# PES UNIVERSITY

Electronic City Campus, 1 KM before Electronic City, Hosur Road,
Bangalore-100

**PROJECT REPORT**
**on**

## " IMAGE COMPRESSION USING HAAR WAVELET TRANSFORM"

Submitted in partial fulfillment of the requirements for the IV Semester
Digital Image Processing using MATLAB (UE18CS257E)

**Bachelor of Technology**
**IN**
**COMPUTER SCIENCE AND ENGINEERING**

**For the Academic year**
**2019-2020**

**BY**

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# PES UNIVERSITY EC CAMPUS

**Hosur Road, Bangalore -560100**

## Department of Computer Science and Engineering


# CERTIFICATE

Certified that the project work entitled **"IMAGE COMPRESSION USING HAAR WAVELET TRANSFORM"** is a bona fide work carried out by **MANISH M** bearing USN: **PES22018000428** and **VAISHNAVI KINI M** bearing USN: **PES2201800253,** students of **PES University EC CAMPUS in** partial fulfillment for the award of **Bachelor of Engineering** in **Computer Science and Engineering** of **PES University**, **Bangalore** during the year 2019-2020.

***Signatures: Manish M, Vaishnavi Kini M***

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|---|---|
| Project Guide:<br>**Dr. Sabeeha Sultana**<br>**Assistant Professor, Dept. of CSE,**<br>**PES UNIVERSITY EC CAMPUS,**<br>**Bengaluru-560100** | **Dr. Sandesh B J**<br>**Head, Dept of CSE**<br>**PES UNIVERSITY EC CAMPUS,**<br>**Bengaluru-560100** |

# Declaration

I hereby declare that the project entitled **"IMAGE COMPRESSION USING HAAR WAVELET TRANSFORM"** submitted for Bachelor of Technology in Computer Science and Engineering of PES University, Bangalore is my original work and the project has not formed the basis of the awards of any degree, associate ship, fellowship or any other similar titles.

**Signature of the Student:**

**Manish M,**

**Vaishnavi Kini M**

**Place: Bangalore**

**Date: 28th May 2020**

# ABSTRACT

The project entitled **"IMAGE COMPRESSION USING HAAR WAVELET TECHNIQUE**" uses Haar wavelet for Image Compression, as the title suggests. Haar Wavelet is the simplest type of wavelet. Each one of the digital images is represented mathematically by a matrix (array) of numbers, ranging from 0 (representing black) to some positive whole number (representing white). Each matrix entry gives rise to a small square which is shaded a constant gray level according to its numerical value. We refer to these little squares as pixels. Colour images have to be handled differently, taking 3 different grayscale-like arrays, one for each of blue, green and red. A matrix with an extremely large amount of 0's is called a sparse matrix. While compressing, fix a nonnegative number, say e, and any coefficient in the wavelet lesser than e, will be made 0, resulting in a relatively sparse matrix.

# ▶ INTRODUCTION

In discrete form, the wavelets are related to a mathematical operation called the Haar Transform. The type of signals that the Haar transform deals with are called discrete signals. These signals are functions of time, with values occurring at certain discrete intervals. Image compression is applied to digital images to reduce their cost for storage or transmission. The Haar transform can be used for image compression. The basic idea here is to transfer the image into a matrix, in which each element of the matrix represents a pixel in the image. Image compression and decompression systems are solely dependent on the techniques/algorithm followed for image compression and decompression. An input image is sent into the compression system, which converts the original image into bitstream, and then compresses the image accordingly. A compression ratio can be calculated, by taking a ratio of bit values in the original image to the bit values in the compressed image.

## 1.1 PROJECT DESCRIPTION

With the increasing growth of technology and the entrance into the digital age, we have to handle a vast amount of information every time which often presents difficulties. So, the digital information must be stored and retrieved in an efficient and effective manner, in order for it to be put to practical use.

Wavelets provide a mathematical way of encoding information in such a way that it is layered according to level of detail. This layering facilitates approximations at various intermediate stages. These approximations can be stored using a lot less space than the original data. Here a low complex 2D image compression method using wavelets as the basis functions and the approach to measure the quality of the compressed image are presented. The particular wavelet chosen and used here is the simplest wavelet form namely the Haar Wavelet. The 2D discrete wavelet transform (DWT) has been applied and the detail matrices from the information matrix of the image have been estimated. The reconstructed image is synthesized using the estimated detail matrices and information matrix provided by the Wavelet transform. The quality of the compressed images has been evaluated using some factors like Compression Ratio (CR), Peak Signal to Noise Ratio (PSNR), Mean Opinion Score (MOS), Picture Quality Scale (PQS) etc.

## 1.2 TEAM MEMBERS

1. Manish Manikandan (SRN- PES2201800428)
2. Vaishnavi Kini M (SRN- PES2201800253)

## HARDWARE AND SOFTWARE REQUIREMENTS

### Hardware

- RAM - 8GB DDR4
- Processor - Intel i

### Software

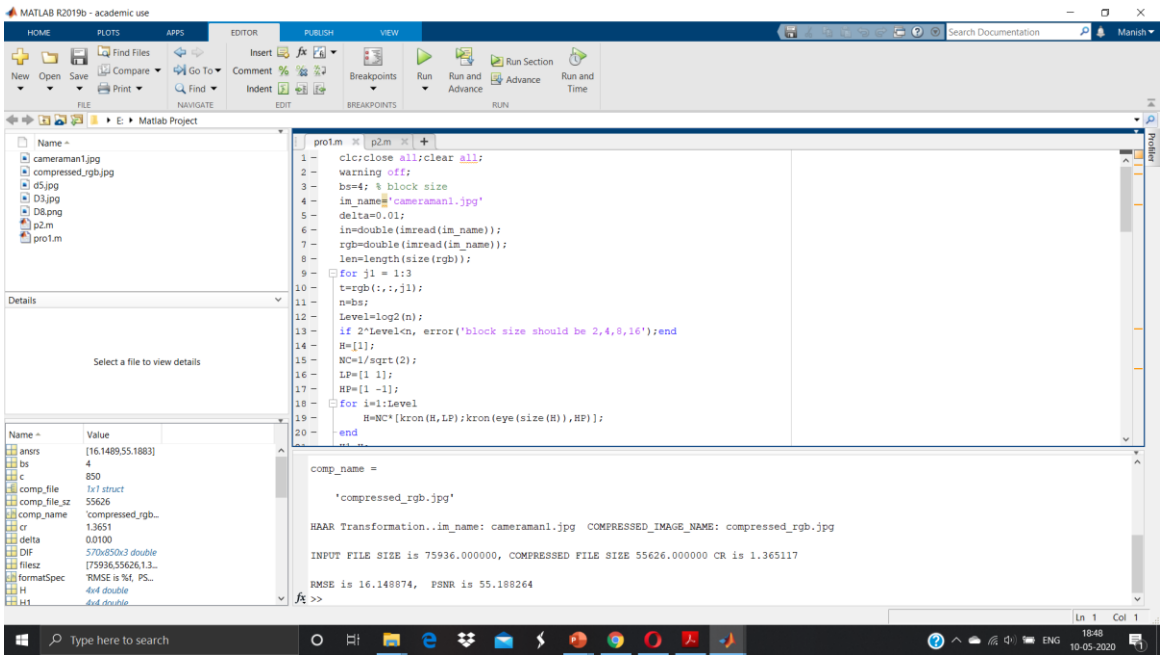
- Operating System – Windows 64 bit
- MATLAB
- Browsers- Chrome and Firefox

## MATLAB TOOLBOXES USED

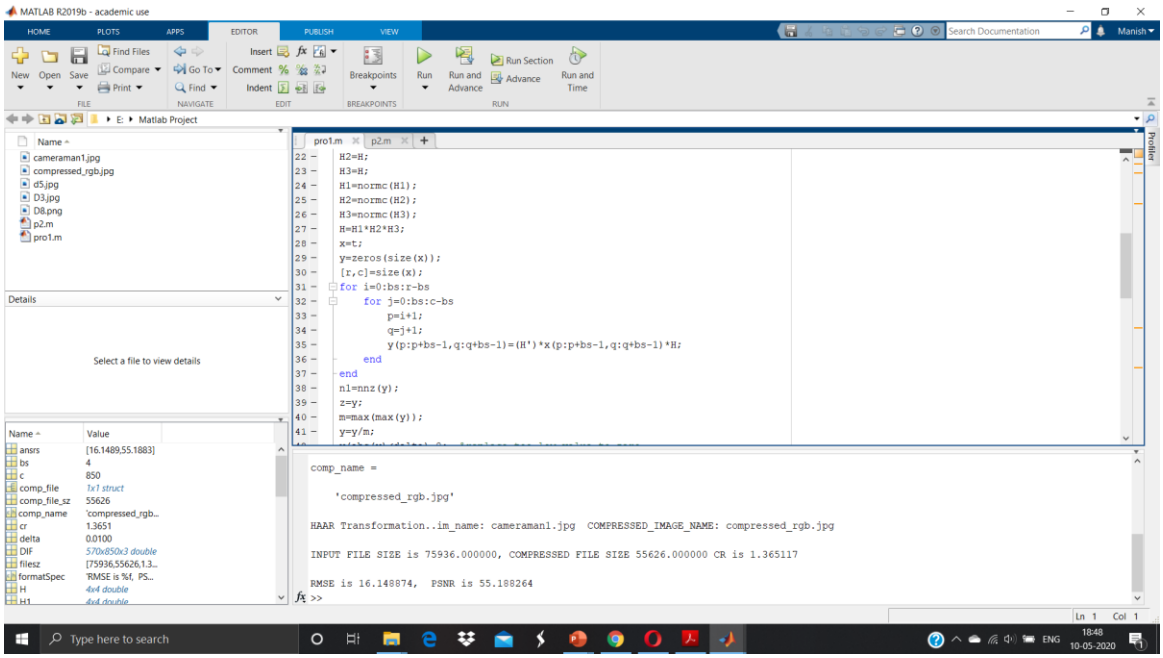
- Computer Vision Toolbox
- Image Processing Toolbox

# 3. SCREENSHOTS

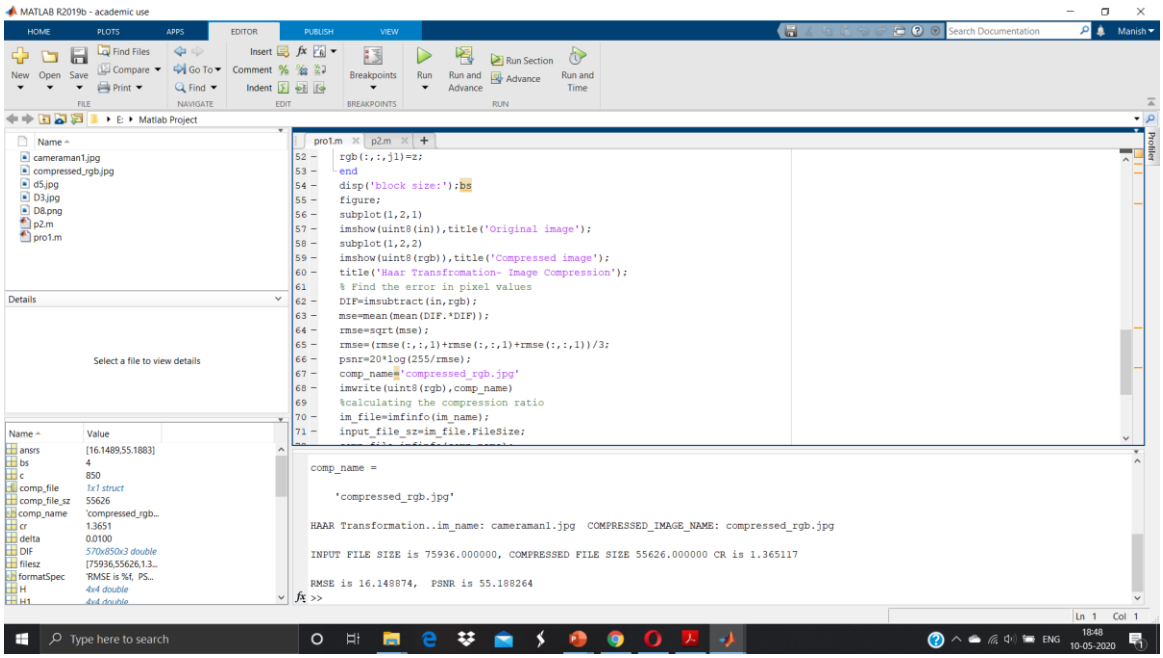
## 1. CODE-I(defining BLOCK SIZE)



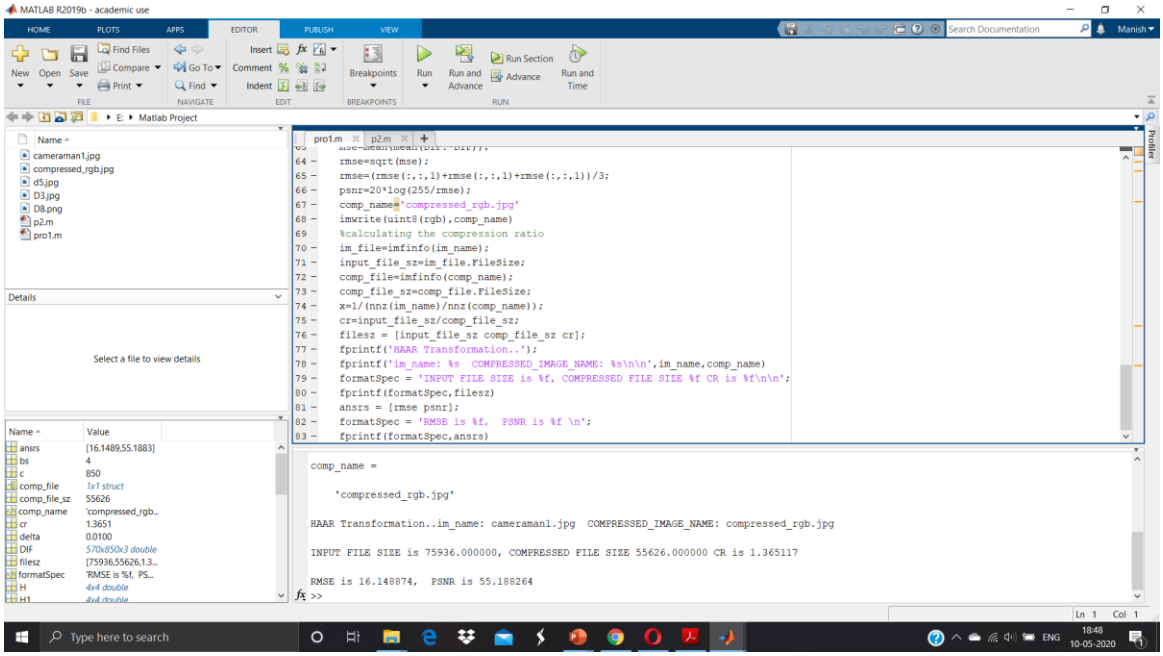
## 2. CODE-II(NORMALIZING THE MATRICES and APPLYING THE OPERATIONS)



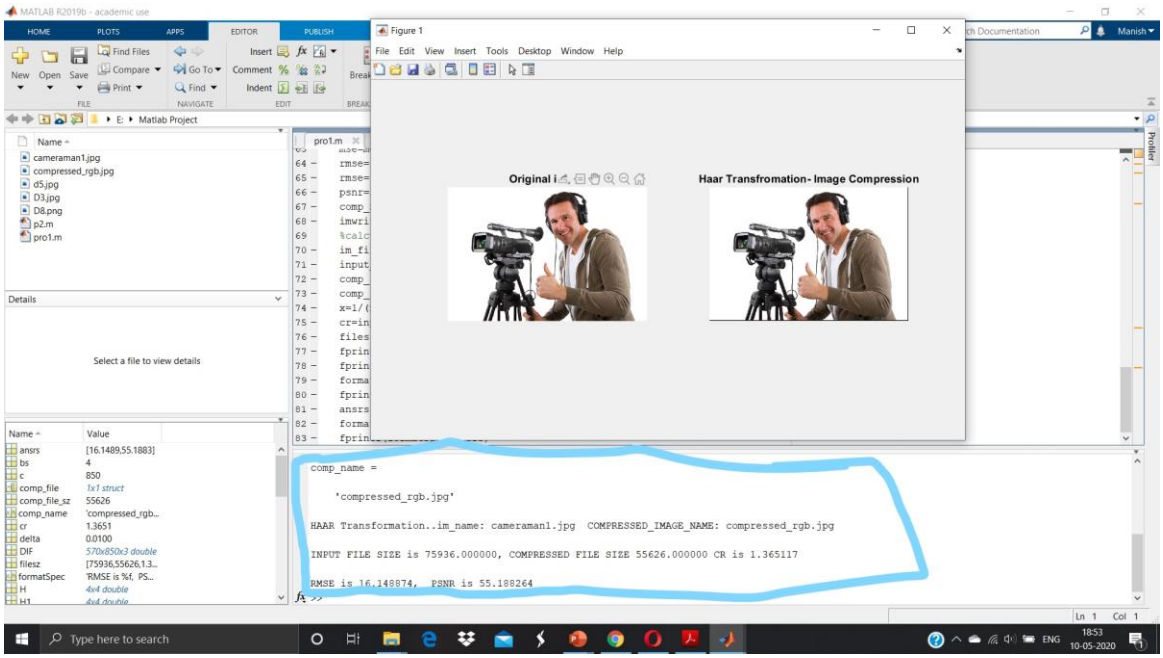

## 3. CODE-III(FINDING THE ERROR IN PIXEL SIZE)



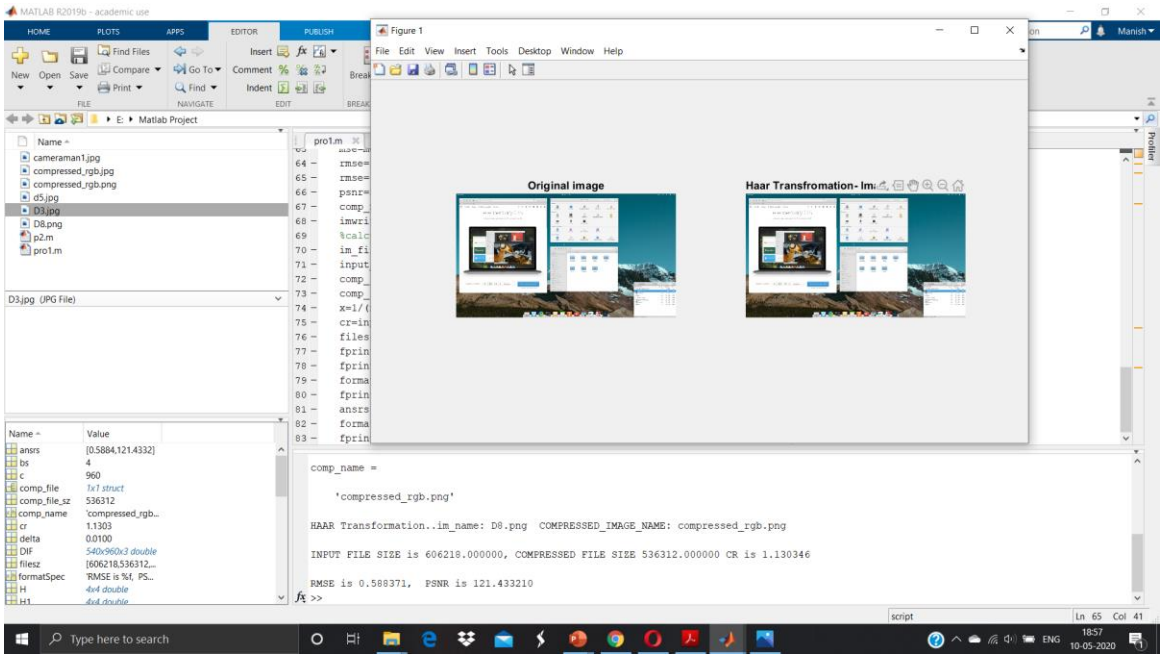
# 4. CODE- IV(CALCULATING THE QUALITY OF THE COMPRESSED IMAGE)




# OUTPUT

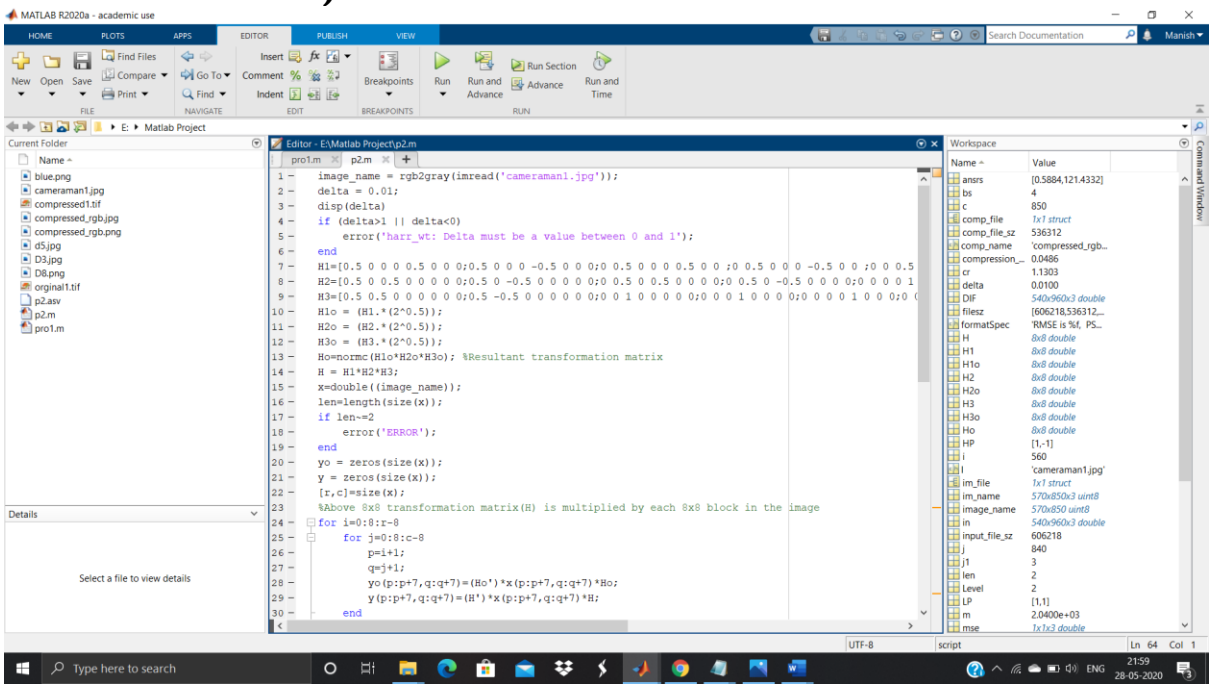


# OUTPUT-2

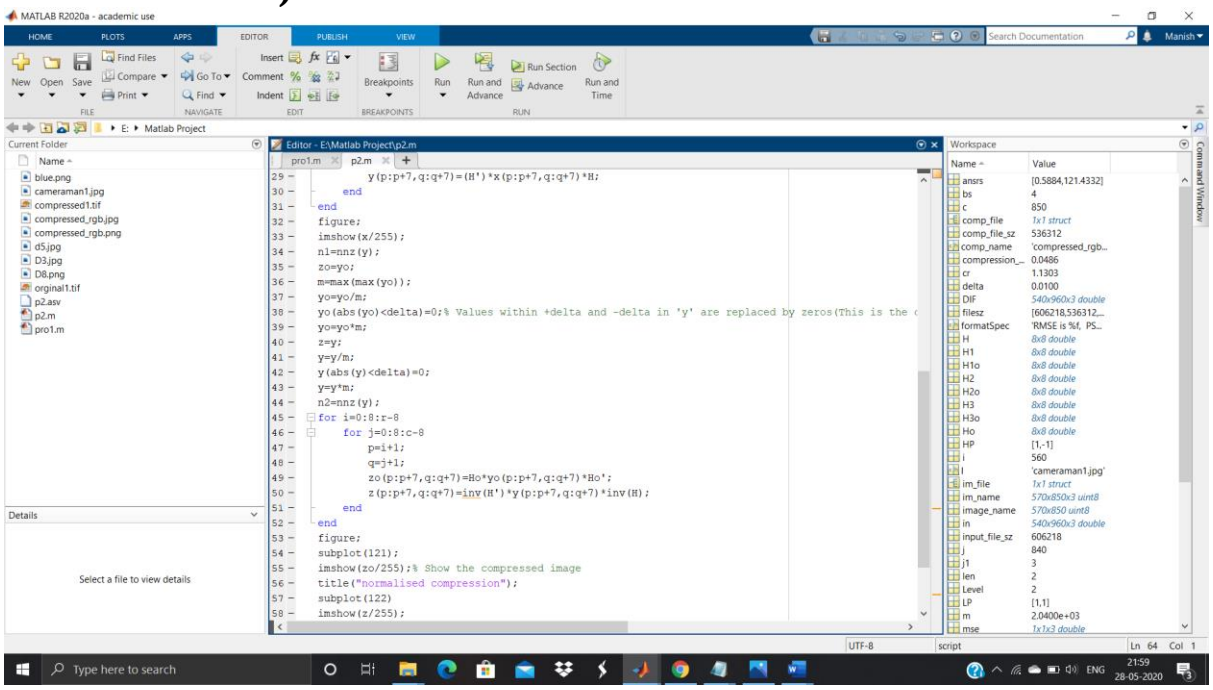



# DIFFERENCE BETWEEN NORMALIZED AND STANDARD COMPRESSION(WITH CODE AND OUTPUT)

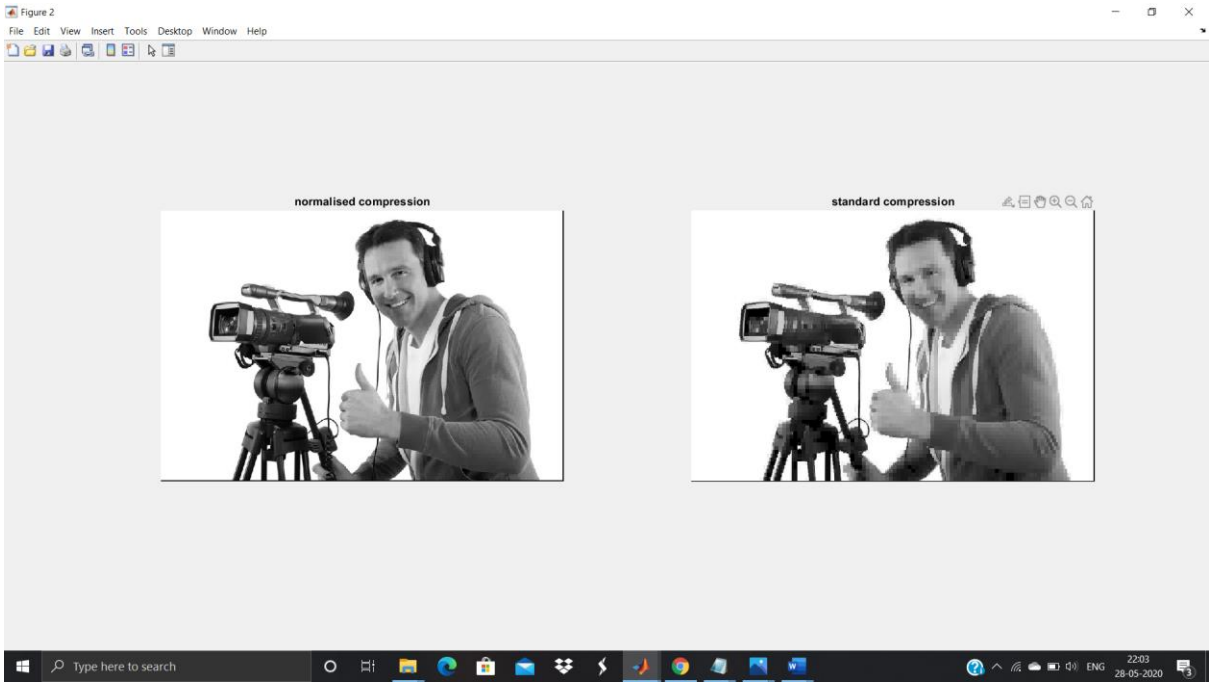
# CODE-I(DEFINING THE MATRICES FOR NORMALIZED COMPRESSION)



# CODE-II(REPLACING THE VALUES AND COMPARING THE IMAGES)




# OUTPUT



## ▶ CONCLUSION

From the above examples, we have understood that Haar wavelet transform based image compression is an efficient way of compressing images as it the decrease in quality between the original image and the compressed image is very less and also this method of compression can be applied on frequently used image types such as jpg, png, etc.

# BIBLIOGRAPHY

Websites Referred

Literature Surveys (1 and 2)


1. Talukder, K.H. and Harada, K., *A Scheme of Wavelet Based Compression of 2D Image*, Proc. IMECS, Hong Kong, pp. 531-536, June 2006.
2. The Haar–Wavelet Transform in Digital Image Processing: Its Status and Achievements Piotr Porwik, Agnieszka Lisowska
3. https://www.eecis.udel.edu/~amer/CISC651/Haar.wavelets.paper.by.Mulcahy.pdf
4. https://en.wikipedia.org/wiki/Haar_wavelet
5. https://arxiv.org/ftp/arxiv/papers/1010/1010.4084.pdf