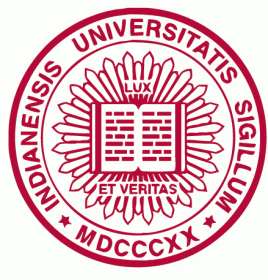
##### INDIANA UNIVERISTY BLOOMINGTON

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##### Assignment 1: Part 1 Fourier Domain

##### B657 Computer Vision

##### REPORT

###### *Submitted by*

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**Under the Guidance of:**

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**Constants:**

Alpha: 10

Radius: (image\_size/2 – 50)

Watermark constant: 0.25

**Check for Watermark:**

Function signature:

Check\_image(SDoublePlane inputImage, int N) where N is the user input

The function checks whether a watermark is present in the image or not by calculating  
the Pearson’s correlation coefficient and compares it with a threshold value (in our case it is 0.25).

The correlation coefficient calculates the relation between the vector v (that is calculated based on the user input N) and the vector c which is calculated by calculating the real parts of the circle in the frequency domain.

**Add Watermark:**

Function signature:

Mark\_image(SDoublePlan inputImage, int N) where N is the user input.

The function adds a watermark in an image by creating a circle on the image of radius (length of image/2 – Radius) and with alpha value 10. The circle is created of N number of pixels where N is provided by the user. Now this circle is correlated to the vector v which is a binary vector.  The binary vector v = (v1, v2…..vl ) (with vi = ( 0, 1)  and the length l  a parameter of the watermarking algorithm) that appears to be a random sequence.  We can seed a random number generator with N, and then use the random number generator to produce the l binary digits. So, if the vector’s value is 1, then the pixel for the circle is highlighted else nothing happens.

**Note:**

While testing the program on a set of about 50 different images, we found out that one set of parameters is not applicable for each type of image. The alpha values need to be adjusted according to the image to get the appropriate result. Some images have more high frequency areas and in those images, large alpha values produce noise while the same alpha value works fine for images having a good mixture of low and high frequencies.

**Qualitative Analysis:**

While doing qualitative analysis on a set of about 30 images, we found the anomaly as described above. However, following are the few screenshots of the images after watermarking them with alpha value 10:



Also, while checking whether the watermarks were present in a set of 30 images, the program could identify 25 images correctly.