

CS4405

Tuesday 7th January 2014

CA - 2 Assignments
9 x 1 hour practicals

Outline

- ▷ Images 20 %
- ▷ Video 25 %
- ▷ Audio 10 %
- ▷ Delivery 40 %

Images

GIF and JPEG

GIF for Line

JPEG for Natural

Video

MPEG-1

Chroma Key - Combining (Green/Blue screen)

Audio

Ana → Dig Conversion

WAVE Audio File Format

Delivery

MM on Data Networks

HTML5 Media Integration

Multimedia Delivery

MPEG-DASH (Dynamic Adaptive Streaming over HTTP)

Moodle

<http://cs4.ucc.ie/moodle/course/view.php?id=8>

KEY : enrollor CS4405

Line Art Images

Median Cut Algorithm

- Smallest Box that bounds all colors.
 - Max Red, Min Red
 - " Green, " Green
 - " Blue, " Blue
- } Median of all.

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Tuesday 28th January 2014

Specifies of JPEG.

High levels of compression + ensure fidelity of image
lossless process.

DCT Compression

Quantisation 3-- two parameters

- Partition
- Codebook

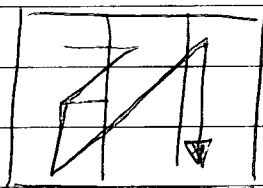
△ JPEG does not have a defined quantisation table

- Luminance Quantisation Table
- Chrominance Quantisation Table

DCT Coefficients

| | | |
|----|----|---|
| 1 | 24 | 0 |
| 24 | 36 | 0 |
| 0 | 0 | 0 |

→



Moves in zigzag form

Changes 2D matrix into a 1D list.

DC coefficient uses 1's complement.

Class B is the max for jpeg.

i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

↑ range ↑

-16 11 10 16 0 ...
 -12 12 0 0 0 ...
 0 0 0 0 0 ...
 \vdots \vdots \vdots \vdots \vdots

$(0, 11)$ $(0, 12)$, $(1, -12)$, $(0, 16)$, $(0, 0)$

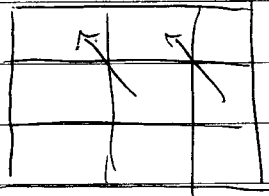
\uparrow
 run length, non-zero AC coefficient

\uparrow
 End of Block

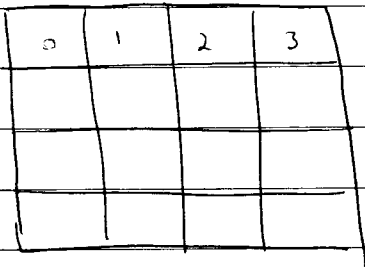
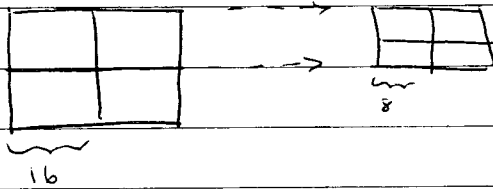
$(0, 4) : 11$ $-15 \dots -8, 8 \dots 15$
 $(0, 4) : -12$ $-15 \dots -8, 8 \dots 15$
 $(1, 4) : -12$ $-15 \dots 8, 8 \dots 15$
 $(0, 4) : -16$ etc.
 $(0, 5) : 16$
 EOB

★ JFIF :- JPEG File Interchange Format
 enables jpeg bitstream to be exchanged
 in a minimal file format

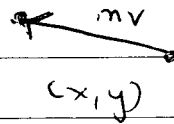
Effects of motion - VIDEO.



Motion estimation blocks, are called Macro blocks. Macroblock sizes power 2 are preferred for efficiency



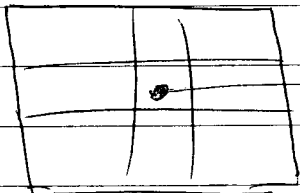
You end up with a list of macroblocks.



= motion vector

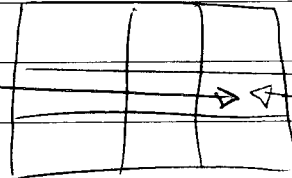
, go so far in the x position and so far in the y position

Forward Prediction

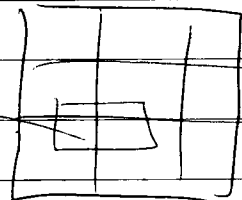


previous frame

Best Match



next frame



future frame

① ② ③ ④

↓ coding

① ③ ②

↓

playout (re-organise)

△ In order to reorganise / playout, some storage is required so resources are recorded. This is only feasible in a digital environment and there will also be a delay. This is ok with video-on-demand but with a real-time operation the decoding / encoding will be an issue.

But this is a lot more efficient.

△ Motion Estimation Issues

- Search (search everywhere or restricted search)
- How are you going to search, you may not find the best match
- What is the best match? How do I determine this?

* Motion estimation is a computationally intensive operation

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Tuesday 18th February 2014

MPEG-1 Video Encoding

- Block based
- Particular Data Rate / Data Geometry / Frame Rate

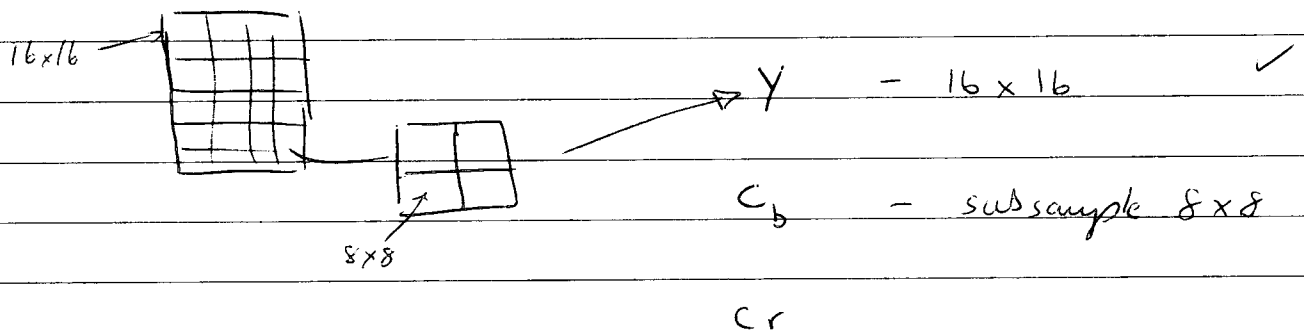
But more flexibility with output.

Has to comply with constraints in order to be legal,

P-picture - Predictive Picture

In mpeg you have two types of block
o Macroblock (motion compensation)

↳



Y will be used as motion compensation.

6 things get coded for each macroblock.

(Continued)

△ Bi-Directionally - B-Picture

An MPEG video stream consists of a mix of picture types (I, B, P)

You will have a natural amount of variability in an MPEG!



Group of Pictures (GOP)

I requires more space than a P, and P more than B.

The number of I-, P- and B- Pictures in a GOP is application dependent.

GOP Structure B-2 numbers $M=3, N=12$

↑ distance between two anchor pictures
 ↓ length, distance between 2 full pictures

1 2 3 4
 I P B B

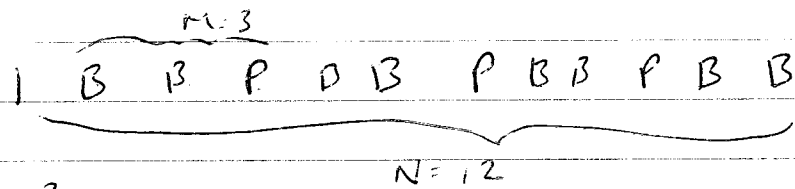


1 3 4 2
 I B B P



Decode I → P

B can use previous or future pictures to decode.



$M = 3$

$N = 12$

Having more I-pictures, the higher the stream size and buffer size.

MPEG was not designed for editing, it was designed for end delivery.

Putting in more B-pictures works only up to a point, eg I B B B B B P, B cannot be predicted from each other, so the further apart the I and P are, the less similar they are going to be. Beyond a certain point the image becomes worse.

Must end with I or P but can start with I or B in the GOP. B pictures need to be reordered.

Open Group of Pictures



Borrow from neighbouring group of pictures



If the GOP started with a B it could/would borrow from the previous GOP

Closed GOP



Can be decoded without reference to any other external keys



Totally self-contained, no borrowing - started with an I-picture

★ DCT - discrete cosine transform

△ if you know JPEA you have the same form in MPEG.

Compression of P-Pictures (prediction - movement)

Get current block + Best Match \rightarrow Difference Macroblock
(Motion compensation must also be taken into account)

△ MV - Motion Vector (forward + backward)

△ MB - Macroblock

Sometimes motion does not work!