

▼ DWT

```
def DWT(coverImage, watermarkImage):
    coverImage = cv2.resize(coverImage,(300,300))
    watermarkImage = cv2.resize(watermarkImage,(150,150))
    cv2.imwrite('DWT/coverImage.png',coverImage)
    cv2.imwrite('DWT/watermarkImage.png',watermarkImage)
    #DWT on cover image
    coverImage = np.float32(coverImage)
    coverImage /= 255;
    coeffC = pywt.dwt2(coverImage, 'haar')
    cA, (cH, cV, cD) = coeffC

    watermarkImage = np.float32(watermarkImage)
    watermarkImage /= 255;

    #Embedding
    coeffW = (0.4*cA + 0.1*watermarkImage, (cH, cV, cD))
    watermarkedImage = pywt.idwt2(coeffW, 'haar')
    print("PSNR value for DWT is",PSNR(coverImage,watermarkedImage))
    watermarkedImage=watermarkedImage*255
    img=watermarkedImage.astype('uint8')
    cv2.imwrite('DWT/watermark_image.png',img)
```

▼ DWT_DCT_SVD

```
def DWT_DCT_SVD(coverImage, watermarkImage):
    coverImage = cv2.resize(coverImage,(512,512))
    watermarkImage = cv2.resize(watermarkImage,(256,256))
    cv2.imwrite('DWT_DCT_SVD/coverImage.png',coverImage)
    cv2.imwrite('DWT_DCT_SVD/watermarkImage.png',watermarkImage)
    coverImage = np.float32(coverImage)

    coverImage /= 255
    coeff = pywt.dwt2(coverImage, 'haar')
    cA, (cH, cV, cD) = coeff

    watermarkImage = np.float32(watermarkImage)
    watermarkImage_dct = cv2.dct(watermarkImage)
    cA_dct = cv2.dct(cA)

    ua,sa,va=np.linalg.svd(cA_dct,full_matrices=1,compute_uv=1)
    uw,sw,vw=np.linalg.svd(watermarkImage,full_matrices=1,compute_uv=1)

    #Embedding
    cA_dct[0:10,0:10] = cA_dct[0:10,0:10] + watermarkImage_dct[0:10,0:10]
```

```

alpha=10
sA=np.zeros((256,256),np.uint8)
sA[:256,:256]=np.diag(sa)
sW=np.zeros((256,256),np.uint8)
sW[:256,:256]=np.diag(sW)
W=sA+alpha*sW

u1,w1,v1=np.linalg.svd(W,full_matrices=1,compute_uv=1)
ww=np.zeros((256,256),np.uint8)
ww[:256,:256]=np.diag(w1)
Wmodi=np.matmul(ua,np.matmul(ww,va))

widct= cv2.idct(Wmodi)
watermarkedImage=pywt.idwt2((widct,(cH,cV,cD)), 'haar')
print("PSNR value for DWT_DCT_SVD",PSNR(coverImage,watermarkedImage))
watermarkedImage=watermarkedImage*255
img=watermarkedImage.astype('uint8')
cv2.imwrite('DWT_DCT_SVD/watermark_image.png',img)

```

▼ Display

```

def display():
    ax=[]
    fig=plt.figure(figsize=(9,4))
    ax.append(fig.add_subplot(1,3,1))
    ax[-1].set_title("Cover Image:")
    plt.imshow(cv2.imread('DWT/coverImage.png'),cmap='gray')
    ax.append(fig.add_subplot(1,3,2))
    ax[-1].set_title("Watermark Image:")
    plt.imshow(cv2.imread('DWT/watermarkImage.png'),cmap='gray')
    ax.append(fig.add_subplot(1,3,3))
    ax[-1].set_title("Watermarked Image:")
    plt.imshow(cv2.cvtColor(cv2.imread('DWT/watermark_image.png'),cv2.COLOR_BGR2GRAY),cmap='g
    fig.suptitle('PSNR value of DWT is 59.0966',fontsize=16)
    fig=plt.figure(figsize=(9,4))
    ax.append(fig.add_subplot(1,3,1))
    ax[-1].set_title("Cover Image:")
    plt.imshow(cv2.imread('DWT_DCT_SVD/coverImage.png'),cmap='gray')
    ax.append(fig.add_subplot(1,3,2))
    ax[-1].set_title("Watermark Image:")
    plt.imshow(cv2.imread('DWT_DCT_SVD/watermarkImage.png'),cmap='gray')
    ax.append(fig.add_subplot(1,3,3))
    ax[-1].set_title("Watermarked Image:")
    plt.imshow(cv2.cvtColor(cv2.imread('DWT_DCT_SVD/watermark_image.png'),cv2.COLOR_BGR2GRAY)
    fig.suptitle('PSNR value of DWT-DCT-SVD is 79.3433',fontsize=16)

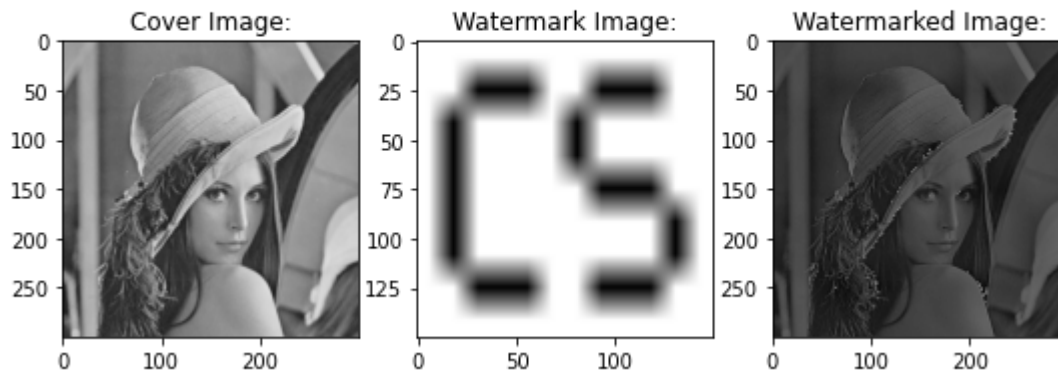
```

▼ Main Function

```
coverImage = cv2.cvtColor(cv2.imread('pictures/imagetest1.png'),cv2.COLOR_BGR2GRAY)
watermarkImage = cv2.cvtColor(cv2.imread('pictures/qrcodetest1.png'),cv2.COLOR_BGR2GRAY)
DWT(coverImage,watermarkImage)
DWT_DCT_SVD(coverImage,watermarkImage)
display()
cv2.waitKey(0)
cv2.destroyAllWindows()
```

↗ PSNR value for DWT is 59.306208669744976
 PSNR value for DWT_DCT_SVD 79.34335827332546

PSNR value of DWT is 59.0966



PSNR value of DWT-DCT-SVD is 79.3433

