ΠΟΛΥΜΕΣΑ
ΧΕΙΜΕΡΙΝΟ ΕΞΑΜΗΝΟ 2017-2018

ΠΡΟΓΡΑΜΜΑΤΙΣΤΙΚΗ ΑΣΚΗΣΗ 3

Ονοματεπώνυμο: Τεριζή Χρύσα
ΑΜ: 2553
Ημερομηνία: 11/01/2018

Βήμα 1

Για να κάνω compile το H.264 reference software έπρεπε να τρέξω στο τερματικό τις ακόλουθες εντολές,

>> *chmod 777* unixprep.sh
>> ./unixprep.sh
>> *make -f* Makefile

Βήμα 4

Α) Κωδικοποίηση της μορφή: **IDR PPPPPP...**

α1) για bitrate = **50 * AM** = 50 * 2553 = 127650

Average data all frames
Total encoding time for the seq.: 42.418 sec (7.07 fps)
Total ME time for sequence: 18.535 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 36.773, 36.419, 14.83050 }
U { PSNR (dB), cSNR (dB), MSE } : { 40.606, 40.408, 5.91957 }
V { PSNR (dB), cSNR (dB), MSE } : { 41.418, 41.094, 5.05444 }

Total bits	1277480 (I 28280, P 1248880, NVB 320)
Bit rate (kbit/s) @ 30.00 Hz	127.75
Bits to avoid Startcode Emulation	2178
Bits for parameter sets	320
Bits for filler data	0

α2) για bitrate = **75 * AM** = 75 * 2553 = 191475

Average data all frames
Total encoding time for the seq. : 43.528 sec (6.89 fps)
Total ME time for sequence: 18.041 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 38.895, 38.621, 8.93268 }
U { PSNR (dB), cSNR (dB), MSE } : { 41.930, 41.736, 4.36016 }
V { PSNR (dB), cSNR (dB), MSE } : { 42.854, 42.545, 3.61916 }

Total bits	1914464 (I 28280, P 1885864, NVB 320)
Bit rate (kbit/s) @ 30.00 Hz	191.45
Bits to avoid Startcode Emulation	2283
Bits for parameter sets	320
Bits for filler data	0

α3) για bitrate = **100 * AM** = 100 * 2553 = 255300

Average data all frames
Total encoding time for the seq. : 44.495 sec (6.74 fps)
Total ME time for sequence: 17.606 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 40.427, 40.210, 6.19570 }
U { PSNR (dB), cSNR (dB), MSE } : { 42.925, 42.755, 3.44772 }
V { PSNR (dB), cSNR (dB), MSE } : { 43.963, 43.671, 2.79270 }

Total bits	2551888 (I 44792, P 2506776, NVB 320)
Bit rate (kbit/s) @ 30.00 Hz	255.19
Bits to avoid Startcode Emulation	2000
Bits for parameter sets	320
Bits for filler data	0

α4) για bitrate = **125 * AM** = 125 * 2553 = 319125

Average data all frames
Total encoding time for the seq.: 45.137 sec (6.65 fps)
Total ME time for sequence: 17.236 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 41.629, 41.424, 4.68418 }
U { PSNR (dB), cSNR (dB), MSE } : { 43.756, 43.611, 2.83117 }
V { PSNR (dB), cSNR (dB), MSE } : { 44.863, 44.594, 2.25780 }

Total bits	3190584 (I 44792, P 3145472, NVB 320)
Bit rate (kbit/s) @ 30.00 Hz	319.06
Bits to avoid Startcode Emulation	2282
Bits for parameter sets	320
Bits for filler data	0

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Βήμα 5

Β) Κωδικοποίηση της μορφή: **IDR BPBPBP...**

β1) για bitrate = **50 * AM** = 50 * 2553 = 127650

Average data all frames

Total encoding time for the seq.: 47.102 sec (6.37 fps)

Total ME time for sequence: 20.953 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 37.284, 36.819, 13.52641 }
U { PSNR (dB), cSNR (dB), MSE } : { 41.056, 40.812, 5.39336 }
V { PSNR (dB), cSNR (dB), MSE } : { 41.909, 41.571, 4.52926 }

Total bits	1273472 (I 28608, P 962632, B 281912 NVB 320)
Bit rate (kbit/s) @ 30.00 Hz	127.35
Bits to avoid Startcode Emulation	2205
Bits for parameter sets	320
Bits for filler data	0

β2) για bitrate = **75 * AM** = 75 * 2553 = 191475

Average data all frames

Total encoding time for the seq.: 49.216 sec (6.10 fps)

Total ME time for sequence: 20.912 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 39.173, 38.847, 8.48002 }
U { PSNR (dB), cSNR (dB), MSE } : { 42.094, 41.889, 4.20944 }
V { PSNR (dB), cSNR (dB), MSE } : { 43.119, 42.811, 3.40405 }

Total bits	1913016 (I 28608, P 1363736, B 520352 NVB 320)
Bit rate (kbit/s) @ 30.00 Hz	191.30
Bits to avoid Startcode Emulation	2037
Bits for parameter sets	320
Bits for filler data	0

β3) για bitrate = **100 * AM** = 100 * 2553 = 255300

Average data all frames

Total encoding time for the seq.: 50.398 sec (5.95 fps)

Total ME time for sequence: 20.592 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 40.643, 40.387, 5.94804 }
U { PSNR (dB), cSNR (dB), MSE } : { 43.054, 42.859, 3.36631 }
V { PSNR (dB), cSNR (dB), MSE } : { 44.149, 43.815, 2.70116 }

Total bits	2552912 (I 44984, P 1718800, B 788808 NVB 320)
Bit rate (kbit/s) @ 30.00 Hz	255.29
Bits to avoid Startcode Emulation	1830
Bits for parameter sets	320
Bits for filler data	0

β4) για bitrate = **125 * AM** = 125 * 2553 = 319125

Average data all frames

Total encoding time for the seq.: 51.235 sec (5.86 fps)

Total ME time for sequence: 20.146 sec

Y { PSNR (dB), cSNR (dB), MSE } : { 41.941, 41.711, 4.38551 }
U { PSNR (dB), cSNR (dB), MSE } : { 43.983, 43.810, 2.70430 }
V { PSNR (dB), cSNR (dB), MSE } : { 45.105, 44.808, 2.14928 }

Total bits	3189560 (I 44984, P 2167400, B 976856 NVB 320)
Bit rate (kbit/s) @ 30.00 Hz	318.96
Bits to avoid Startcode Emulation	1884
Bits for parameter sets	320
Bits for filler data	0

ΒΗΜΑ 8

Α) Για το **encoder_lowdelay_main.cfg**

α1) για targetBitRate = **50 * AM** = 50 * 2553 = 127650

Summary

Total Frames	Bitrate	Y-PSNR	U-PSNR	V-PSNR	YUV-PSNR
300 a	127.0704	38.9316	42.5426	43.4715	39.4402
I slices					
1 i	890.4000	42.0057	44.2058	46.3845	42.8259
P slices					
0 p	-nan	-nan	-nan	-nan	-nan
B slices					
299 b	124.5175	38.9213	42.5370	43.4618	39.4323

α2) για targetBitRate = **75 * AM** = 75 * 2553 = 191475

Summary

Total Frames	Bitrate	Y-PSNR	U-PSNR	V-PSNR	YUV-PSNR
300 a	191.3224	41.1852	43.9862	45.0432	41.6154
I slices					
1 i	991.2000	42.8915	44.7410	46.9347	43.6424
P slices					
0 p	-nan	-nan	-nan	-nan	-nan
B slices					
299 b	188.6472	41.1795	43.9837	45.0369	41.6099

α3) για targetBitRate = **100 * AM** = 100 * 2553 = 255300

Summary

Total Frames	Bitrate	Y-PSNR	U-PSNR	V-PSNR	YUV-PSNR
300 a	254.1232	42.6992	45.0025	46.1264	43.1095
I slices					
1 i	1097.5200	43.6585	45.5194	47.7160	44.4119
P slices					
0 p	-nan	-nan	-nan	-nan	-nan
B slices					
299 b	251.3025	42.6960	45.0007	46.1211	43.1058

α4) για targetBitRate = **125 * AM** = 125 * 2553 = 319125

Summary

Total Frames	Bitrate	Y-PSNR	U-PSNR	V-PSNR	YUV-PSNR
300 a	316.9896	43.8751	45.7838	46.9636	44.2513
I slices					
1 i	1201.4400	44.4414	46.1066	48.2878	45.1524
P slices					
0 p	-nan	-nan	-nan	-nan	-nan
B slices					
299 b	314.0316	43.8732	45.7827	46.9592	44.2486

ΒΗΜΑ 9

Β) Για το **encoder_randomaccess_main.cfg**

β1) για targetBitRate = **50 * AM** = 50 * 2553 = 127650

Summary

Total Frames	Bitrate	Y-PSNR	U-PSNR	V-PSNR	YUV-PSNR
300 a	128.7440	39.1673	43.2060	44.1937	39.7776
I slices					
10 i	1129.9200	42.0428	44.2056	45.4181	42.4825
P slices					
0 p	-nan	-nan	-nan	-nan	-nan
B slices					
290 b	94.2207	39.0681	43.1715	44.1515	39.7088

β2) για targetBitRate = **75 * AM** = 75 * 2553 = 191475

Summary

Total Frames	Bitrate	Y-PSNR	U-PSNR	V-PSNR	YUV-PSNR
300 a	192.5784	41.3711	44.5490	45.6135	41.9521
I slices					
10 i	1336.2240	43.5993	45.2790	46.6357	43.9548
P slices					
0 p	-nan	-nan	-nan	-nan	-nan
B slices					
290 b	153.1423	41.2943	44.5238	45.5783	41.8971

β3) για targetBitRate = **100 * AM** = 100 * 2553 = 255300

Summary

Total Frames	Bitrate	Y-PSNR	U-PSNR	V-PSNR	YUV-PSNR
300 a	256.4472	42.9638	45.5858	46.6845	43.4781
I slices					
10 i	1497.5520	44.7036	46.0954	47.3551	44.9846
P slices					
0 p	-nan	-nan	-nan	-nan	-nan
B slices					
290 b	213.6505	42.9038	45.5682	46.6614	43.4344

β4) για targetBitRate = **125 * AM** = 125 * 2553 = 319125

Summary

Total Frames	Bitrate	Y-PSNR	U-PSNR	V-PSNR	YUV-PSNR
300 a	320.3928	44.2242	46.5324	47.5940	44.6906
I slices					
10 i	1638.6480	45.6553	46.7624	48.0245	45.8953
P slices					
0 p	-nan	-nan	-nan	-nan	-nan
B slices					
290 b	274.9357	44.1748	46.5245	47.5792	44.6545

ΒΗΜΑ 10

Έχουμε τα ακόλουθα διανύσματα,

R_h264_PP = [1277480, 1914464, 2551888, 3190584];
R_h264_BP = [1273472, 1913016, 2552912, 3189560];
R_h265_low = [1270704, 1913224, 2541232, 3169896];
R_h265_rand = [1287440, 1925784, 2564472, 3203928];

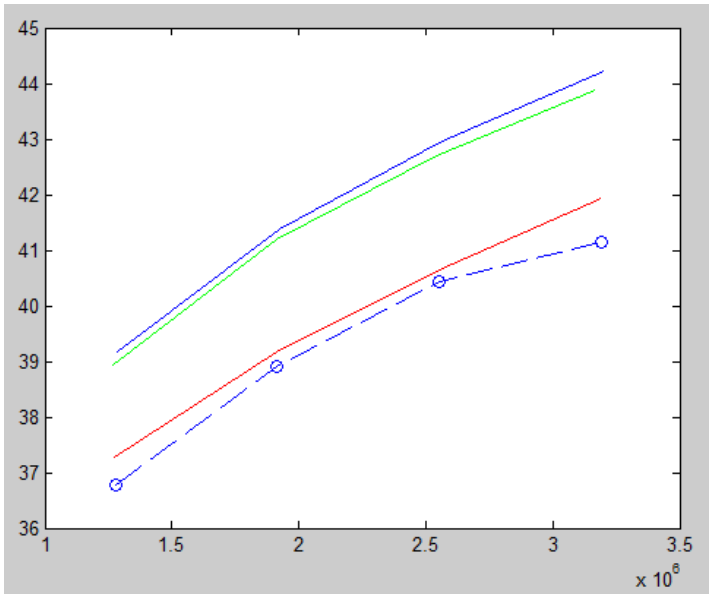
PSNR_h264_PP = [36.773, 38.895, 40.427, 41.137];
PSNR_h264_BP = [37.284, 39.173, 40.643, 41.941];
PSNR_h265_low = [38.9316, 41.1852, 42.6992, 43.8751];
PSNR_h265_rand = [39.1673, 41.3711, 42.9638, 44.2242];

Καλώντας την συνάρτηση **bjontegaard2.m** έχουμε τα ακόλουθα αποτελέσματα,

Είσοδος της συνάρτησης bjontegaard2.m	**BD – PSNR**	**BD - RATE**
[R_h264_PP, PSNR_h264_PP , R_h264_BP, PSNR_h264_BP]	0.375528037164975	-6.920059268097978
[R_h264_PP, PSNR_h264_PP , R_h265_low, PSNR_h265_low]	2.337307392209632	-34.790598252835366
[R_h264_PP, PSNR_h264_PP , R_h265_rand, PSNR_h265_rand]	2.522800756874744	-36.579494876603171

<u>Συμπεράσματα</u>

Κάνοντας μία γραφική παράσταση με τα αποτελέσματα από τον παραπάνω πίνακα βλέπουμε το ακόλουθο γράφημα(οριζόντιος άξονας = Rate, κατακόρυφος άξονας = PSNR),



Η αντιστοίχιση των χρωμάτων του γραφήματος με τις 4 κωδικοποιήσεις είναι η ακόλουθη,

- H.264.PP -> μπλέ – ο
- H.264.BP -> κόκκινο
- H.265.lowdelay -> πράσινο
- H.265.randomaccess -> μπλέ

Άρα, αυτοί οι τέσσερις τρόποι συμπίεσης διατάσσονται κατά αύξουσα σειρά με βάση την αποδοτικότητα συμπίεσης ως εξής,

αύξουσα σειρά αποδοτικότητας συμπίεσης ↓

(χειρότερη συμπίεση)
H.264.PP
H.264.BP
H.265.lowdelay
H.265.randomaccess
(καλύτερη συμπίεση)