

# Image Compression using Bayesian Fourier

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**Abstract**—The project is to prepare software which will compress images efficiently using the principle of Polynomial Regression. It will have a user-friendly interface, and it will be web based software where the database of images clicked by the account holders will be stored in their accounts. The software will have options for uploading the original image, compressing the image and downloading and storing the compressed output image in a desired folder of the system. The Polynomial regression actually calculates the residual sum of squares for the pixels of the image plotted in a graph using a learning algorithm like Bayesian, or the algebraic method and tends to minimize it calculating the optimal parameters for more precision of the output compressed image. The product will have the minimum cost so it will be beneficial for the market and people and it will enhance the rate of compression of images in form of jpeg or png etc. than the previously used compression techniques.

**Index-Terms**— *Image coding, Bayesian Fourier, Polynomial regression, Discrete wavelet transforms, JPEG, Machine learning, Decoding, regression analysis, Image quality, Vector Quantization*

## INTRODUCTION

The goal of image compression software is to lessen unimportant and repetition of the picture information with a specific end goal to have the capacity to store or transmit information in a proficient shape. Image compression might be lossy or lossless. Lossless compression is favored for authentic purposes and regularly for medicinal imaging, specialized drawings, clip art, or comics. Lossy compression strategies, particularly when utilized at low piece rates, present pressure antiquities. Lossy strategies are particularly reasonable for common pictures, for example, photos in applications where minor (now and then intangible) loss of constancy is satisfactory to accomplish a considerable diminishment in bit rate. Lossy compression that produces insignificant contrasts might be called outwardly lossless.

This Research work particularly deals with JPEG image compression wavelet with an idea to minimize the computational requirements to achieve enhanced reproduction of image quality. We use the variable length coding to compress the image. The JPEG compression strategy is a standout amongst the most well known compression plans. There are numerous equipment and programming frameworks in light of the JPEG compression standard. This means the arrangement is still essential before these software progress toward becoming outdate. The product introduces a versatile relapse technique connected to the standard JPEG compression for chronicling higher compression proportions. Additionally, an intriguing coding plan, variable length coding, is presented likewise for enhance the JPEG standard. Since the coding plan is not in light of recurrence examination from sure of pictures to pick up a codebook, the decoded pictures that are encoded with

this plan are guaranteed in normal quality. The standard JPEG compression plan can import these two for higher compression rates or more extensive application fields.

Our software generally emphasizes on the compression rate so the storage of the image is more efficient and transmission of the image is easier. A variable length coding system is additionally presented for quickening the decompression execution and distinguishing the code blunder. Plus, the variable length coding system is not in view of recurrence examination so that the decoded picture quality is in normal yet not particularly useful for sure of pictures as it were. The change from applying these two systems is just contrasted with the JPEG compression plot, on the grounds that these two procedures are intended for being placed in the JPEG plan to improve the compression rate and picture quality.

The software project aims to provide an attractive user interface to attract the users, it aims at utilizing the minimum cost to produce it, so it will be efficient for the market. It will have the minimum risks because it will not have staff risk as once the software is made no staff will be required to control it. In case of any technical problems it will be self-handle able. The future scope of the project includes developing more efficient image compression algorithms that will provide both lossless compression and higher rate of compression.

## LITERATURE REVIEW

Here we have searched about polynomial regression and the concept of regression in compression of image in the previous papers. Jiao et al proposes another picture compression calculation which consolidates SVM regression with wavelet change. Compression is accomplished by utilizing SVM regression to surmised wavelet coefficients. In view of the normal for wavelet deterioration, the coefficient connection in wavelet space is dissected. As per the connection trademark at various scales and introductions, three sorts of organizing techniques for wavelet coefficients are outlined, which make SVM compress the coefficients all the more effectively [1]. P. Anandan and R. S. The paper manages investigation of image compression procedures utilizing Curvelet Transform in view of Support vector machine and Core vector machine with their execution comes about. An examination is done on different sorts of image coding procedures in light of Curvelet Transform that exist. Capacities that have discontinuities along straight lines can't be viably spoken to by typical wavelet changes yet characteristic pictures have geographic lines, for example, edges, surfaces which can't be all around recreated if compression is finished by 1-D Transforms. [2].

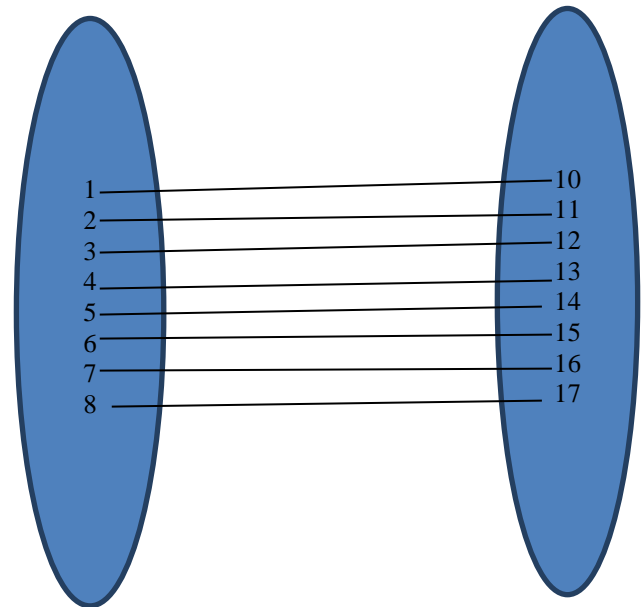
Rothe et al proposes a proficient novel relic decrease calculation in light of the balanced tied down neighborhood regression (A+), a strategy from image super-determination writing. We double fold the relative picks up in PSNR when contrasted and the best in class strategies, for example, SLGP, while being order(s) of magnitude speedier [3]. Sachin Dhawan X proposes to give a formula for choosing one of the well known image compression calculations in view of Wavelet, JPEG/DCT, VQ, and Fractal approaches. We survey and talk about the focal points and impediments of these calculations for compacting dark scale pictures; give a test correlation on 256x256 generally utilized picture of Lenna and one 400x400 unique mark picture [4]. Hemalatha et al presents all the lossy compression techniques and evaluation measures used in their various related field, because it provides a good compression ratio and reducing the file size when the images are used for storing or transmitting through the network. This survey paper exhibits a clear idea about lossy compression and it is depend on quality of the image, compression ratio and speed of the compression. In future medical image data can be implemented by using lossy compression techniques[5]. Vijayvargiya et al addresses about different image compression procedures. On the premise of investigating the different image compression procedures this paper shows a review of existing exploration papers. In this paper we dissect distinctive sorts of existing technique for image compression. Compression of a picture is fundamentally unique then pressure of paired crude information. To comprehend these utilization diverse sorts of methods for image compression. Presently there is question might be emerge that how to picture pack and which sorts of system is utilized. For this reason there are fundamentally two sorts are strategy are presented in particular lossless and lossy picture compression procedures [6]. Caballero et al extend Phillips' (1986) comes about by demonstrating an induction drawn from polynomial details, under stochastic non-stationarity, is misdirecting unless the factors co-incorporate. We utilize a summed up polynomial detail as a vehicle to study its asymptotic and limited example properties. Our outcomes, hence, prompt a call to be mindful at whatever point experts appraise polynomial relapses [7]. Ajao et al paper presents the cubic polynomial minimum square regression as a powerful option strategy for making cost expectation in business instead of the standard linear regression. The review uncovers that polynomial regression is a superior option with a high coefficient of assurance [8].

### PROPOSED METHODOLOGY

We actually use the method of polynomial regression and Bayesian Fourier method both to compress the set of data points which are actually the pixels of the image given. We break the image of 512x512 into blocks of 64x64 and then this block elements are arranged in a vector elements, and then

this vector is mapped into the respective function and then it is compressed, by understanding the 64x64 pixels using 8x8 co-efficient, which compresses the data size to almost 12.5 percent of its original size.

In this section we basically use a mapping function to compress the image. Suppose there is a 256x256 pixels image, and now we try to understand the whole image with 8 co-efficient of a polynomial curve. For example there are an input set of 8 elements, and we have the output set of elements.



The input set of elements is on the left side and the output function on which it is mapped into is on the right side. For example if the input elements represent the pixels of the image, so it is an image represented by 8 pixels so the image data size of 8\*8=64 bytes. Now if we take a mapping function of  $f(x)=0.9x+8.9$ ; or  $a*x+b$ ; we will get the approximate set of output pixels. This was a basic example of mapping using linear regression, here we use polynomial regression. Now here the mapping function used is Bayesian Fourier transform where we calculate the parameters  $a_0, a_1, b_1$ .

The mathematical equation used in the mapping function is,

$$F(x) = a_0 + \sum(a_i * \sin(x/i)) + \sum(b_i * \cos(x/i))$$

where conditions inputs belong to [0,1] where if the input pixels are P then  $X=p/255$ , this is while done while compressing the image and while the image gets compressed or 64 bits get compressed to 8 bits then we use the decompression function to map the values of the output pixels and get the decompressed image. Then we use the function to view the decompressed image.

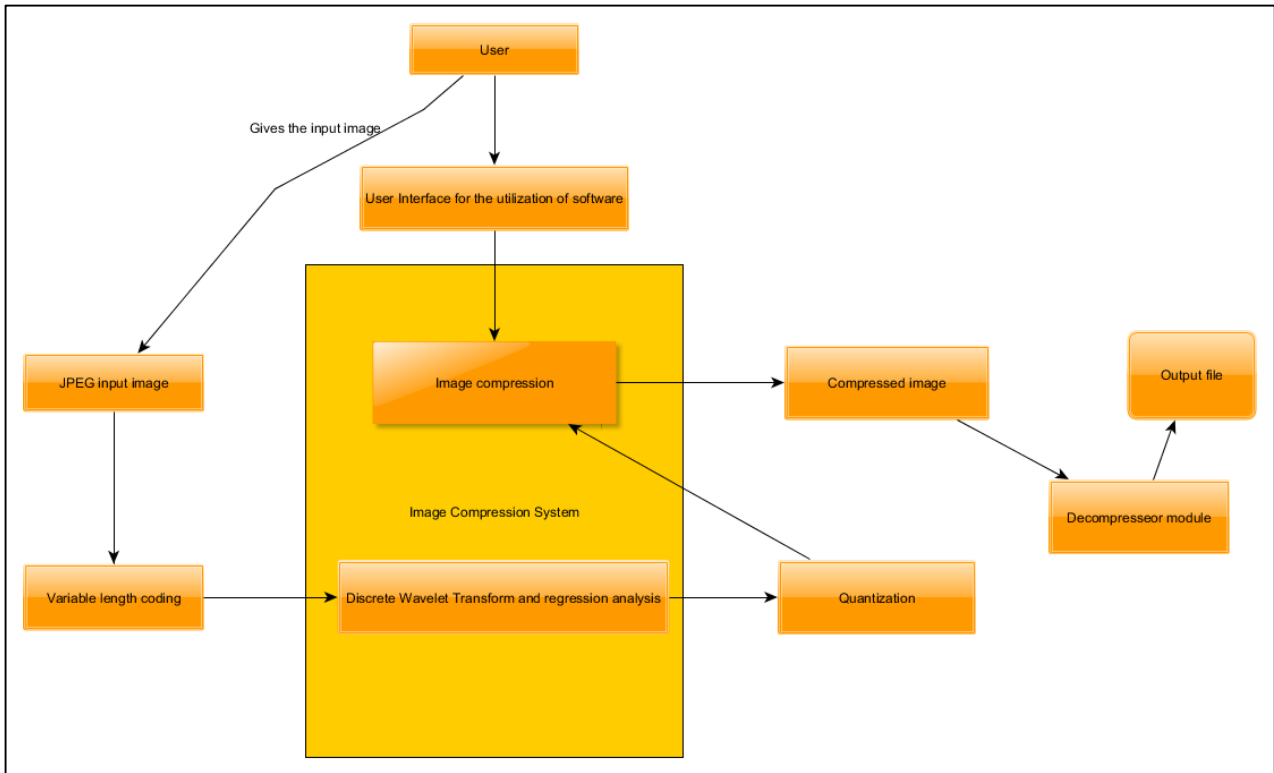


Fig: The following flowchart shows the basic outline of the image compression method used by us. The compressed image which is to be realized with some limited number of parameters are first decompressed using the parameter values function and then the compressed image is viewed in the console

### System Environment

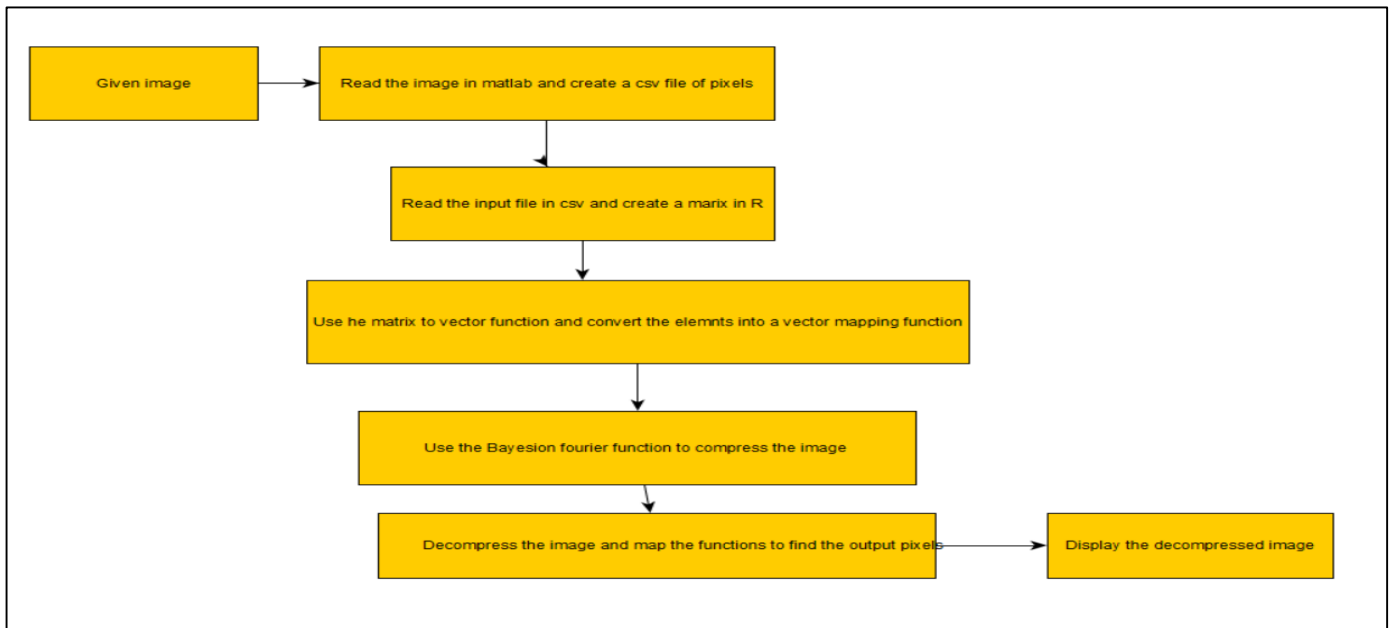


Fig: This is the flow diagram for our image compression software which will use the method of regression analysis to compress the image size from M bits to N bits and then any decompression software also can be used to restore the image to original size.

The software asks for an input JPEG image from the user with the help of an external user interface. The user gives the required image to be compressed, and processes the image. While the processing the image, the software using regression analysis and variable length coding to compress the image. The compressed image is now available on the system which

is to be stored in a proper file destination by the user by clicking on the Save as option on the top left corner of the software.

FLOWCHART

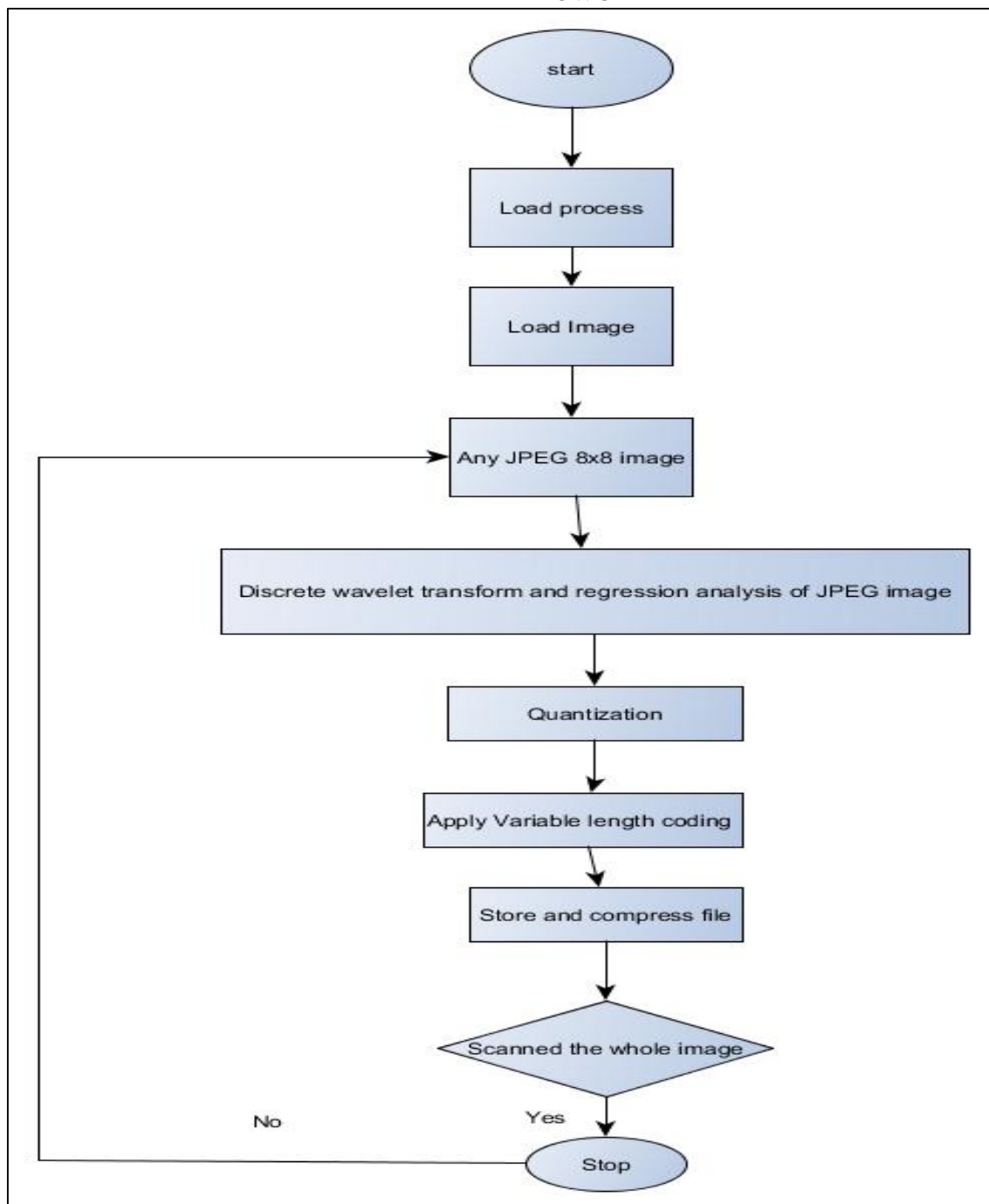


Fig: Here in the flowchart the complete procedure of image compression is expressed step- wise one after the other

Algorithm

```
image<-read.csv("C:/Users/Aditi Ghosh/Desktop/jump.csv")
matrix1=as.matrix(image)
vector1=as.vector(matrix1)
iSamplerN <-function(n,matrix,prob_vector,interval){

  sample_prob = 0 ;
  sample_number =c();

  for(j in 1:length(prob_vector)){
    temp = max(prob_vector);
    sample_prob = sample_prob + temp;
    for(i in 1:length(prob_vector)){
      if(prob_vector[i]==temp){
        prob_vector[i] = -1;
        sample_number = c(sample_number, i);
        break;
      }
    }
    if(sample_prob>interval){
      break;
    }
  }
  sample = matrix(0,nrow=0,ncol=length(matrix[1,]));

  for(i in 1:length(sample_number)){
    sample=rbind(sample,matrix[sample_number[i],]);
  }
  return(uniform_samplerN(n,sample));
}
y<-iSamplerN(image,matrix1,vector1,0:1)
```

RESULTS AND DISCUSSIONS

The comparison between original image and compressed image is given below and the graph shows the percentage in compression in data size with the variation in parameters. We observe from the result there is not much difficulty in recognizing the object properly and the quality of the image is not much destroyed, while the size of the image is compressed up to 87.5 percent.

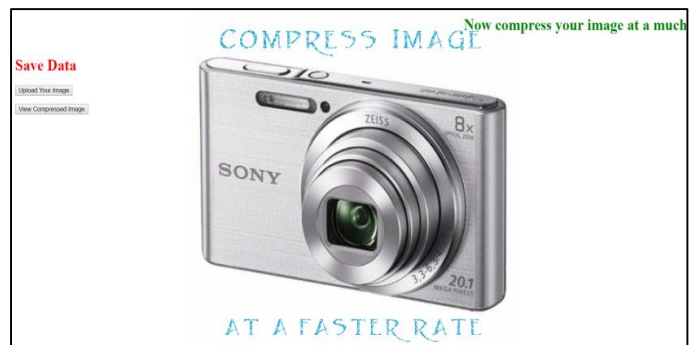
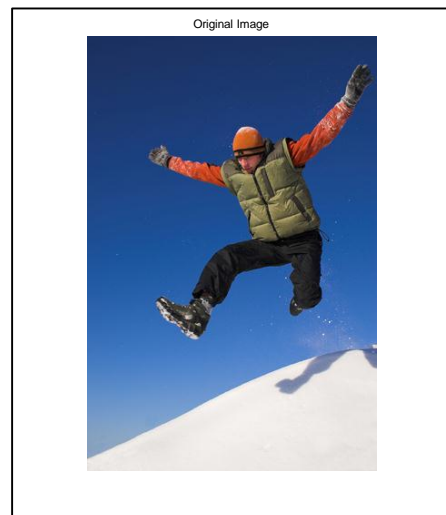
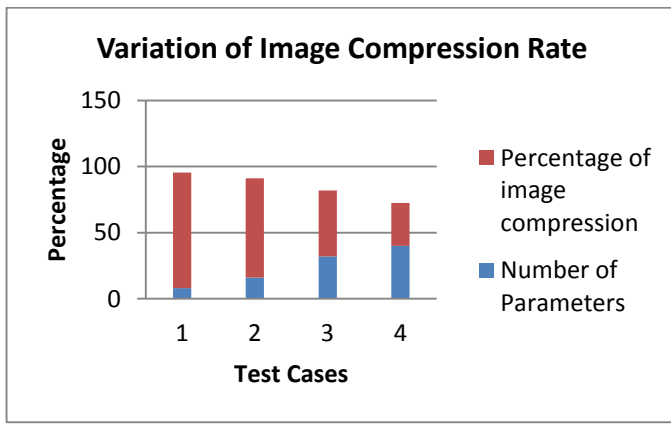
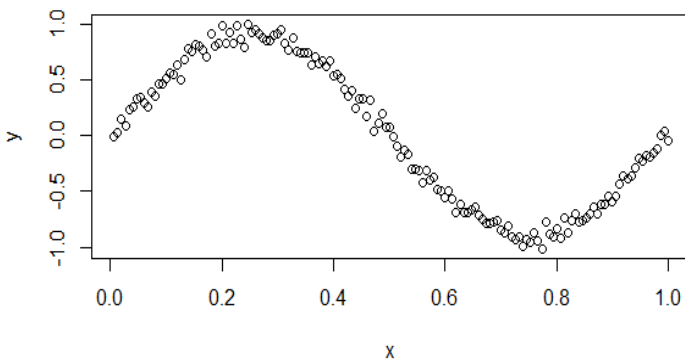


Fig: Main page for software where we get to know about the compression of image.







This graph shows the variation of the compression of image in changing the parameters of the image. The blue region shows the number of parameters and the red region shows the percentage of image compression for the corresponding number of parameters.

### CONCLUSION AND FUTURE WORK

This paper mainly focuses on the principle of high level compression of image using Bayesian Fourier and polynomial regression and maintaining its quality. We aim to further improve the quality of the software by making changes in the algorithm and reducing the space and time complexity of the program. The software project aims to provide an attractive user interface to attract the users, it aims at utilizing the minimum cost to produce it, so it will be efficient for the market. It will have the minimum risks because it will not have staff risk as once the software is made no staff will be required to control it. In case of any technical problems it will be self-handle able. The future scope of the project includes developing more efficient image compression algorithms that will provide both lossless compression and higher rate of compression. We aim to come up with a more efficient algorithm which will compress the images to half its size and maintain the quality of the image up to 80 percent.

### REFERENCES

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