

Lesson 5 The Fourier Domain HW 5A

Solution:

The FT of the sub-sampled image of 'trui' was calculated using the following code:

```
a = readim('trui','')%Load Image
```

```
s = newim(a);
```

```
s(0:8:end,0:8:end)=1
```

```
b = a*s
```

```
c = ft(b)
```

The resultant images are:

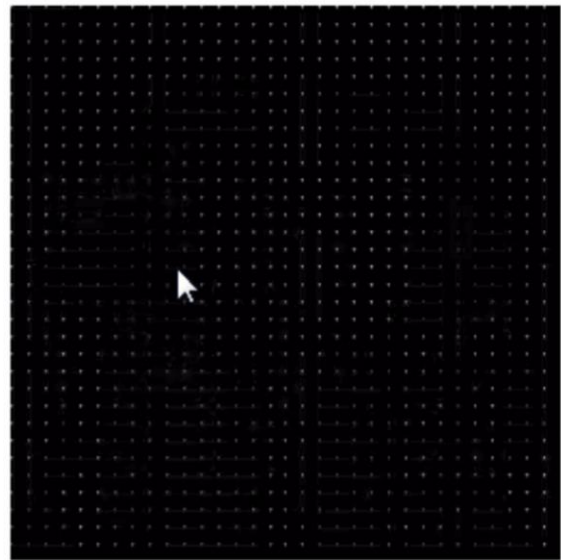


Fig 1: sub sampled 'trui'

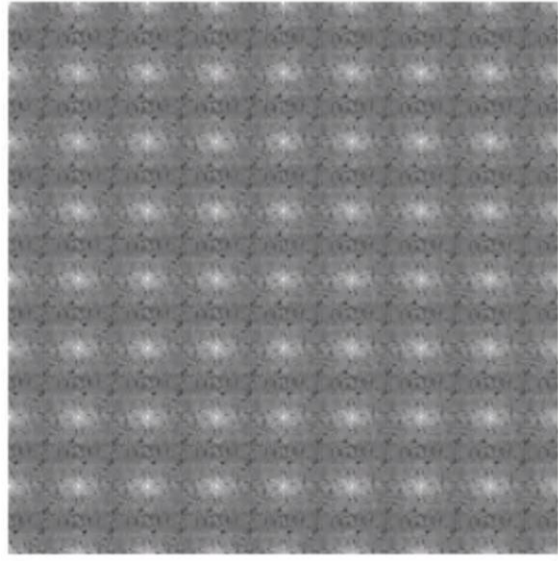


Fig 2: FT of sub-sampled 'trui'

Because Figure 2 shows eight identical/overlapping spectrum photos side-by-side and top-to-bottom, the new window should be 32*32 pixels in size.

The following command was used to create a perfect ("brick wall") low-pass filter:

```
d = 64*(max(abs(xx(c)), abs(yy(c)))<16)
```

(To compensate for intensity loss due to sub sampling, the filter was multiplied by 64.)

The frequency is increased to sixteen.

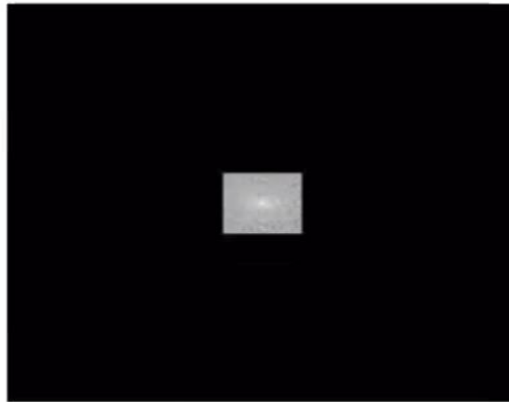


Fig 3: Low-Pass Filter

When the image is multiplied by the sub-sampled FT and then IFT'ed, it looks like this:



Fig 4: IFT of filtered, sub-sampled 'trui'

We should filter away the higher frequencies in trui (using a Gaussian filter) before sub-sampling to avoid the aliasing shown in Fig 4. It's used as an anti-aliasing filter in this application.