

ΠΟΛΥΜΕΣΑ – ΠΡΟΓΡΑΜΜΑΤΙΣΤΙΚΗ ΑΣΚΗΣΗ 2

ΧΕΙΜΕΡΙΝΟ ΕΞΑΜΗΝΟ 2021-2022

ΟΝΟΜ/ΜΟ: ΤΣΑΟΥΣΗ ΑΘΝΑΣΙΑ-ΔΑΝΑΗ

A.M.:3349

Εκτύπωση του αποτελέσματος του κωδικοποιητή για καθεμία από τις 8 κωδικοποιήσεις του H.264:

(Κωδικοποίηση της μορφής IDR P P P P P P P . . .)

- Bitrates 25 * 3349 = 83725

```
----- Average data all frames -----
Total encoding time for the seq. : 34.015 sec (8.82 fps)
Total ME time for sequence      : 17.256 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 34.561, 34.123, 25.16273 }
U { PSNR (dB), cSNR (dB), MSE } : { 39.521, 39.275, 7.68346 }
V { PSNR (dB), cSNR (dB), MSE } : { 40.172, 39.829, 6.76433 }

Total bits                      : 838056 (I 28280, P 809456, NVB 320)
Bit rate (kbit/s) @ 30.00 Hz   : 83.81
Bits to avoid Startcode Emulation : 2419
Bits for parameter sets        : 320
Bits for filler data            : 0

Exit JM 19 (FRExt) encoder ver 19.0
```

- Bitrates 45 * 3349 = 150705

```
----- Average data all frames -----
Total encoding time for the seq. : 35.118 sec (8.54 fps)
Total ME time for sequence      : 16.688 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 37.645, 37.334, 12.01262 }
U { PSNR (dB), cSNR (dB), MSE } : { 41.089, 40.898, 5.28846 }
V { PSNR (dB), cSNR (dB), MSE } : { 42.016, 41.720, 4.37630 }

Total bits                      : 1506680 (I 28280, P 1478080, NVB 320)
Bit rate (kbit/s) @ 30.00 Hz   : 150.67
Bits to avoid Startcode Emulation : 2116
Bits for parameter sets        : 320
Bits for filler data            : 0
```

- Bitrates $65 * 3349 = 217685$

```
----- Average data all frames -----
Total encoding time for the seq. : 36.319 sec (8.26 fps)
Total ME time for sequence      : 16.437 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 39.539, 39.300, 7.63890 }
U { PSNR (dB), cSNR (dB), MSE } : { 42.304, 42.116, 3.99475 }
V { PSNR (dB), cSNR (dB), MSE } : { 43.295, 42.988, 3.26827 }

Total bits                      : 2176336 (I 28280, P 2147736, NVB 320)
Bit rate (kbit/s) @ 30.00 Hz   : 217.63
Bits to avoid Startcode Emulation : 1921
Bits for parameter sets        : 320
Bits for filler data           : 0

-----
Exit JM 19 (FRExt) encoder ver 19.0
```

- Bitrates $85 * 3349 = 284665$

```
----- Average data all frames -----
Total encoding time for the seq. : 37.113 sec (8.08 fps)
Total ME time for sequence      : 16.145 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 41.003, 40.773, 5.44200 }
U { PSNR (dB), cSNR (dB), MSE } : { 43.327, 43.158, 3.14266 }
V { PSNR (dB), cSNR (dB), MSE } : { 44.409, 44.105, 2.52706 }

Total bits                      : 2846032 (I 44792, P 2800920, NVB 320)
Bit rate (kbit/s) @ 30.00 Hz   : 284.60
Bits to avoid Startcode Emulation : 2254
Bits for parameter sets        : 320
Bits for filler data           : 0

-----
Exit JM 19 (FRExt) encoder ver 19.0
```

(Κωδικοποίηση της μορφής IDR BPBPBP. . . .)

- Bitrates $25 * 3349 = 83725$

```
----- Average data all frames -----
Total encoding time for the seq. : 40.597 sec (7.39 fps)
Total ME time for sequence      : 20.999 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 35.163, 34.692, 22.07263 }
U { PSNR (dB), cSNR (dB), MSE } : { 39.929, 39.657, 7.03627 }
V { PSNR (dB), cSNR (dB), MSE } : { 40.603, 40.261, 6.12287 }

Total bits                      : 835048 (I 28608, P 643856, B 162264 NVB 320)
Bit rate (kbit/s) @ 30.00 Hz   : 83.50
Bits to avoid Startcode Emulation : 2228
Bits for parameter sets        : 320
Bits for filler data           : 0

-----
Exit JM 19 (FRExt) encoder ver 19.0
```

- Bitrates $45 * 3349 = 150705$

```
----- Average data all frames -----
Total encoding time for the seq. : 38.757 sec (7.74 fps)
Total ME time for sequence      : 18.790 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 38.141, 37.728, 10.97064 }
U { PSNR (dB), cSNR (dB), MSE } : { 41.563, 41.338, 4.77878 }
V { PSNR (dB), cSNR (dB), MSE } : { 42.496, 42.185, 3.93197 }

Total bits                      : 1506344 (I 28608, P 1132792, B 344624 NVB 320)
Bit rate (kbit/s) @ 30.00 Hz   : 150.63
Bits to avoid Startcode Emulation : 2217
Bits for parameter sets        : 320
Bits for filler data           : 0

-----
Exit JM 19 (FRExt) encoder ver 19.0
```

- Bitrates $65 * 3349 = 217685$

```

----- Average data all frames -----
Total encoding time for the seq. : 38.203 sec (7.85 fps)
Total ME time for sequence      : 17.538 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 39.925, 39.633, 7.07666 }
U { PSNR (dB), cSNR (dB), MSE } : { 42.612, 42.410, 3.73303 }
V { PSNR (dB), cSNR (dB), MSE } : { 43.698, 43.392, 2.97769 }

Total bits                      : 2175088 (I 28608, P 1568832, B 577328 NVB 320)
Bit rate (kbit/s) @ 30.00 Hz   : 217.51
Bits to avoid Startcode Emulation : 1957
Bits for parameter sets        : 320
Bits for filler data           : 0

-----
Exit JM 19 (FRExt) encoder ver 19.0

```

- Bitrates $85 * 3349 = 284665$

```

----- Average data all frames -----
Total encoding time for the seq. : 56.217 sec (5.34 fps)
Total ME time for sequence      : 25.893 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 41.295, 41.068, 5.08526 }
U { PSNR (dB), cSNR (dB), MSE } : { 43.515, 43.341, 3.01270 }
V { PSNR (dB), cSNR (dB), MSE } : { 44.663, 44.364, 2.38051 }

Total bits                      : 2846216 (I 44984, P 1934296, B 866616 NVB 320)
Bit rate (kbit/s) @ 30.00 Hz   : 284.62
Bits to avoid Startcode Emulation : 1936
Bits for parameter sets        : 320
Bits for filler data           : 0

-----
Exit JM 19 (FRExt) encoder ver 19.0

```

Εκτύπωση του αποτελέσματος του κωδικοποιητή για καθεμία από τις 8 κωδικοποιήσεις του H.265:

(Αρχείο: *encoder_lowdelay_main.cfg*)

- Bitrates 27 * 3349 = 90423

```
SUMMARY -----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        300      a    90.5832  37.1078  41.3660  42.2703  37.6650

I Slices-----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
         1      i   812.4000  41.2983  43.5119  45.7560  42.1259

P Slices-----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
         0      p      -nan      -nan      -nan      -nan      -nan

B Slices-----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        299      b    88.1691  37.0938  41.3589  42.2586  37.6557

RVM: 0.000
Bytes written to file: 113229 (90.583 kbps)

Total Time:      130.219 sec.
```

- Bitrates 47 * 3349 = 157403

```
SUMMARY -----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        300      a   157.9408  40.1370  43.2671  44.3210  40.5891

I Slices-----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
         1      i   930.7200  42.3866  44.3029  46.6109  43.1600

P Slices-----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
         0      p      -nan      -nan      -nan      -nan      -nan

B Slices-----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        299      b   155.3563  40.1294  43.2636  44.3133  40.5826

RVM: 0.000
Bytes written to file: 197426 (157.941 kbps)

Total Time:      168.672 sec.
```

- Bitrates 67 * 3349 = 224383

```
SUMMARY -----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        300      a   223.8232  42.0174  44.5585  45.6437  42.4371

I Slices-----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
         1      i  1088.1600  43.5822  45.5405  47.5438  44.3405

P Slices-----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
         0      p      -nan      -nan      -nan      -nan      -nan

B Slices-----
      Total Frames |   Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        299      b   220.9324  42.0121  44.5553  45.6374  42.4320

RVM: 0.000
Bytes written to file: 279779 (223.823 kbps)

Total Time:      187.516 sec.
```

- Bitrates 87 * 3349 = 291363

```
SUMMARY -----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        300      a    289.7520  43.3825  45.4536  46.5852  43.7722

I Slices-----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        1        i   1145.5200  44.0849  45.7028  47.7579  44.7752

P Slices-----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        0        p    -nan     -nan     -nan     -nan     -nan

B Slices-----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
       299        b    286.8899  43.3802  45.4528  46.5813  43.7692

RVM: 0.000
Bytes written to file: 362190 (289.752 kbps)

Total Time:      215.875 sec.
```

(Αρχείο: encoder_randomaccess_main.cfg)

- Bitrates 27 * 3349 = 90423

```
SUMMARY -----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        300      a    91.6824  37.4085  42.1788  43.0327  38.0476

I Slices-----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        10        i   970.6080  40.6318  43.0886  44.3141  41.2148

P Slices-----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        0        p    -nan     -nan     -nan     -nan     -nan

B Slices-----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
       290        b    61.3746  37.2974  42.1475  42.9885  37.9707

RVM: 0.000
Bytes written to file: 114603 (91.682 kbps)

Total Time:      110.188 sec.
```

- Bitrates 47 * 3349 = 157403

```
SUMMARY -----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        300      a   158.5296  40.2611  43.8157  44.9080  40.8648

I Slices-----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        10        i  1219.3440  42.7290  44.6464  46.0342  43.0984

P Slices-----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
        0        p    -nan     -nan     -nan     -nan     -nan

B Slices-----
      Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
       290        b   121.9498  40.1760  43.7871  44.8692  40.8050

RVM: 0.000
Bytes written to file: 198162 (158.530 kbps)

Total Time:      118.125 sec.
```

- Bitrates 67 * 3349 = 224383

```
SUMMARY -----
Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
    300      a    225.5208  42.2349  45.1160  46.1653  42.7819

I Slices-----
Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
    10      i    1427.2560  44.2174  45.7901  47.0195  44.5420

P Slices-----
Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
     0      p      -nan      -nan      -nan      -nan      -nan

B Slices-----
Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
    290      b    184.0817  42.1665  45.0927  46.1358  42.7323

RVM: 0.000
Bytes written to file: 281901 (225.521 kbps)

Total Time:      134.500 sec.
```

- Bitrates 87 * 3349 = 291363

```
SUMMARY -----
Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
    300      a    292.5504  43.7129  46.0978  47.2280  44.1978

I Slices-----
Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
    10      i    1576.5600  45.2286  46.4244  47.7319  45.4909

P Slices-----
Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
     0      p      -nan      -nan      -nan      -nan      -nan

B Slices-----
Total Frames | Bitrate   Y-PSNR   U-PSNR   V-PSNR   YUV-PSNR
    290      b    248.2742  43.6607  46.0866  47.2107  44.1595

RVM: 0.000
Bytes written to file: 365688 (292.550 kbps)

Total Time:      150.359 sec.
```

BD-PSNR

H.264 Κωδικοποίηση της μορφής IDR P P P P P P P . . . σε σύγκριση με:

- H.264- Κωδικοποίηση της μορφής IDR B P B P B P . . .

```
>> bjontegaard2([83.81 150.67 217.63 284.60],[34.561 37.645 39.539 41.003],[83.50 150.63 217.51 284.62],[35.163 38.141 39.925 41.295],'dsnr')
ans = 0.47949
...
```

- H.265-Αρχείο: encoder_lowdelay_main.cfg

```
>> bjontegaard2([83.81 150.67 217.63 284.60],[34.561 37.645 39.539 41.003],[90.5832 157.9408 223.8232 289.7520],[37.1078 40.1370 42.0174 43.3825],'dsnr')
ans = 2.2390
```

- H.265- Αρχείο: encoder_randomaccess_main.cfg

```
>> bjontegaard2([83.81 150.67 217.63 284.60],[34.561 37.645 39.539 41.003],[91.6824 158.5296 225.5208 292.5504],[37.4085 40.2611 42.2349 43.7129],'dsnr')
ans = 2.3943
```

BD-RATE

H.264 Κωδικοποίηση της μορφής IDR P P P P P P P . . . σε σύγκριση με:

- H.264- Κωδικοποίηση της μορφής IDR B P B P B P . . .

```
>> bjontegaard2([83.81 150.67 217.63 284.60],[34.561 37.645 39.539 41.003],[83.50 150.63 217.51 284.62],[35.163 38.141 39.925 41.295],'rate')
ans = -8.9314
```

- H.265-Αρχείο: encoder_lowdelay_main.cfg

```
-----
>> bjontegaard2([83.81 150.67 217.63 284.60],[34.561 37.645 39.539 41.003],[90.5832 157.9408 223.8232 289.7520],[37.1078 40.1370 42.0174 43.3825],'rate')
ans = -34.503
```

- H.265- Αρχείο: encoder_randomaccess_main.cfg

```
-----
>> bjontegaard2([83.81 150.67 217.63 284.60],[34.561 37.645 39.539 41.003],[91.6824 158.5296 225.5208 292.5504],[37.4085 40.2611 42.2349 43.7129],'rate')
ans = -36.199
```

Τελικά:

H.264(IDR PPP) <H.264(IDR BPB)<H.265(low_delay)< H.265(random_access)