

# IIA Design Project SF2: Image Processing

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Engineering Department

Easter 2019

# Image Compression



- An 8-bit 256x256 grey-scale image
- 2x - 3x compression has little impact on image
- Greater compression starts to distort data ...
- ... eventually the image is almost un-recognisable

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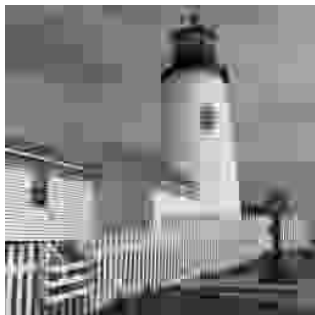
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# Project Aims

- To learn about what is typically involved in **image compression schemes**
- To look at some **specific compression options**
- To consider how **image quality** can be assessed
- To investigate and assess your own compression scheme, based around those introduced earlier

# Quantization



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- Quantization refers to the number of grey levels used
- Initially this is not noticeable
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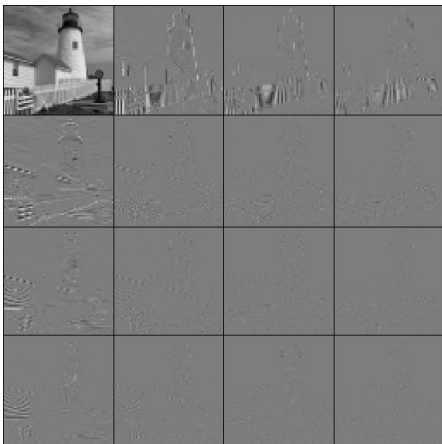
# Filtering



- Store the **lower frequency** components at progressively **lower resolutions**
- We can then effectively **compress the higher frequencies**

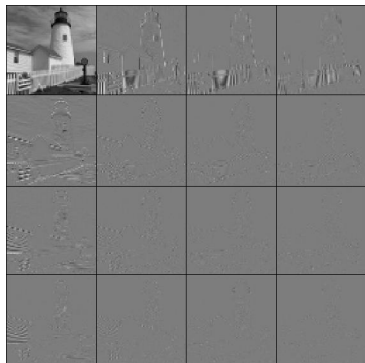
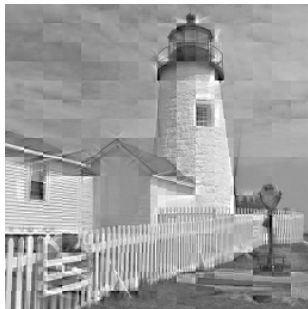


# Discrete Cosine Transform (DCT)



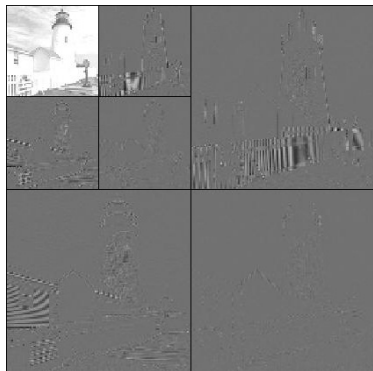
- Split each image block into **frequency components**
- (Re-arranged here to make it easier to see)
- **Compress** each of the blocks separately in frequency order

# Lapped Bi-orthogonal Transform



- A bit like pre-processing the image first and then applying a DCT
- The pre-processing applies **across the boundaries** of the DCT blocks

# Discrete Wavelet Transform (DWT)



- Split the whole image into **four frequency bands**
- Repeat this procedure with the lowest (top-left) frequency band
- **Compress** grouped components from each band

# JPEG Compression

- Stands for **Joint Photographic Experts Group**
- Typical compression process:
  - Split image into 8x8 blocks
  - Use DCT on each of these blocks, and quantise
  - **Lossless Huffman coding** of these quantised coefficients
- You will get the chance to **try to do better** than this (to some extent mirroring the more recent JPEG2000 and JPEG-XR standards)

## Image Quality

These are all compressed to a ratio of about 12:1



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error 7.63



error 7.05



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Visual Quality ??

# Timing and Reports

**Week 1:**

Matlab introduction  
Image filtering  
Laplacian Pyramid  
Quantisation



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1<sup>st</sup> interim report:  
2 pages (12 marks)  
9:15am Thursday

# Timing and Reports

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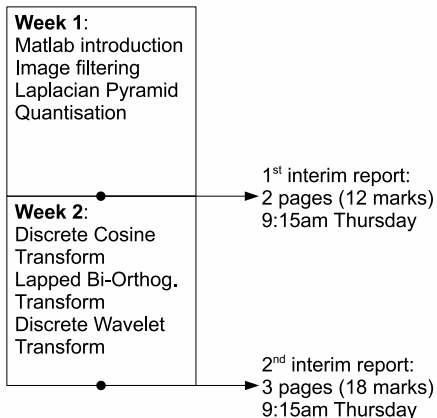
Matlab introduction  
Image filtering  
Laplacian Pyramid  
Quantisation

**Week 2:**

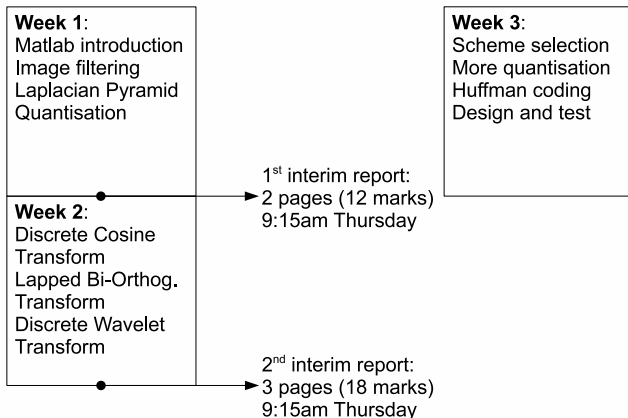
Discrete Cosine  
Transform  
Lapped Bi-Orthog.  
Transform  
Discrete Wavelet  
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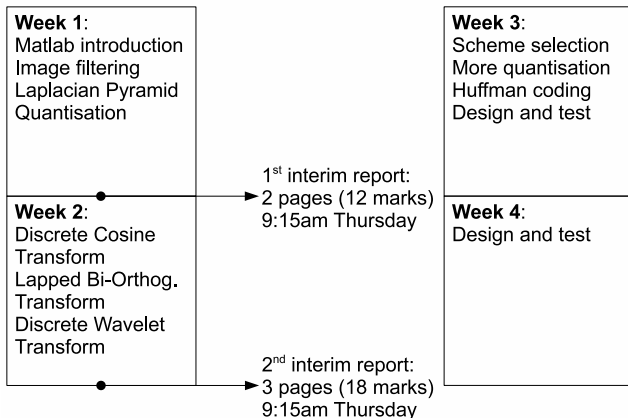
# Timing and Reports



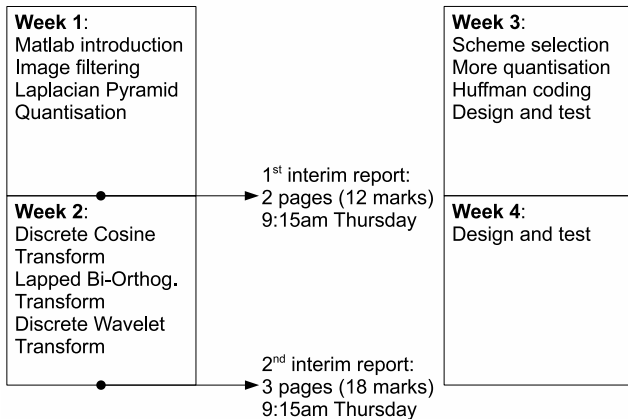
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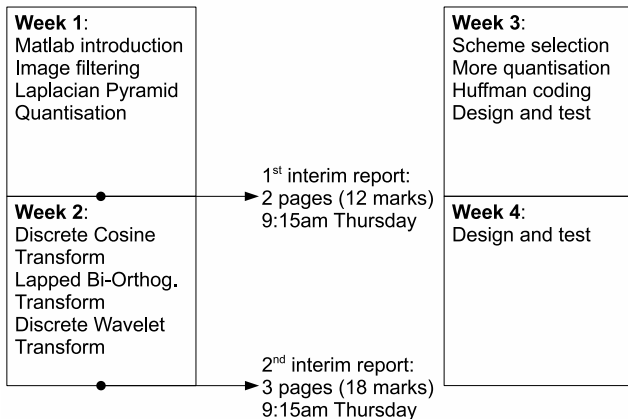


# Timing and Reports



Interim Report 1, 2 pages (12 marks): 9.15am 16.05.19

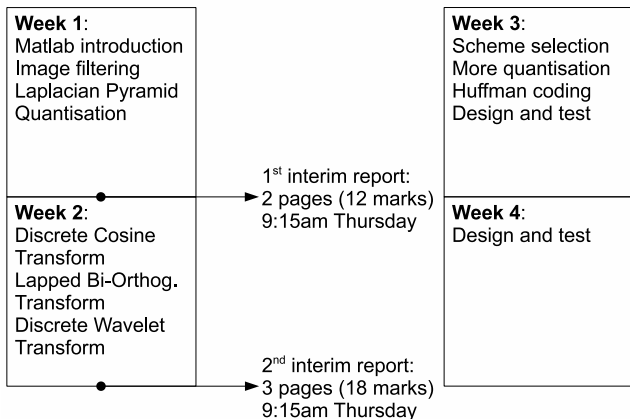
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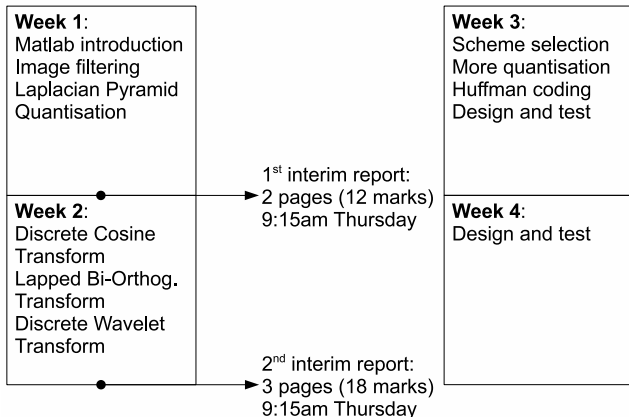
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Competition: 11am Monday (3rd June)



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Interim Report 2, 3 pages (18 marks): 9.15am 23.05.19

Competition: 11am Monday (3rd June)

Final Report, 9 pages (50 marks): 4pm Thursday (6th June)

# Rules

- Design is in pairs, but reports are individual
- **Thursdays (9am-11am) and Mondays (11am-1pm)** are compulsory (**1 mark penalty for each hour**).
- **Thursday afternoon (2pm-6pm)** is strongly advised. In 2019 we have clusters 5 & 6 – these will be booked for your use on Thursday afternoon.
- **Interim report deadlines** are very important (**3 mark penalty for each day**)
- The **final report must not be late**.
- Computer issues **are not a valid excuse**
- All reports will be submitted online via the Moodle site.

## Information

Everything you need to know is in the handout and on the Moodle site.

See Moodle site (you should all be enrolled – first thing is to check and see me if you are not).

Demonstrators will be [Hugo Hadfield](#) and [Alex Grafton](#).