicting remarkable spectral efficiencies for wi-fi systems with more than one transmit and gather antennas. The spectral efficiency earnings require correct know-how of the channel at the receiver and occasionally on the transmitter as properly. In addition to spectral performance gains, ISI and interference from exclusive users can be decreased using smart antenna techniques. The price of the performance upgrades acquired via MIMO techniques is the brought fee of deploying a couple of antennas, the space and circuit strength necessities of those more antennas and the brought complexity required for multidimensional sign processing. [7] A 2d method of conducting range is by means of using either transmit antennas or obtain antennas with extraordinary polarization. Directional antennas offer attitude (or directional) variety by using restricting the collect antenna beam width to a given angle. In the extreme, if the mindset may be very small then at maximum one of the multipath rays will fall in the get preserve of beam width, so there may be no multipath fading from more than one methods. [8,9,10] However, this variety method required each a sufficient huge type of directional antennas to span all viable pointers of arrival of or a unmarried antenna whose directivity may be instructed to the appearance angle of one of the multipath additives (ideally the most powerful one). Note also that with this technique the SNR may additionally additionally lower due to the lack of multipath components that fall out of doors the get hold of antenna beam width – unless the directional gain of the antenna is satisfactorily big to capture up on this lost strength. Initially until mid-1990s, focus was on receiver diversity where multiple copies of transmitted signal were obtained using many receiving antenna (Nt = 1, Nr = N).Use of multiple transmit antennas was restricted to sending the signal over each antenna- a form of repetition coding. This led to increase in the capacity of channels first introduced by Shannon in 1948, where he showed that on noisy channels one can transmit information at positive rate with error probability going to zero asymptotically in the coding block size. For a noisy channel at time k for the input { Xk } there is the output [Yk], the capacity is given in terms of the mutual information between the channel input vector x and the output vector y as

C=max I(X;Y)=max[H(Y)-H(Y/X)].

H (Y|X) = H (n), is the entropy in the noise. Since this noise n has fixed entropy independent of the channel input, maximizing mutual information is equivalent to maximizing the entropy in y. The MIMO capacity is achieved by maximizing the mutual information satisfying the power constraint [11]. MIMO though has many advantages, also has several limitations of increasing cost of radio frequency system. This disadvantage can be overcome by using single RF frontend and employing transmitter antenna selection or spatial modulation. Multiple antennas on the transmitter side can be selectively used based on the channel state information to improve the capacity of the system. Spatial modulation does not need channel state information but its performance deteriorates rapidly during unfavorable channel conditions. Therefore an adaptive scheme incorporating the features of the two schemes is thought of,[12,13,14].

3 Antenna Switching Consider a MIMO system with Nt transmitting antennas and Nr receiving antennas arranged as shown in figure 1.On the transmitter side there is a single RF chain system with Nt antennas connected through antenna switch. However on the receiver side, every receiving antenna has a RF chain [15]

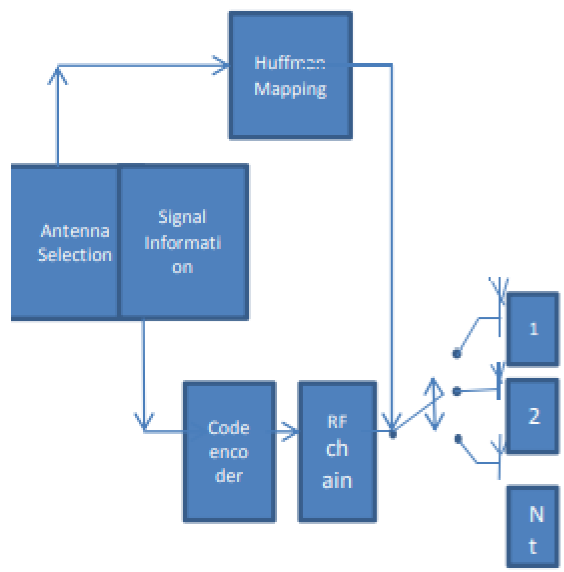


Figure 1: RF chain model with Huffman Coding

BINARY HUFFMAN CODING Given a source sequence Xt ={X (1)…X(T)} for a given alphabet X,it is mapped to a set of binary sequences called Huffman codes. Index set being binary, based on probability of occurrence of sampling, mapping is done. Frequently occurring is given a longer code length and rarely occurring given shorter code lengths-codes being uniquely decodable by the receiver. Therefore this concept can conveniently because be used to select all or few among the transmitting antennas based on the feedback of channel state and offered capacity .The feedback about the overall SNR is provided by the multiple receiver system. Selection of a transmitter antenna based on a code sequence for maximum channel capacity dependent on feedback from receiver is illustrated for Nt=4 and Nt=8.In computer science and information theory, a Huffman code is a particular type of optimal prefix code that is commonly used for lossless data compression. The process of finding and/or using such a code proceeds by means of Huffman coding, an algorithm developed by David A. Huffman while he was a Sc.D. student at MIT, and published in the 1952 paper "A Method for the Construction of Minimum-Redundancy Codes".[1] The output from Huffman's algorithm can be viewed as a variable-length code table for encoding a source symbol (such as a character in a file). The algorithm derives this table from the estimated probability or frequency of occurrence (weight) for each possible value of the source symbol. As in other entropy encoding methods, more common symbols are generally represented using fewer bits than less common symbols. Huffman's method can be efficiently implemented, finding a code in time linear to the number of input weights if these weights are sorted.[2] However, although optimal among methods encoding symbols separately, Huffman coding is not always optimal among all compression methods In 1951, David A. Huffman and his MIT information theory classmates were given the choice of a term paper or a final exam. The professor, Robert M. Fano, assigned a term paper on the problem of finding the most efficient binary code. Huffman, unable to prove any codes were the most efficient, was about to give up and start studying for the final when he hit upon the idea of using a frequency-sorted binary tree and quickly proved this method the most efficient.[3] In doing so, Huffman outdid Fano, who had worked with information theory inventor Claude Shannon to develop a similar code. Building the tree from the bottom up guaranteed optimality, unlike top-down Shannon-Fano coding.

INFORMAL DESCRIPTION

GIVEN

A set of symbols and their weights,(usually prportional to probabilities)

Find

A prefix-free binary code(a set of codewords)with minimum expected codeword length(equivalently, a tree with minimum weighted path length from the root).

Formalized desctription

Input

Alphabet A=(a1,a2,..,an),which is the symbol alphabet of size n.

Tuple W=(w1,w2,..wn),which is the tuple of the (positive) symbol weights(usually proportional to probabilities),i.e. w_i=weight(a_i),1<=i<=n.

Output

Code C(W)=(c1,c2,...cn),which is the tuple of (binary)codewords,where c_i is the codewrd for a_i,1<=i<=n.

Goal

Let $L(C(W)) = \sum_{i=1}^{n} \mathrm{wi} * \mathrm{length(ci)}$ be the weighted path length of Code C.condition:L(C(W))<=L(T(W)) for any code T(W)

As defined by shannon (1948),the information content h(in bits) of each symbol a_1 with non-null probability is

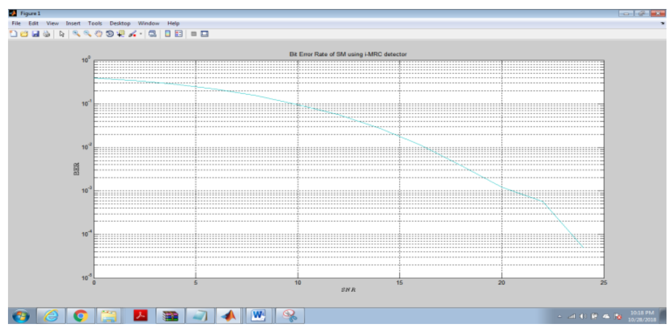
$h(a_i)= \mathrm{Log}_2\frac{1}{wi}$.

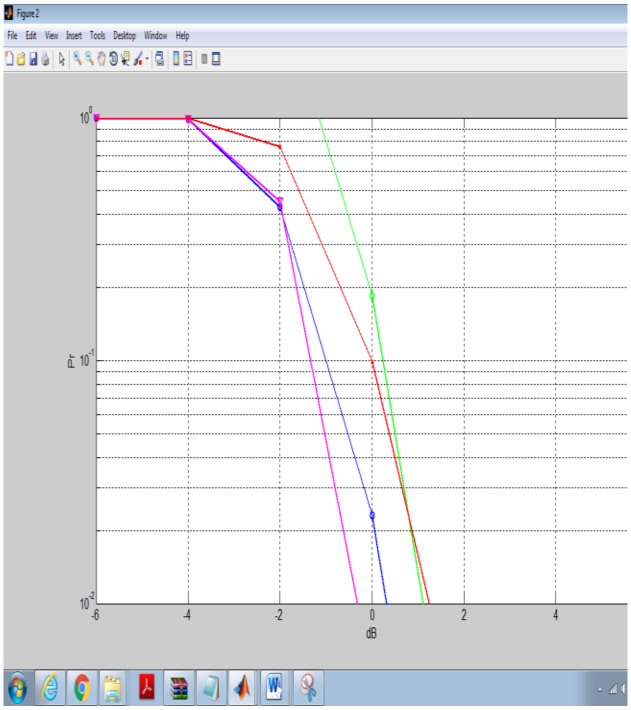
the entropy H(in bits)is the weighted sum across all symbols a_i with non-zero probability w_i of the information content of each symbol:

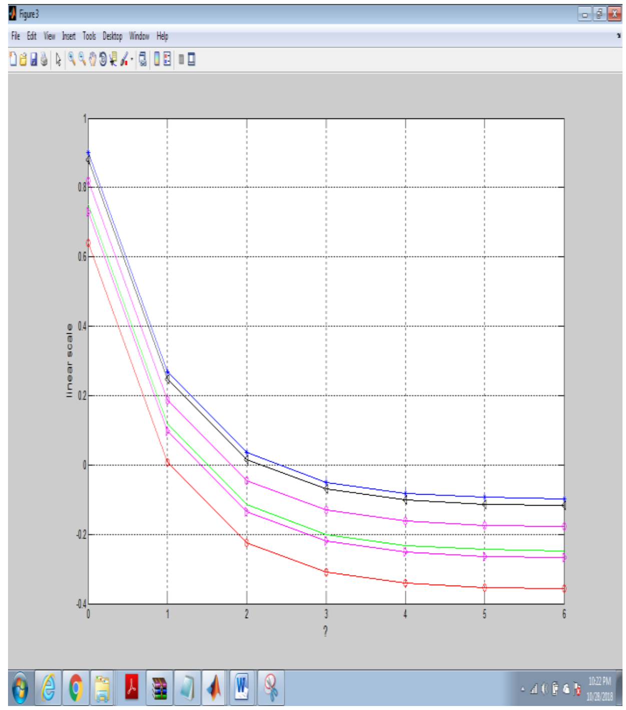
$$H(A)=\sum_{wi>0} \mathrm{wi}\, h(\mathrm{ai}) = \sum_{wi>0} \mathrm{wi}\ \mathrm{Log}_2\frac{1}{wi} = -\sum_{wi>0} \mathrm{wi}\ \mathrm{Log}_2 \mathrm{wi}.$$

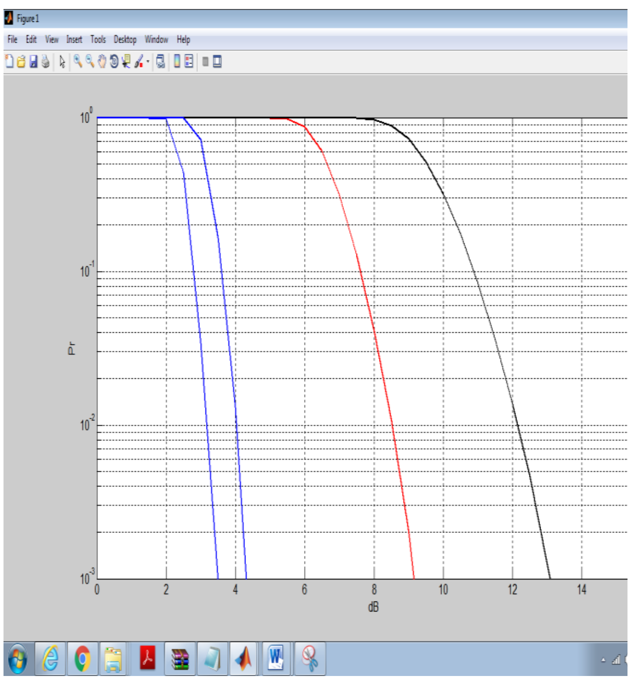
Huffman coding uses a specific method for choosing the representation for each symbol, resulting in a prefix code (sometimes called "prefix-free codes", that is, the bit string representing some particular symbol is never a prefix of the bit string representing any other symbol). Huffman coding is such a widespread method for creating prefix codes that the term "Huffman code" is widely used as a synonym for "prefix code" even when such a code is not produced by Huffman's algorithm.

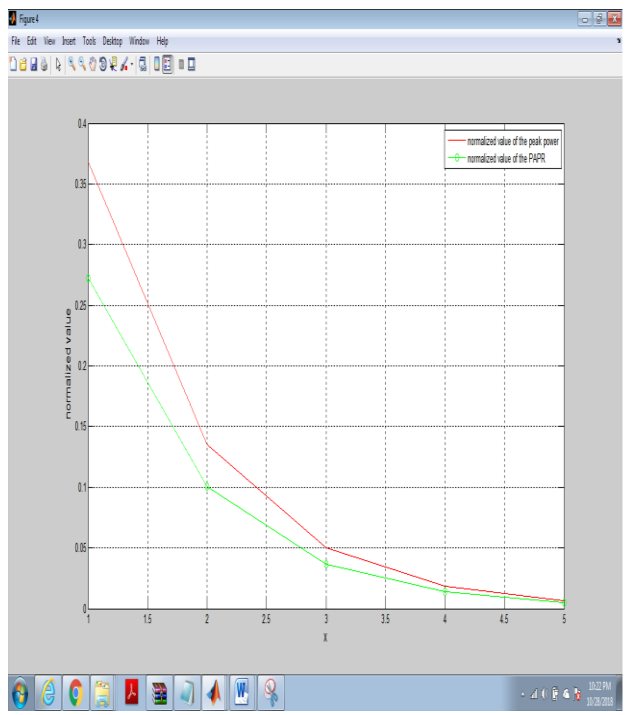
SIMULATION RESULTS:











CONCLUSION The performance of an adaptive scheme using Huffman scheme for a single RF chain system has been discussed in this paper. This scheme allows activating transmitting antennas with different probabilities to maximize channel capacity. Results show that adaptive scheme provides remarkable performance improvement over conventional spatial modulation.

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