

Kwantyzacja i próbkowanie dźwięku oraz re-sampling

Wojciech Latos

Podsumowanie cz. 1

Na podstawie poniższych wykresów można zauważyć, że najbardziej obiecującymi parametrami, które moim zdaniem mają największe szanse na dalszą lepszą kompresję w drugiej części zadania są :

Subsampling (ex aequo): 4:2:0, 4:1:1 oraz 4:1:0

Sądzę, że 4:1:0 jest najbardziej obiecującym wyborem pod względem przyszłej kolejnej kompresji, ponieważ jest to najmocniejsza kompresja chrominancji. Z zasady działania subsamplingu sądzę, że będzie to najlepszy wybór.

Dzielnik oraz licznik klatek kluczowych w owym teście nie wskazywał żadnych wpływów na jakość kompresji.

Gdybyśmy potrzebowali tak zwanej pixel-perfect jakości wideo, w dużym stopniu nie zwracając uwagi na rozmiar skompresowanego pliku, wybrałbym opcje 4:2:2 bądź 4:4:0. Opcja 4:4:4 nie dokonuje kompresji. Wykres jest linią prostą o zerowej wartości.

Podsumowanie cz. 2

Mając do dyspozycji tylko poniższe wykresy z drugiej części badania wysnuwam wniosek, że najlepszą odległością pomiędzy klatkami kluczowymi okazała się liczba 2.

W przypadku warstw G oraz B stopień kompresji oscylował w okolicach wartości 90-95%, natomiast w przypadku warstwy R wartość ta wynosiła prawie 65% do 85%.

Spadki kompresji na wykresach zbiegają się z momentami, w których została ustalona nowa klatka kluczowa.

Mając jako kryterium tylko rozmiar skompresowanego pliku, moglibyśmy w celach wyłonienia najlepszej metody obliczyć pole pod krzywą. Im większe pole, tym kompresja okazałaby się lepszą.

Bazując na poniższych wykresach oraz przedstawionej metodzie oceny można byłoby wybrać odległość między klatkami kluczowymi na poziomie 12 klatek.

Jednakże teraz wchodzi sprawa jakości samego obrazu po dekompresji. W przypadku 12 klatek kluczowych jakość wideo jest znacznie gorsza niż w przypadku 2 klatek kluczowych.

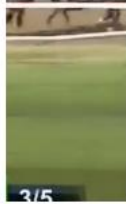
Uważam, że optymalnym rozwiązaniem jest wybranie odległości co 3 klatki dla wideo o długości 15 klatek.

Dodatkowo można zauważyć, że kanały G i B (zielony i niebieski), które są bezpośrednio związane z luminancją w modelu YCbCr, osiągają wysokie wartości kompresji na poziomie około 90-95%. To sugeruje, że te dane dobrze się je kompresuje strumieniowo

Badanie cz. 1 - bez RLE

Subsampling: 4:4:4, Divisor: 1, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B

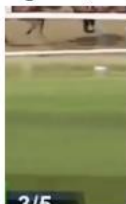


Delta B



Subsampling: 4:4:4, Divisor: 1, KeyFrame counter: 3, Frame: 11

Original (ROI)



Original R



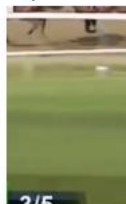
Original G



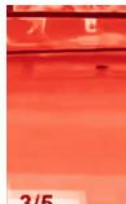
Original B



Decompressed (ROI)



Decompressed R



Decompressed G



Decompressed B



Delta R



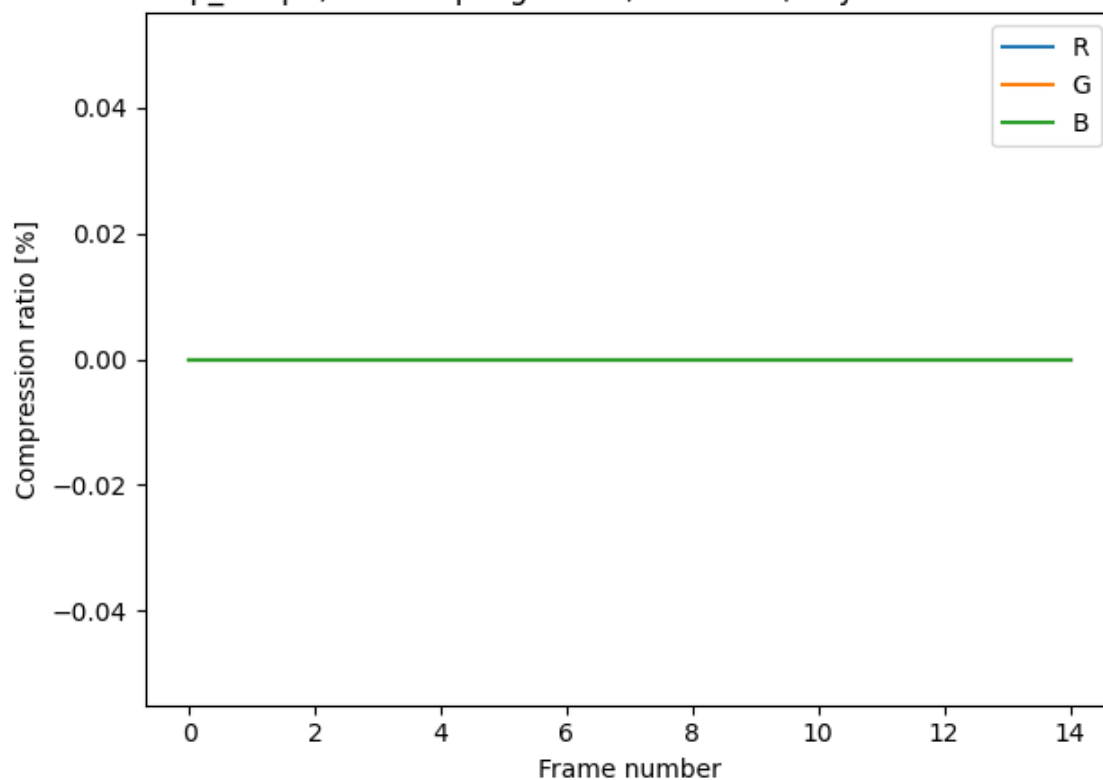
Delta G



Delta B

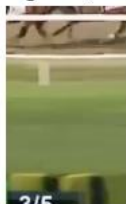


clip_4.mp4, subsampling: 4:4:4, divisor: 1, KeyFrame counter:3

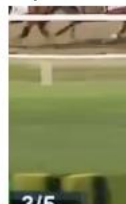


Subsampling: 4:4:4, Divisor: 2, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B

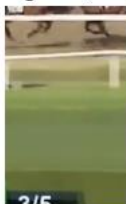


Delta B



Subsampling: 4:4:4, Divisor: 2, KeyFrame counter: 3, Frame: 11

Original (ROI)



Original R



Original G



Original B



Decompressed (ROI)



Decompressed R



Decompressed G



Decompressed B



Delta R



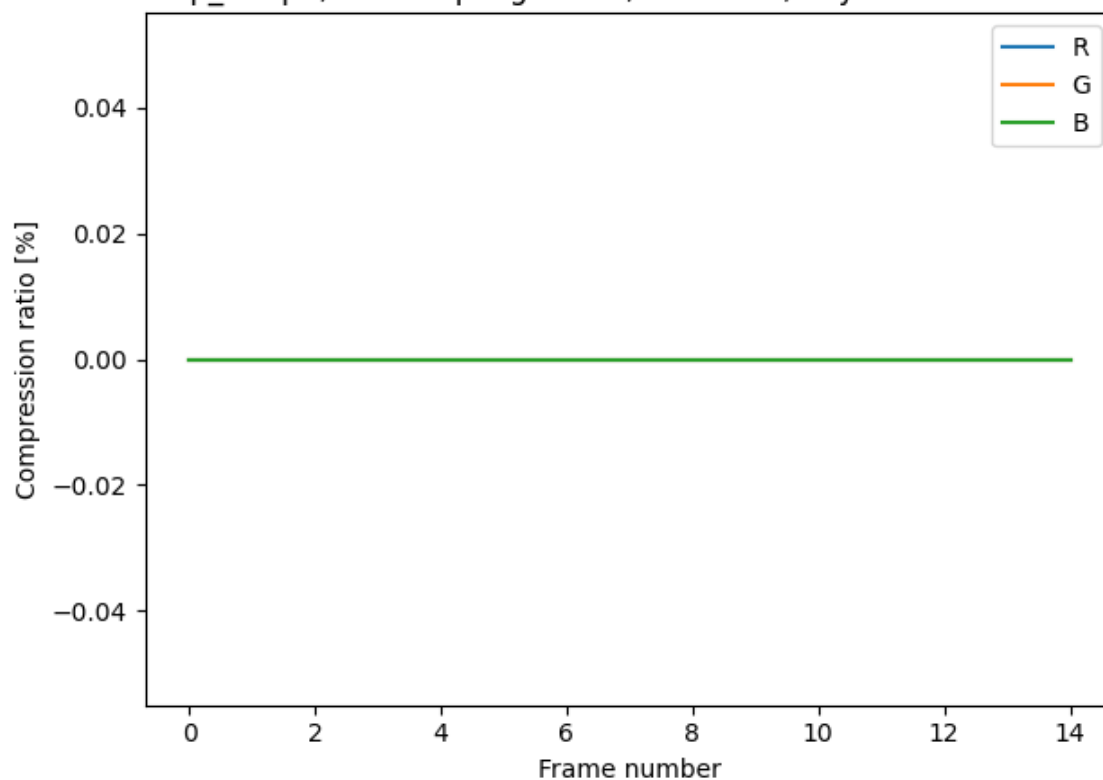
Delta G



Delta B

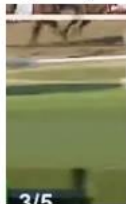


clip_4.mp4, subsampling: 4:4:4, divisor: 2, KeyFrame counter:3

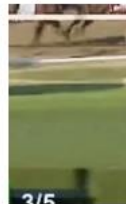


Subsampling: 4:4:4, Divisor: 4, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:4:4, Divisor: 4, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



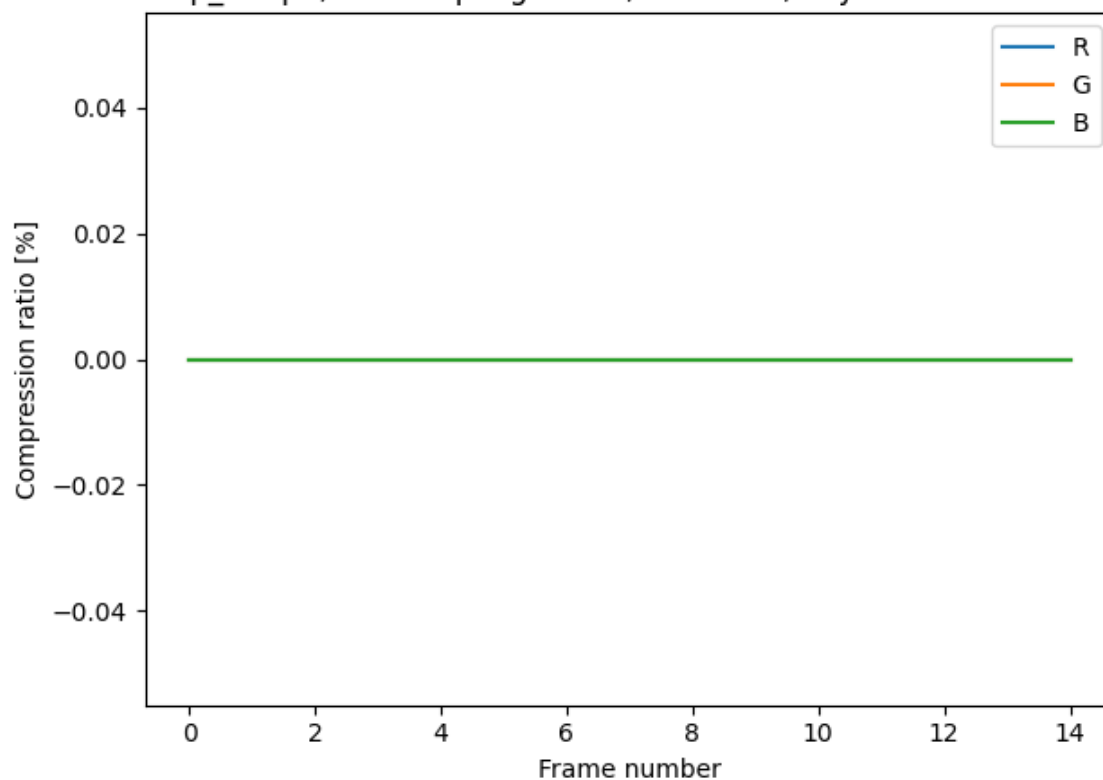
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:4:4, divisor: 4, KeyFrame counter:3



Subsampling: 4:4:4, Divisor: 8, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B

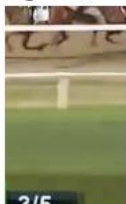


Delta B



Subsampling: 4:4:4, Divisor: 8, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



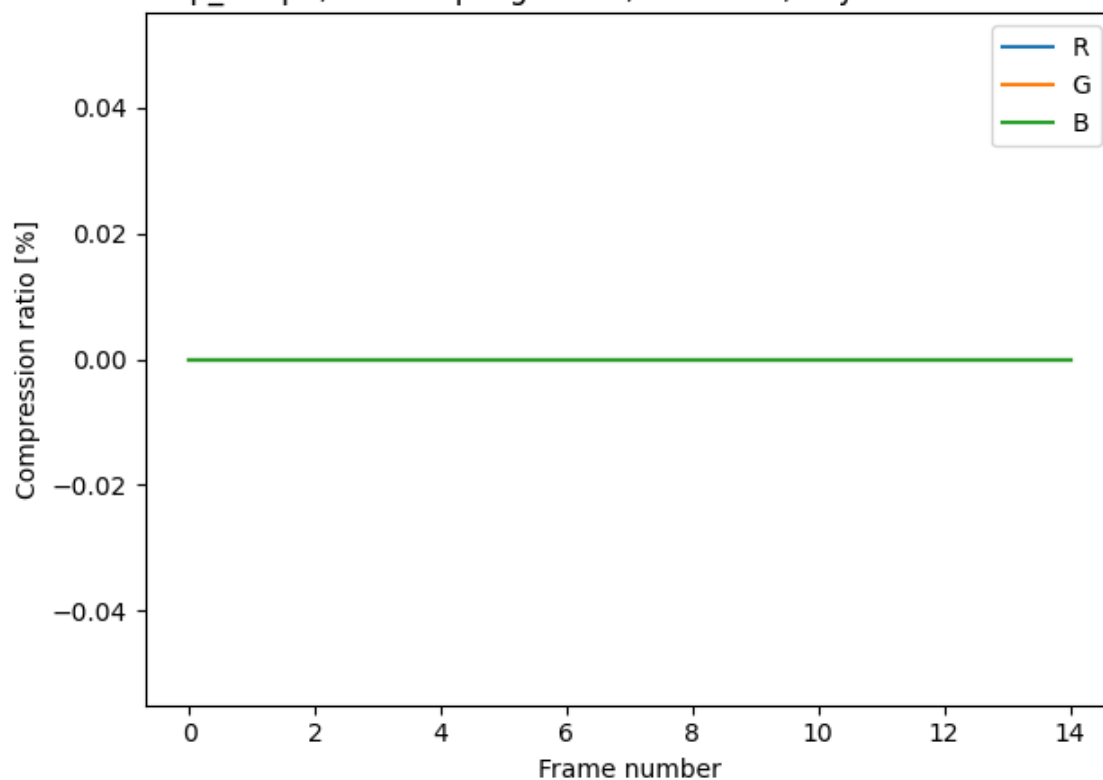
Decompressed B



Delta B

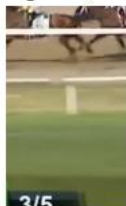


clip_4.mp4, subsampling: 4:4:4, divisor: 8, KeyFrame counter:3

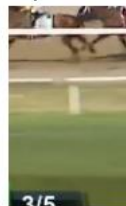


Subsampling: 4:2:2, Divisor: 1, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B

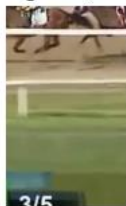


Delta B

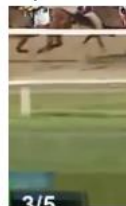


Subsampling: 4:2:2, Divisor: 1, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



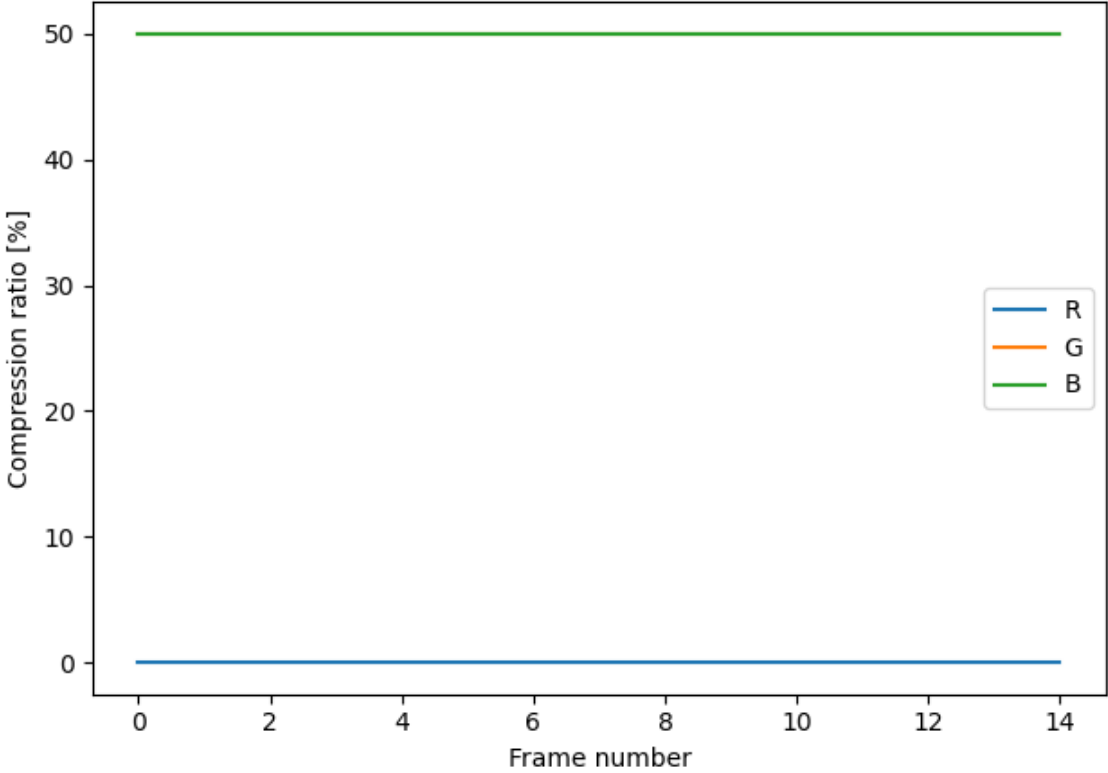
Decompressed B



Delta B

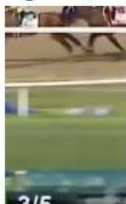


clip_4.mp4, subsampling: 4:2:2, divisor: 1, KeyFrame counter:3



Subsampling: 4:2:2, Divisor: 2, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B

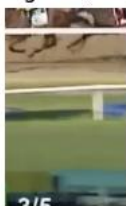


Delta B



Subsampling: 4:2:2, Divisor: 2, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



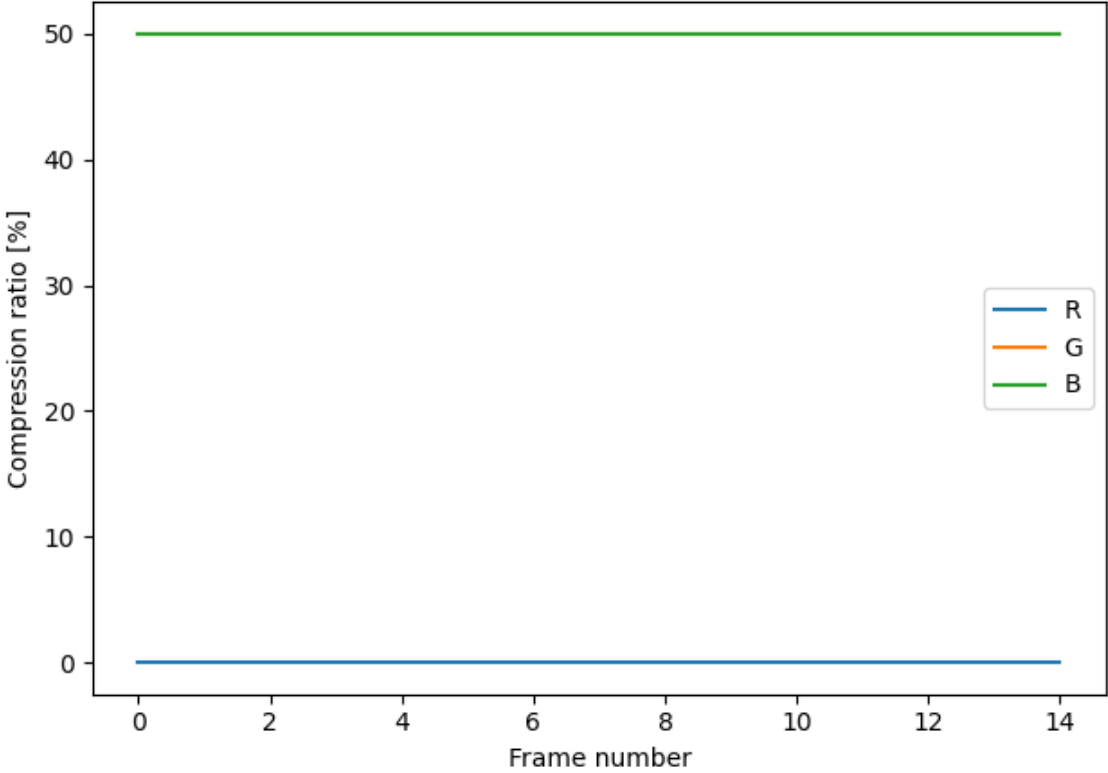
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:2:2, divisor: 2, KeyFrame counter:3



Subsampling: 4:2:2, Divisor: 4, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B

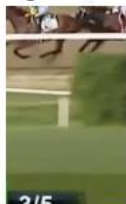


Delta B

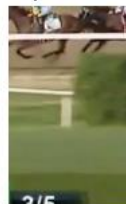


Subsampling: 4:2:2, Divisor: 4, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



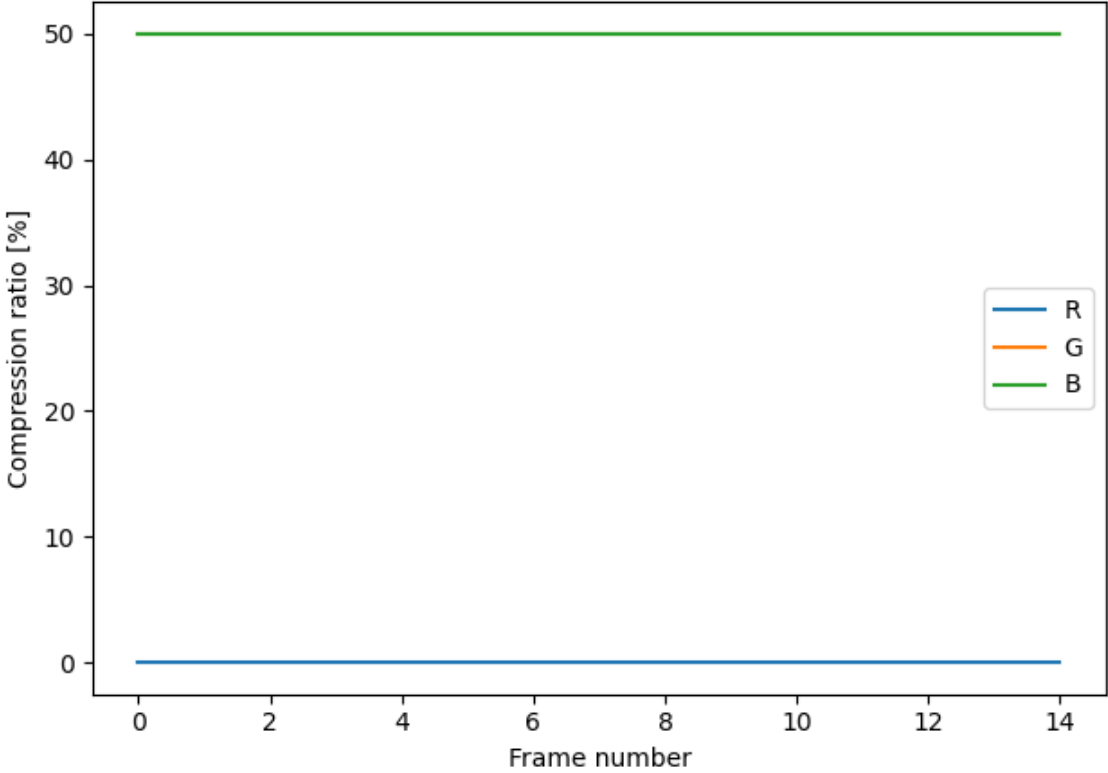
Decompressed B



Delta B

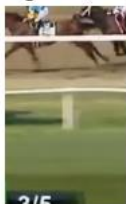


clip_4.mp4, subsampling: 4:2:2, divisor: 4, KeyFrame counter:3

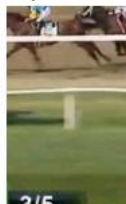


Subsampling: 4:2:2, Divisor: 8, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B

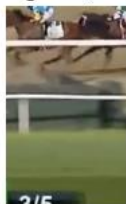


Delta B

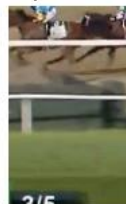


Subsampling: 4:2:2, Divisor: 8, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



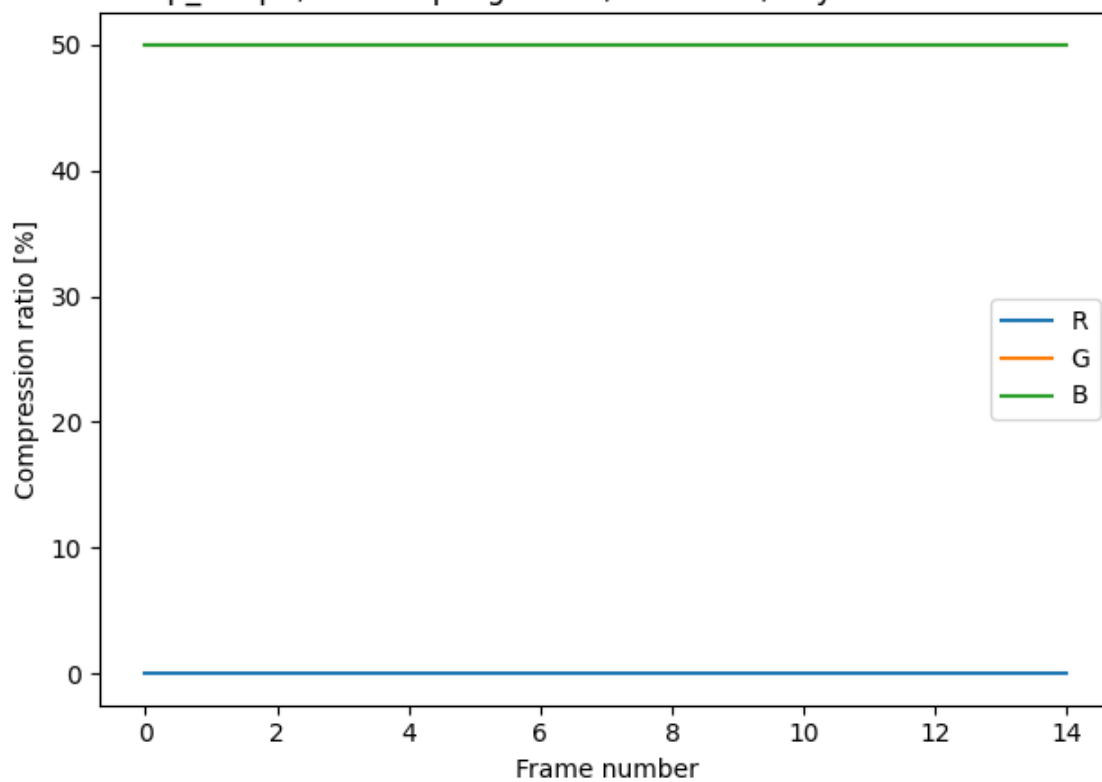
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:2:2, divisor: 8, KeyFrame counter:3



Subsampling: 4:4:0, Divisor: 1, KeyFrame counter: 3, Frame: 2

Original (ROI)



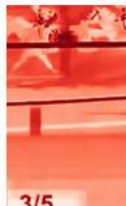
Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:4:0, Divisor: 1, KeyFrame counter: 3, Frame: 11

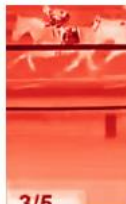
Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



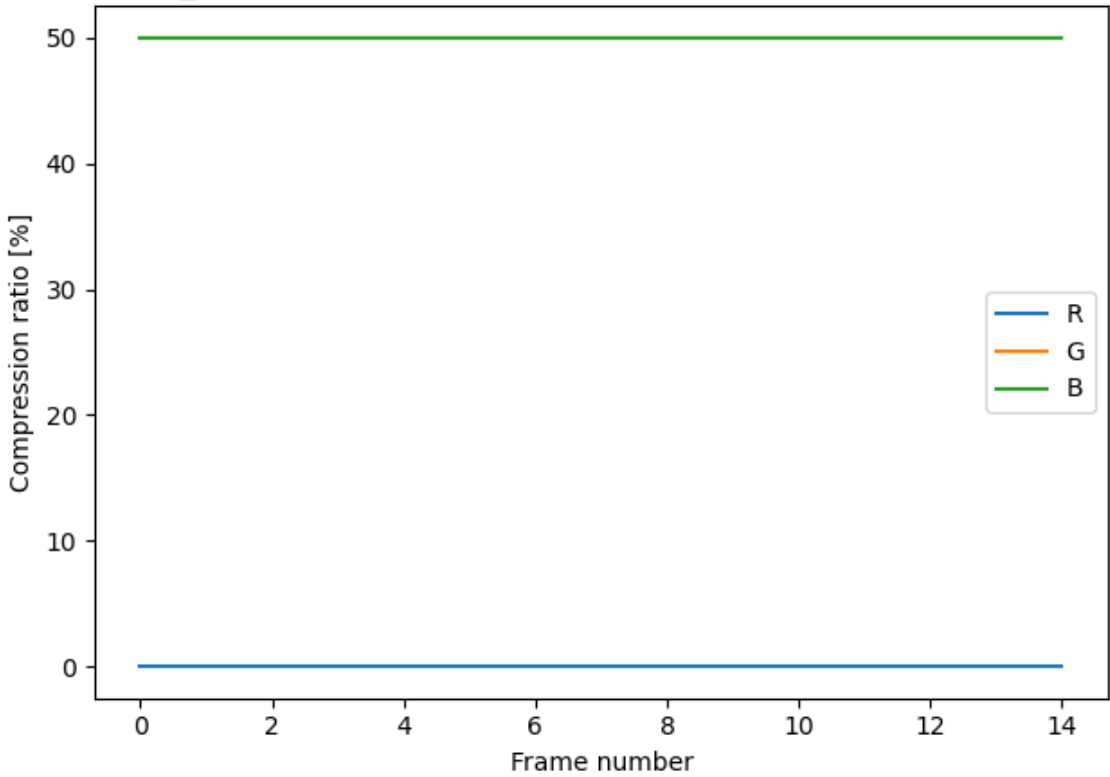
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:4:0, divisor: 1, KeyFrame counter:3

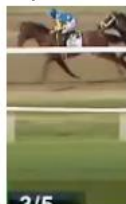


Subsampling: 4:4:0, Divisor: 2, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:4:0, Divisor: 2, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



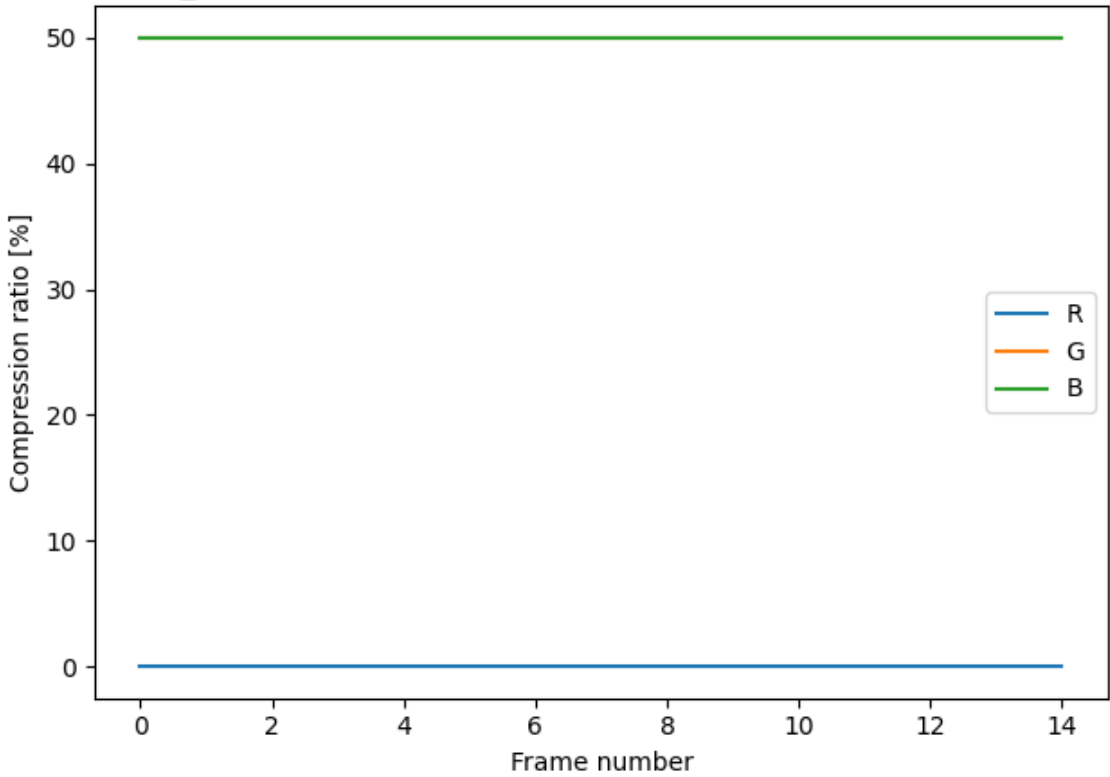
Decompressed B



Delta B

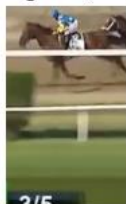


clip_4.mp4, subsampling: 4:4:0, divisor: 2, KeyFrame counter:3



Subsampling: 4:4:0, Divisor: 4, KeyFrame counter: 3, Frame: 2

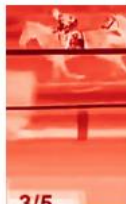
Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:4:0, Divisor: 4, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



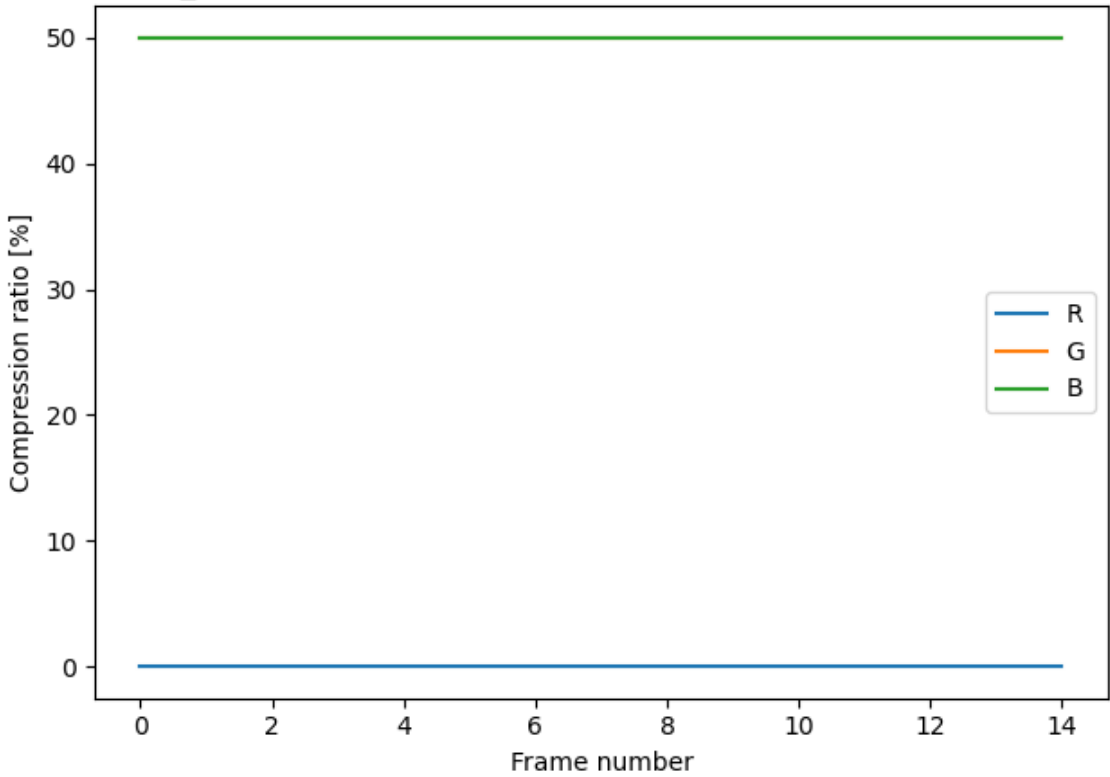
Decompressed B



Delta B

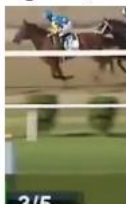


clip_4.mp4, subsampling: 4:4:0, divisor: 4, KeyFrame counter:3

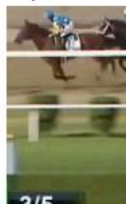


Subsampling: 4:4:0, Divisor: 8, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:4:0, Divisor: 8, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



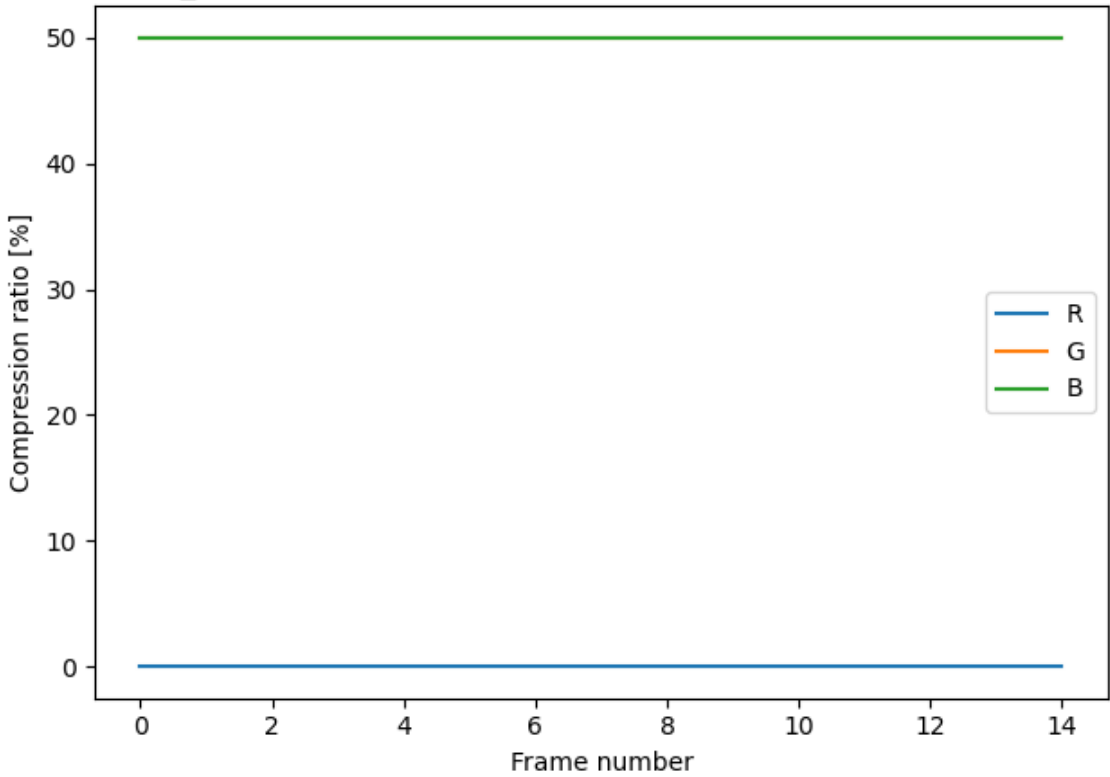
Decompressed B



Delta B

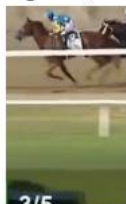


clip_4.mp4, subsampling: 4:4:0, divisor: 8, KeyFrame counter:3



Subsampling: 4:2:0, Divisor: 1, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B

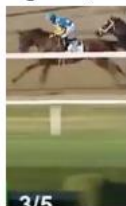


Delta B



Subsampling: 4:2:0, Divisor: 1, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



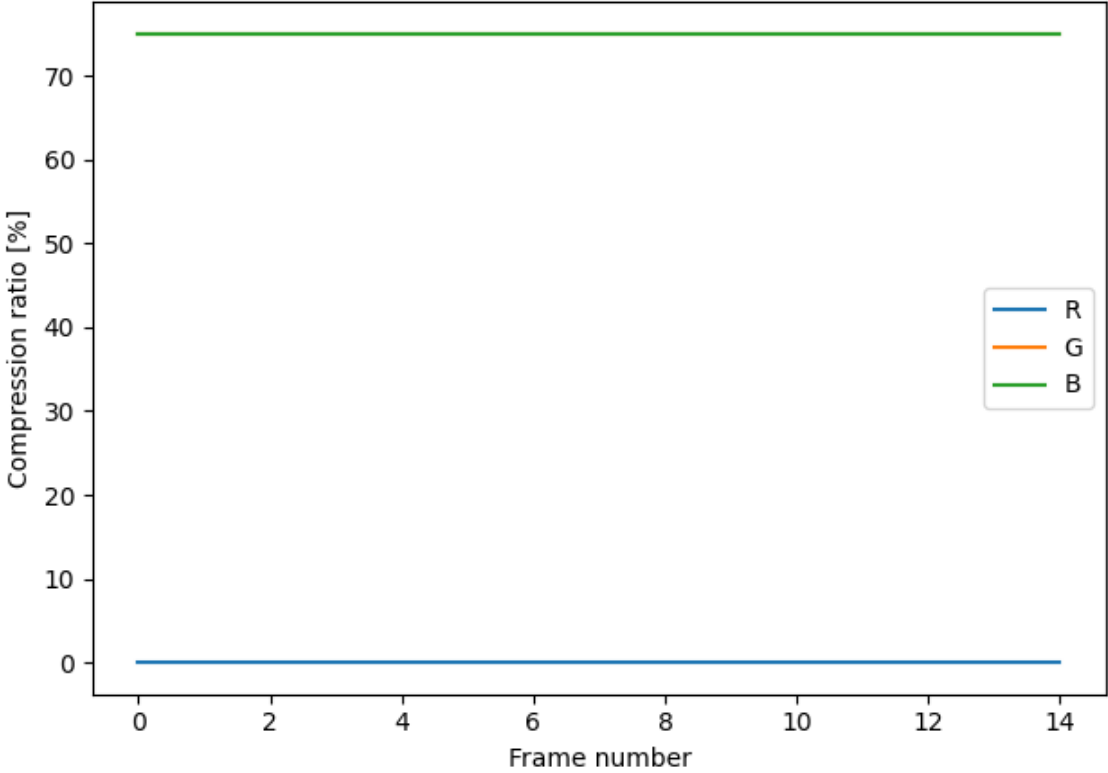
Decompressed B



Delta B

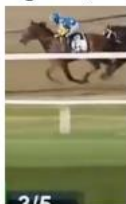


clip_4.mp4, subsampling: 4:2:0, divisor: 1, KeyFrame counter:3

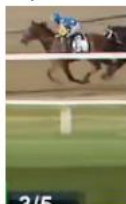


Subsampling: 4:2:0, Divisor: 2, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:2:0, Divisor: 2, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



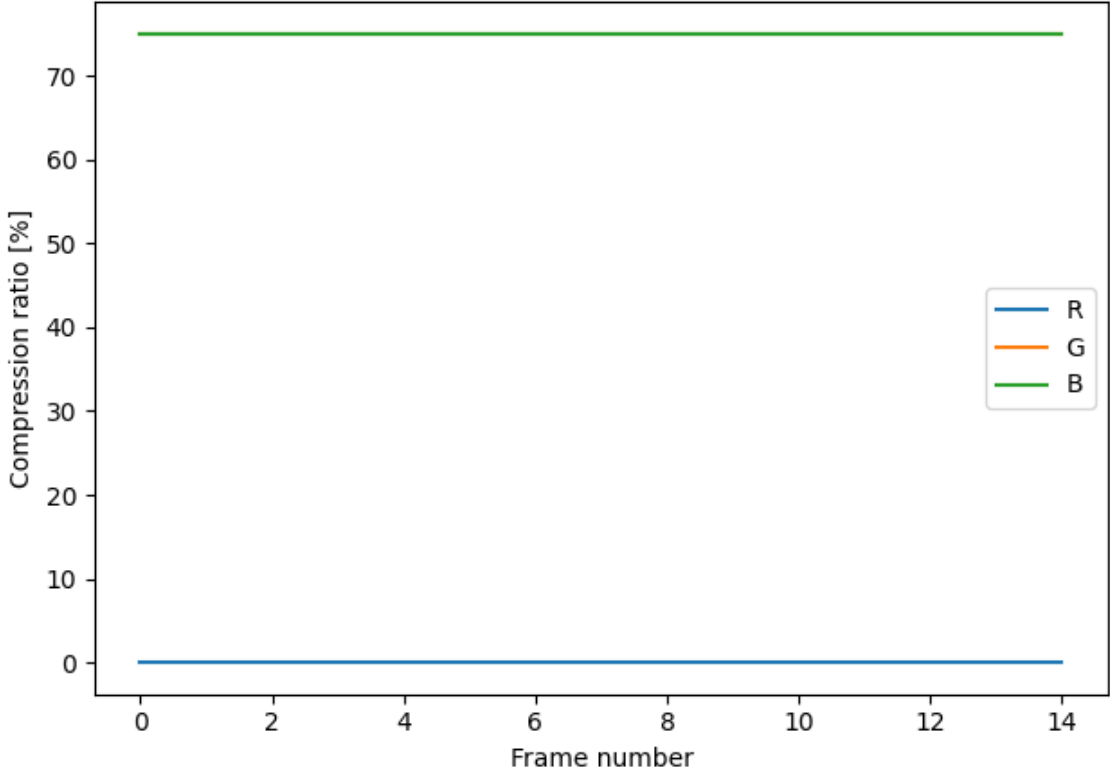
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:2:0, divisor: 2, KeyFrame counter:3



Subsampling: 4:2:0, Divisor: 4, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:2:0, Divisor: 4, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



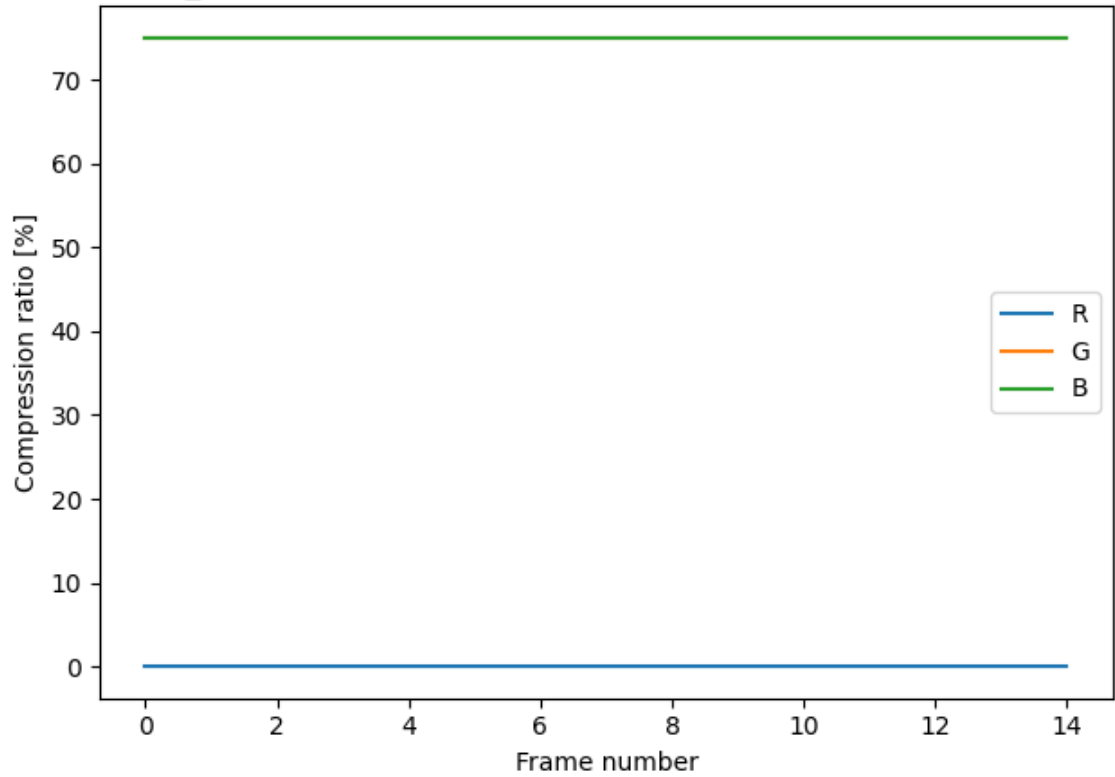
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:2:0, divisor: 4, KeyFrame counter:3



Subsampling: 4:2:0, Divisor: 8, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B

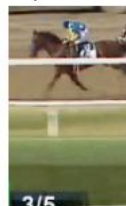


Subsampling: 4:2:0, Divisor: 8, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



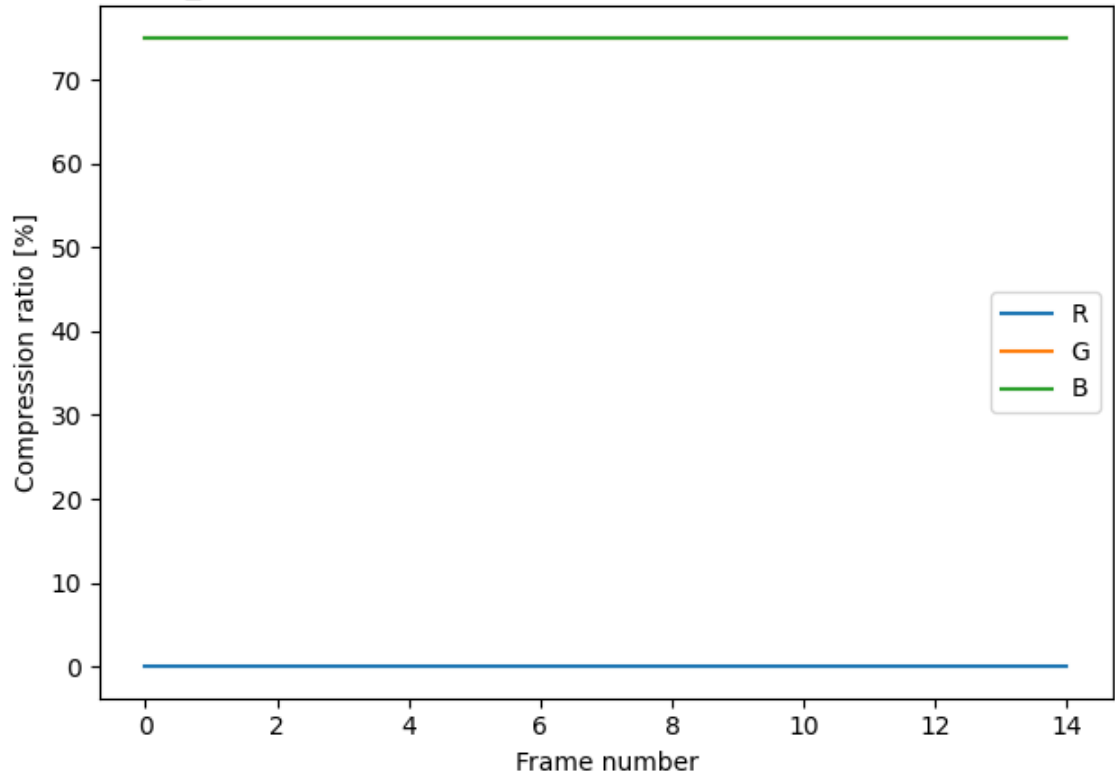
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:2:0, divisor: 8, KeyFrame counter:3



Subsampling: 4:1:1, Divisor: 1, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:1:1, Divisor: 1, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



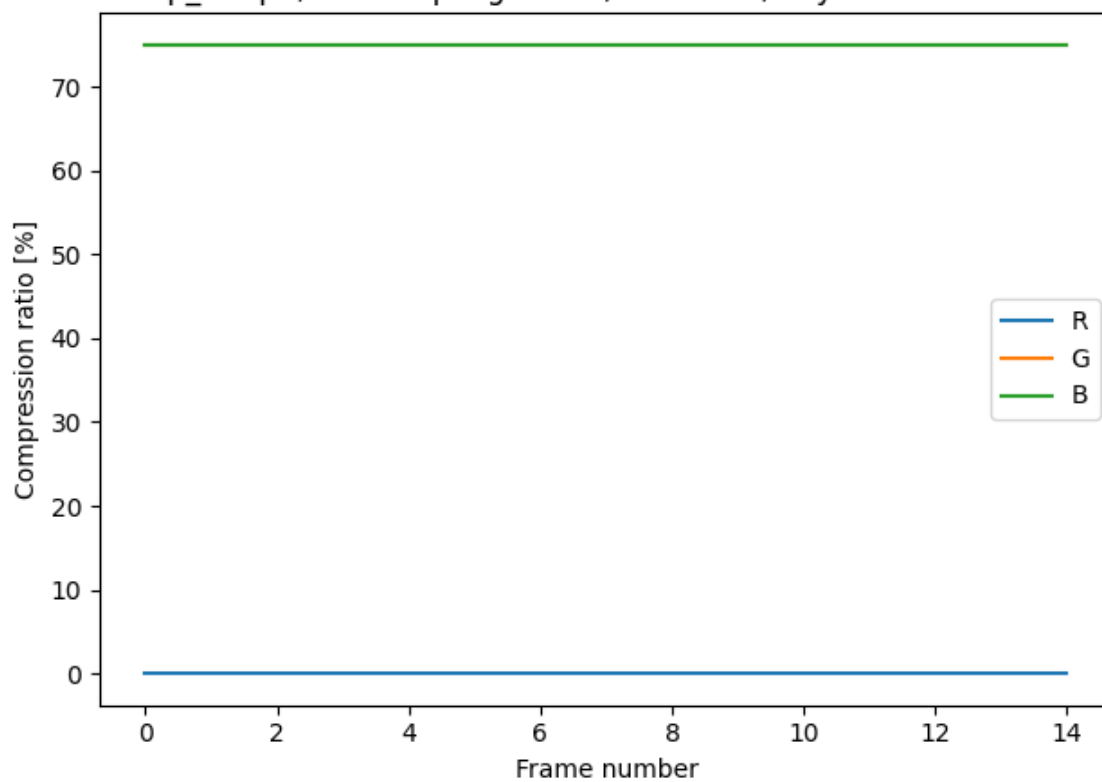
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:1:1, divisor: 1, KeyFrame counter:3



Subsampling: 4:1:1, Divisor: 2, KeyFrame counter: 3, Frame: 2

Original (ROI)



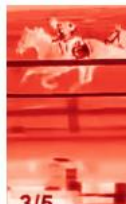
Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:1:1, Divisor: 2, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



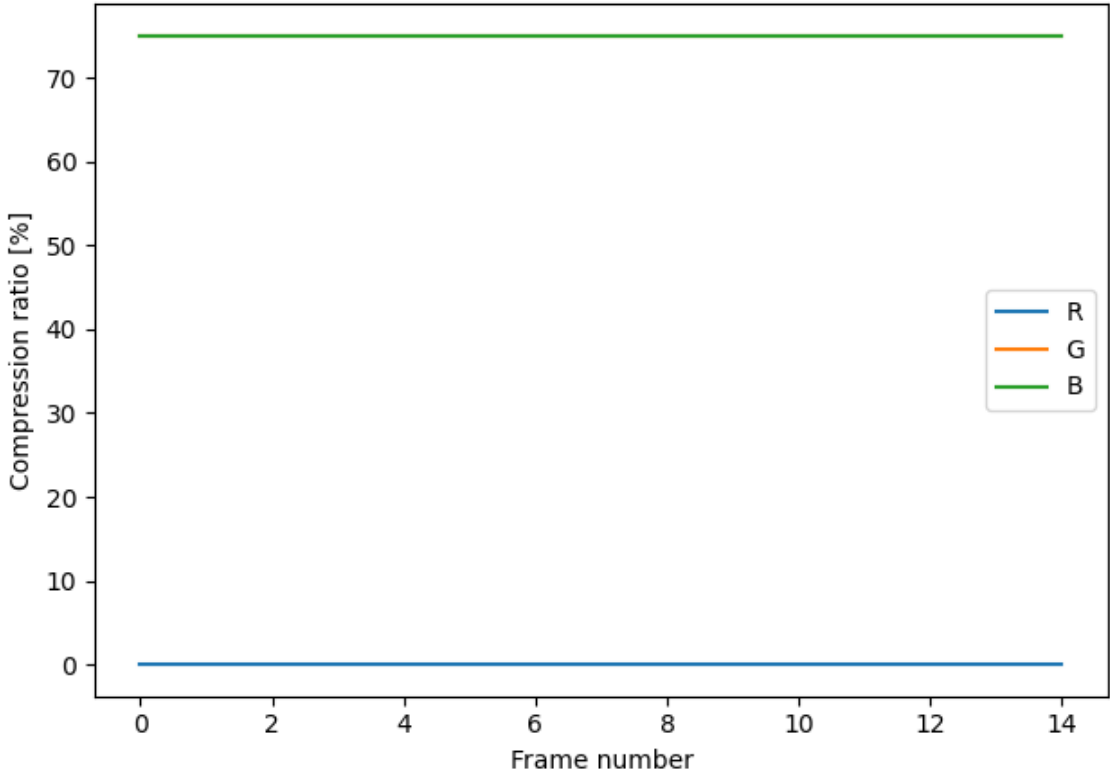
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:1:1, divisor: 2, KeyFrame counter:3



Subsampling: 4:1:1, Divisor: 4, KeyFrame counter: 3, Frame: 2

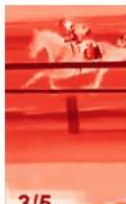
Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B

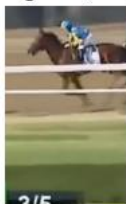


Delta B

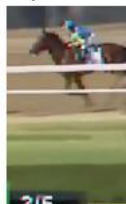


Subsampling: 4:1:1, Divisor: 4, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



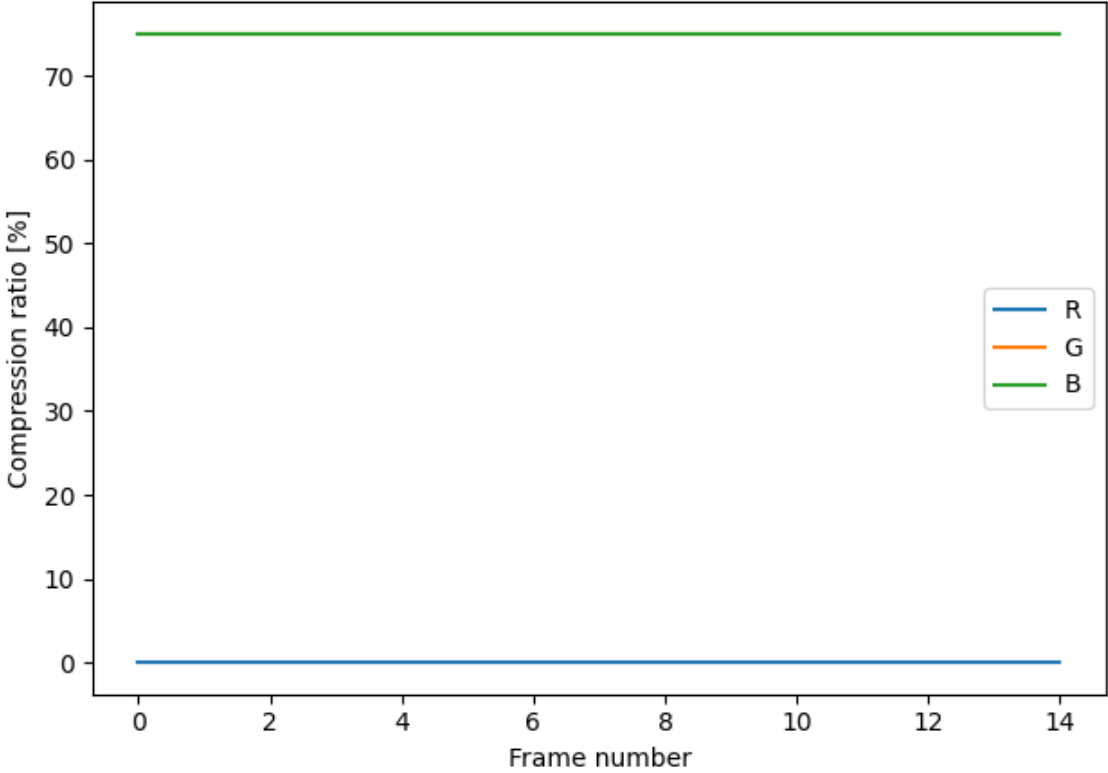
Decompressed B



Delta B

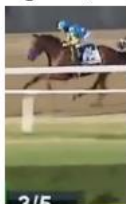


clip_4.mp4, subsampling: 4:1:1, divisor: 4, KeyFrame counter:3

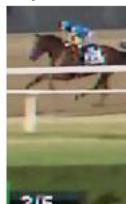


Subsampling: 4:1:1, Divisor: 8, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:1:1, Divisor: 8, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



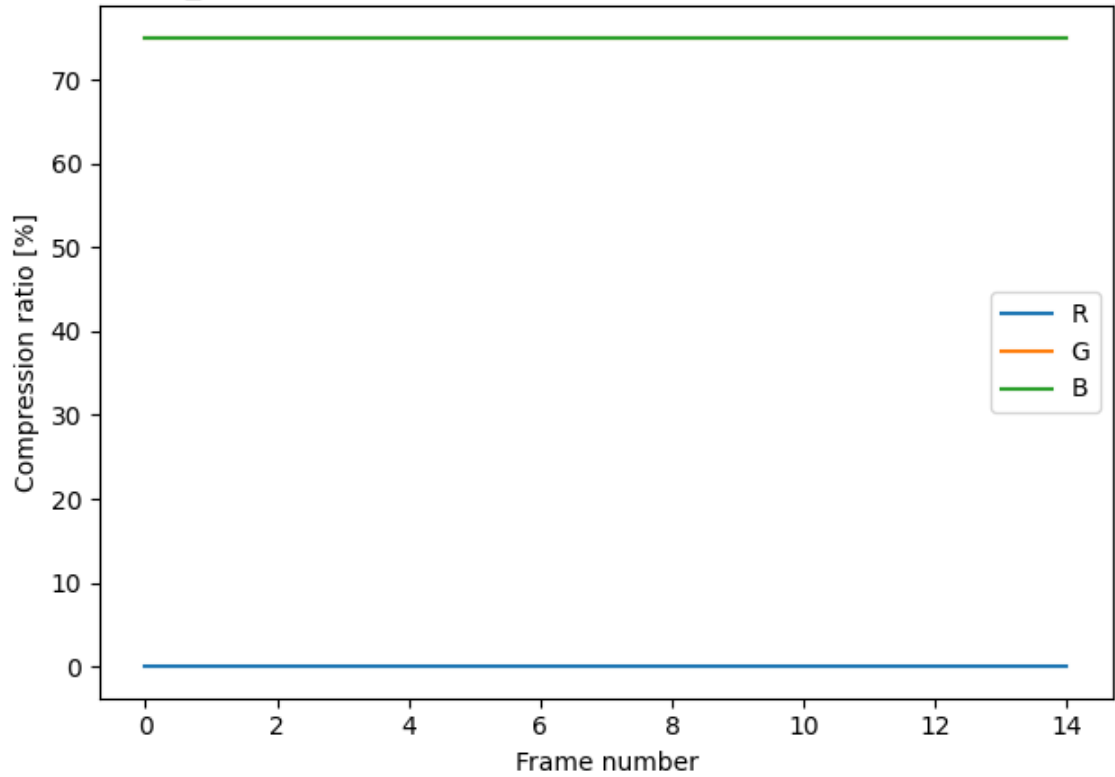
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:1:1, divisor: 8, KeyFrame counter:3



Subsampling: 4:1:0, Divisor: 1, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:1:0, Divisor: 1, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



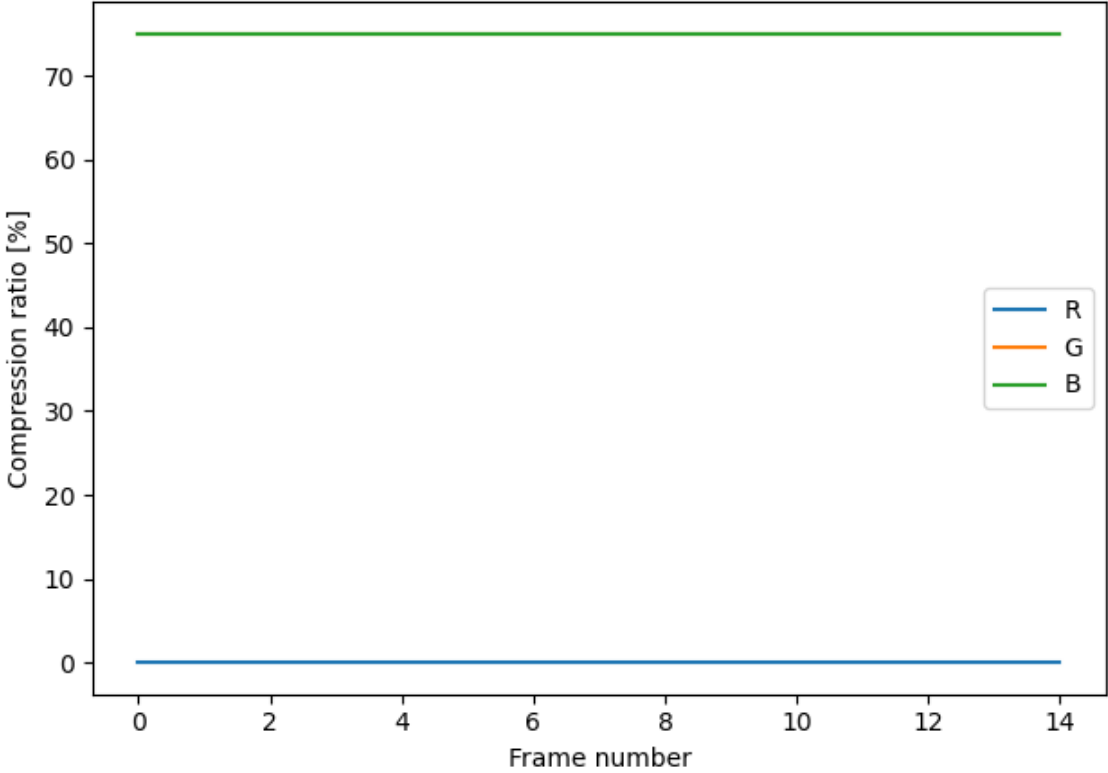
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:1:0, divisor: 1, KeyFrame counter:3



Subsampling: 4:1:0, Divisor: 2, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



Decompressed B



Delta B



Subsampling: 4:1:0, Divisor: 2, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



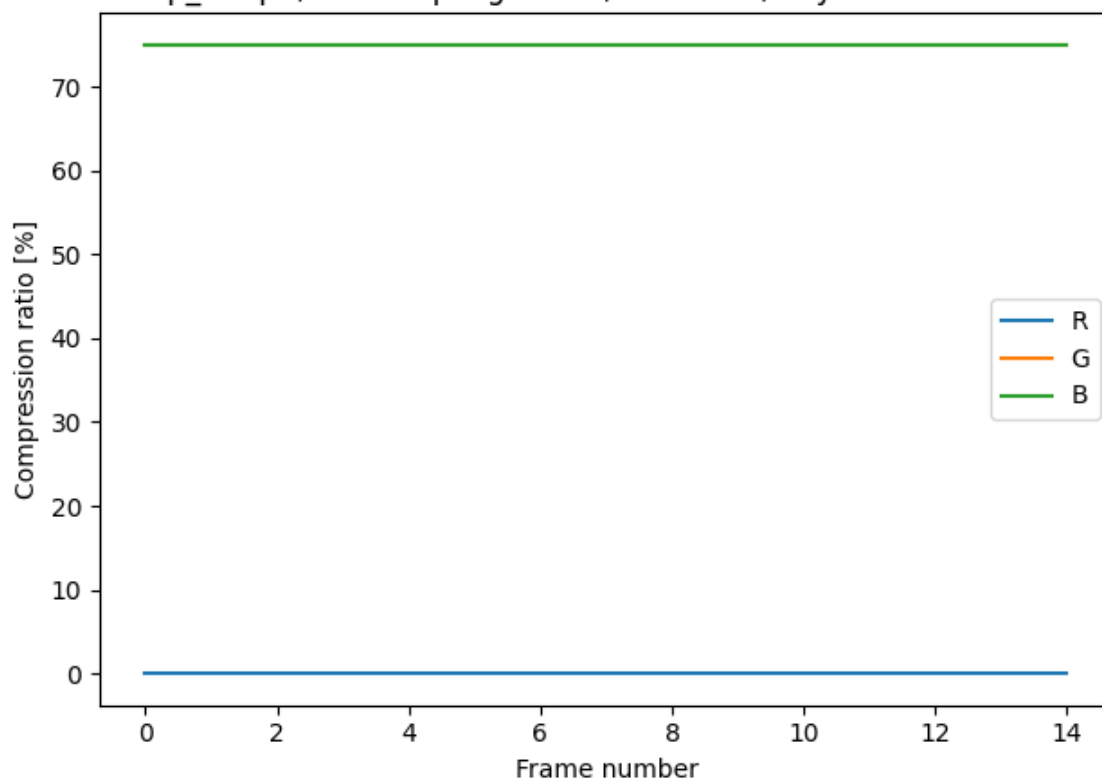
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:1:0, divisor: 2, KeyFrame counter:3



Subsampling: 4:1:0, Divisor: 4, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



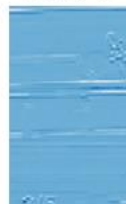
Original B



Decompressed B



Delta B



Subsampling: 4:1:0, Divisor: 4, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



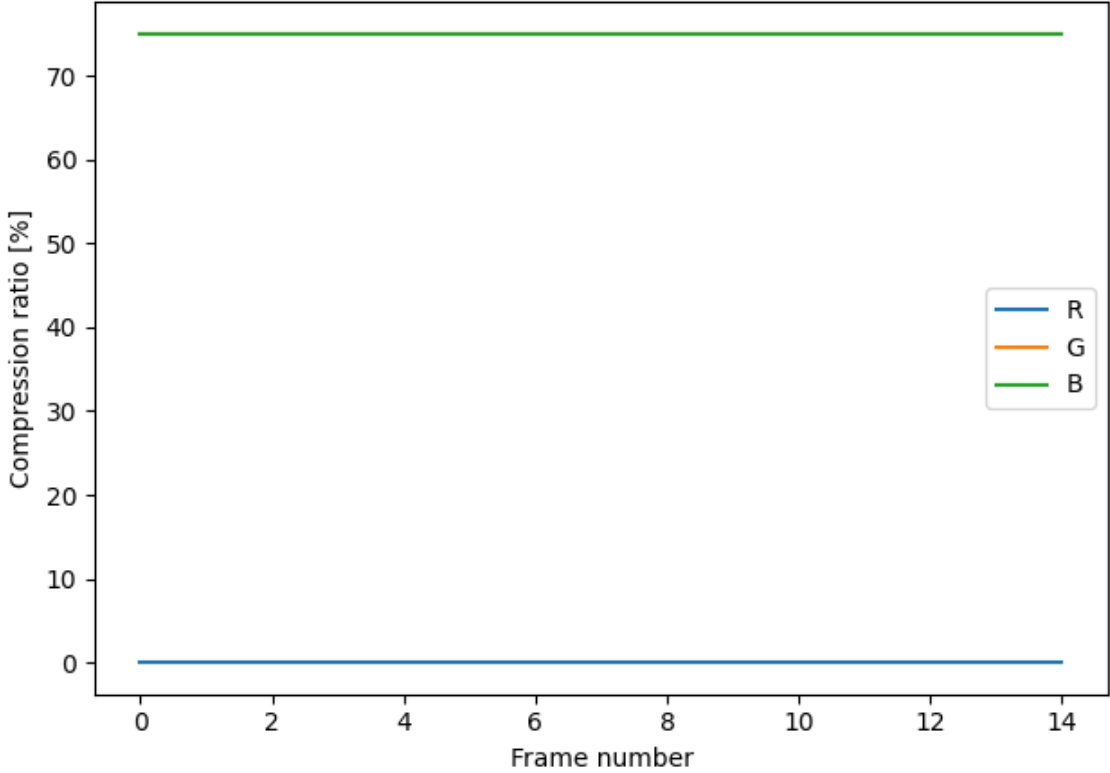
Decompressed B



Delta B



clip_4.mp4, subsampling: 4:1:0, divisor: 4, KeyFrame counter:3



Subsampling: 4:1:0, Divisor: 8, KeyFrame counter: 3, Frame: 2

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



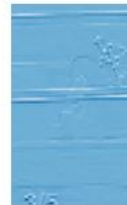
Original B



Decompressed B



Delta B



Subsampling: 4:1:0, Divisor: 8, KeyFrame counter: 3, Frame: 11

Original (ROI)



Decompressed (ROI)



Original R



Decompressed R



Delta R



Original G



Decompressed G



Delta G



Original B



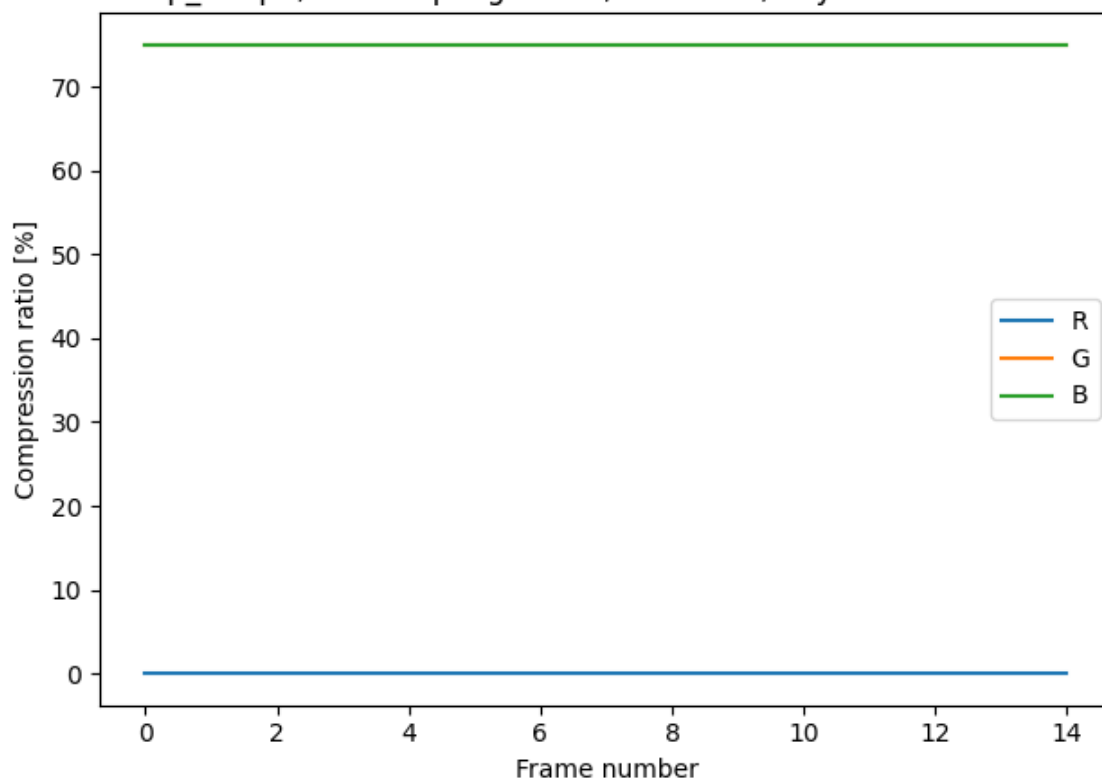
Decompressed B



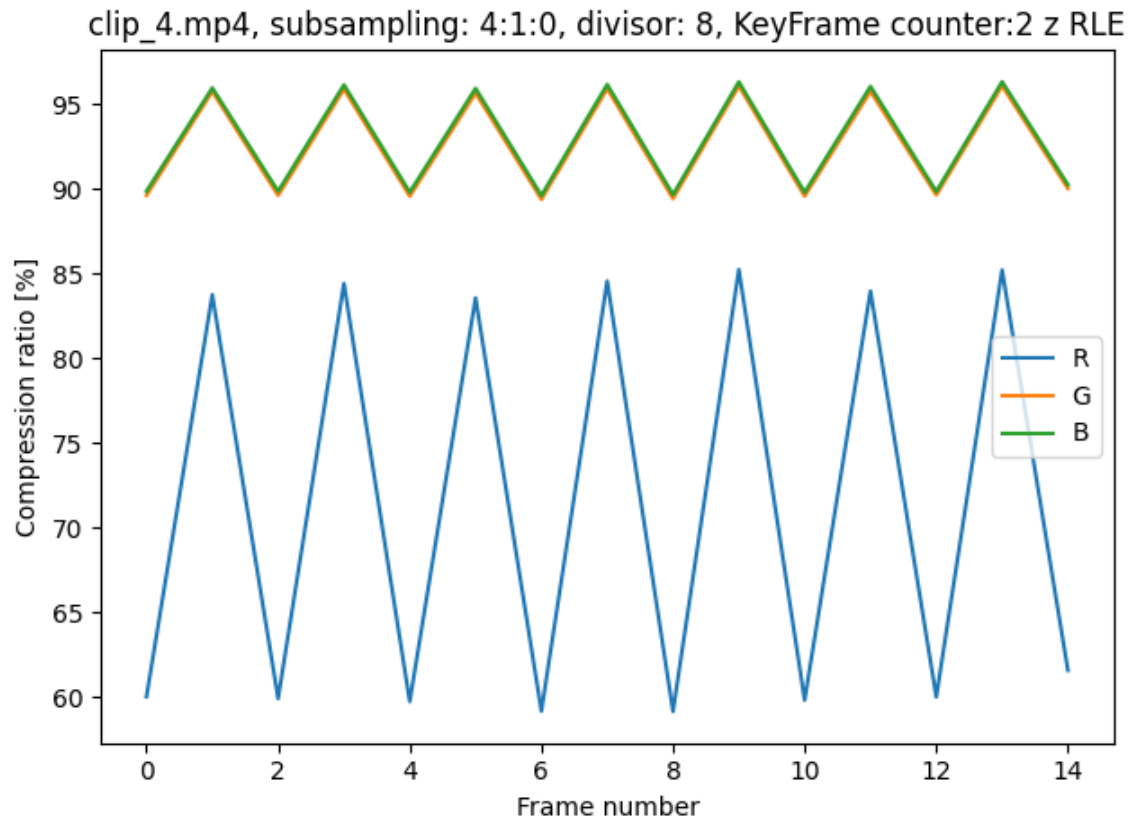
Delta B



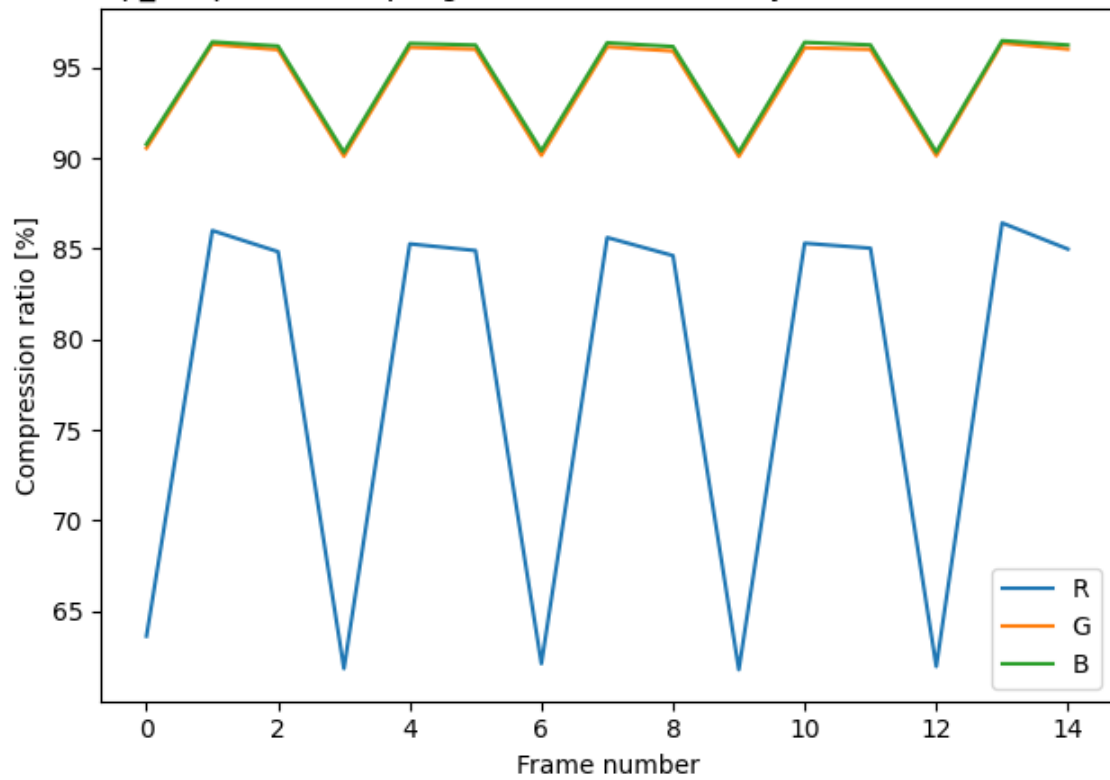
clip_4.mp4, subsampling: 4:1:0, divisor: 8, KeyFrame counter:3



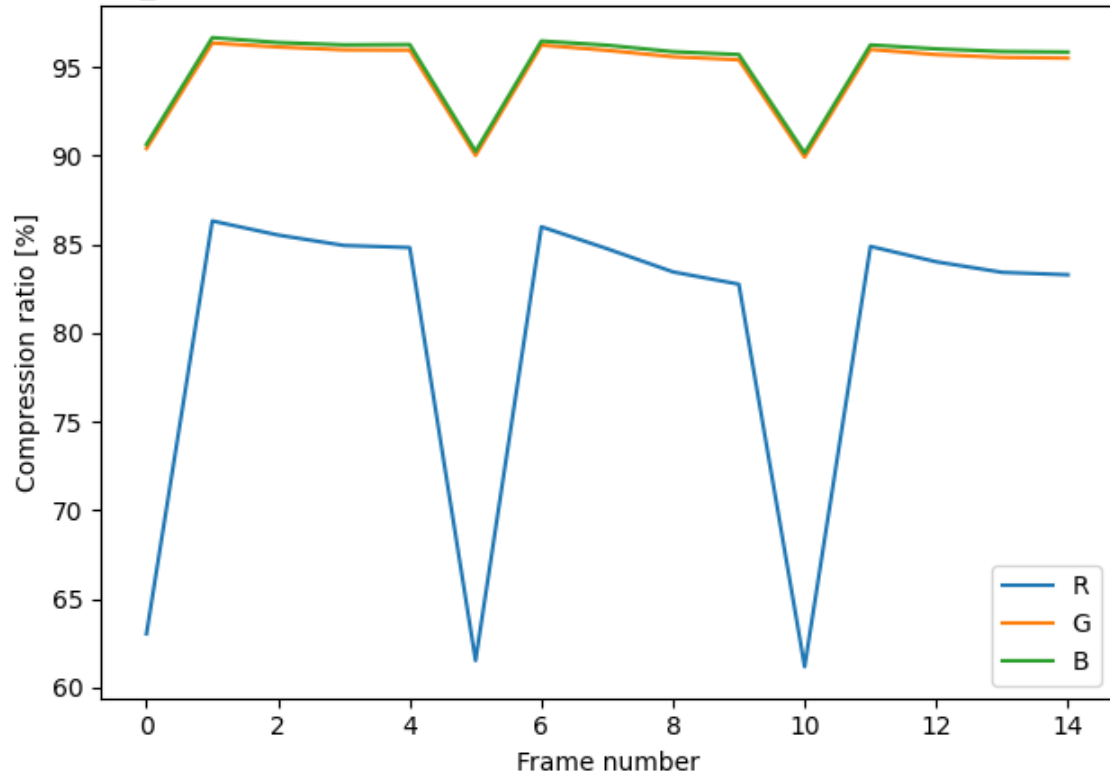
Badanie cz. 2 - z RLE



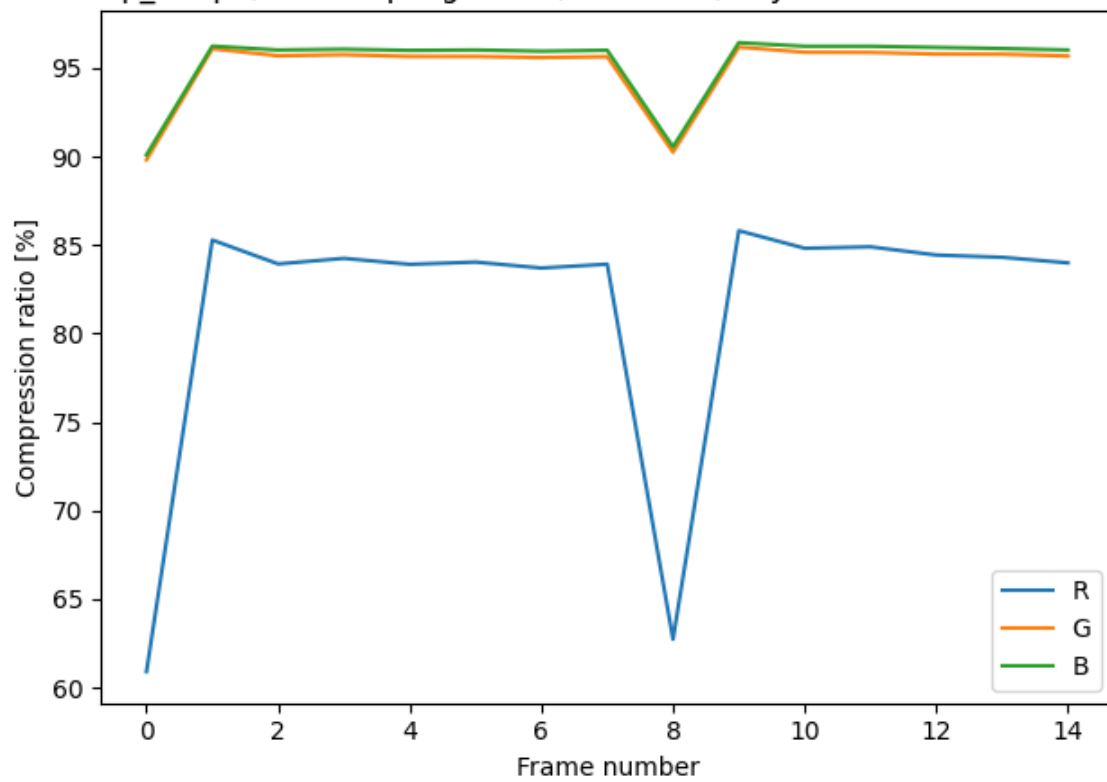
clip_4.mp4, subsampling: 4:1:0, divisor: 8, KeyFrame counter:3 z RLE



clip_4.mp4, subsampling: 4:1:0, divisor: 8, KeyFrame counter:5 z RLE



clip_4.mp4, subsampling: 4:1:0, divisor: 8, KeyFrame counter:8 z RLE



clip_4.mp4, subsampling: 4:1:0, divisor: 8, KeyFrame counter:12 z RLE

