hw2_1_newsmqp　hw2_1_ngcmpeg 兩個程式碼一樣

1.程式執行環境

作業系統:

- MacBook Pro（14 吋，2021 年）
- 晶片 Apple M1 Pro
- 記憶體 16GB
- 版本 12.3

Python 版本

- 3.9.12

安裝的庫

- import cv2
- import numpy as np
- import time

2.使用的 visual features

每一幀的彩色圖像 RGB 都轉換為灰度圖像，目的是將圖像中的色彩信息去除，保留亮度信息。通過比較相鄰幀之間的灰階圖像，計算出兩幀之間的絕對差異，並通過所有差一直相加摒除以總像素數獲得差異直，找出鏡頭變化。

```
15      def calculate_frame_difference(self, frame1, frame2):
16          gray1 = cv2.cvtColor(frame1, cv2.COLOR_BGR2GRAY)  # 將幀轉換為灰階
17          gray2 = cv2.cvtColor(frame2, cv2.COLOR_BGR2GRAY)
18          diff = cv2.absdiff(gray1, gray2)  # 計算絕對差異
19          norm_diff = np.sum(diff) / diff.size
20          return norm_diff
```

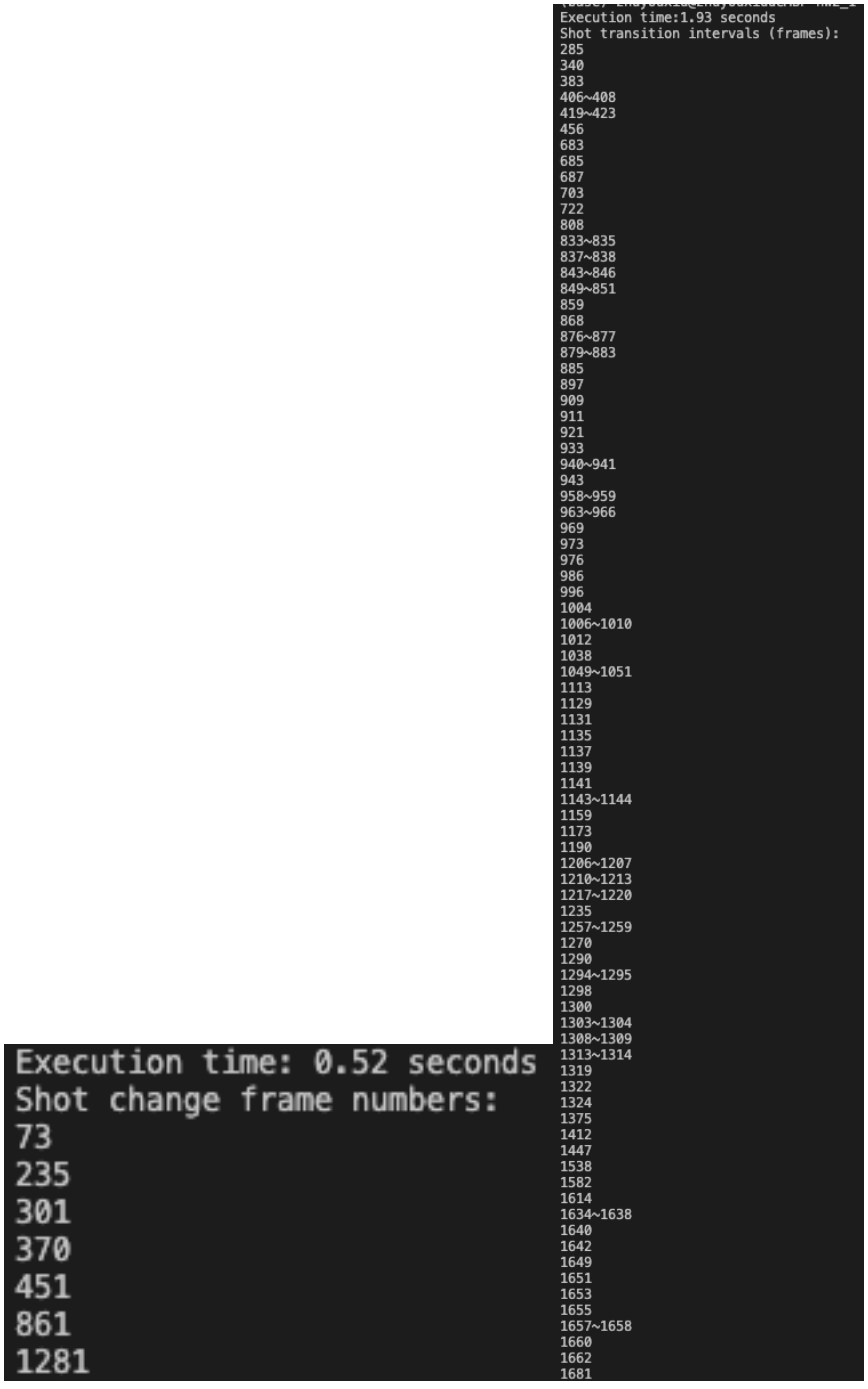
3.shot change detection 演算法

比較連續的兩幀之間的灰階圖像的差異，以及預設的閥值，來檢測鏡頭的變化，如果差異的值超過閥值，那就是鏡頭變化，有加上 **stability_threshold** 預設設定 5，用來確定鏡頭是否穩定，當連續幀之間的灰度差異超過此閥值時，認定發生了鏡頭變換。

```
15      def auto_set_parameters(self):
16          diff_threshold = 21  # 人為調整
17          stability_threshold = 5  # 同上
18          return diff_threshold, stability_threshold
```

```python
    def is_stable_change(self, index, boundaries):
        """檢查鏡頭變化點前後的穩定性。"""
        if len(boundaries) < 2:  # 如果檢測到的邊界少於2，認為是穩定的
            return True
        return (index - boundaries[-1]) > self.stability_threshold  # 檢查變化是否穩定
```

4. 偵測效能



hw2_2_climate

1.程式執行環境

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安裝的庫

- import cv2
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2.使用的 visual features

通過比較相鄰幀之間的灰度直方圖來檢測鏡頭變化，這裡使用卡方統計方法，通過比較相鄰幀之間的灰度直方圖差異來判斷鏡頭變化的發生，計算差異度，目的是為了簡化處理。

```
#直方圖差異值
    def histogram_diff(self, hist1, hist2):
        return cv2.compareHist(hist1, hist2, cv2.HISTCMP_CHISQR)
```

3.shot change detection 演算法

通過計算相鄰兩幀之間的灰度直方圖差異，採用了 256 級的灰度直方圖，圖像的亮度被分成 256 個不同的等級進行分析，使用卡方統計方法，來比較相鄰兩幀之間的直方圖差異當差異值超過指定的閾值時，即視為發生了鏡頭變化，將該幀的幀數添加到鏡頭變化的幀數列表中。最後，將檢測到的鏡頭變化時間間隔打印出來。

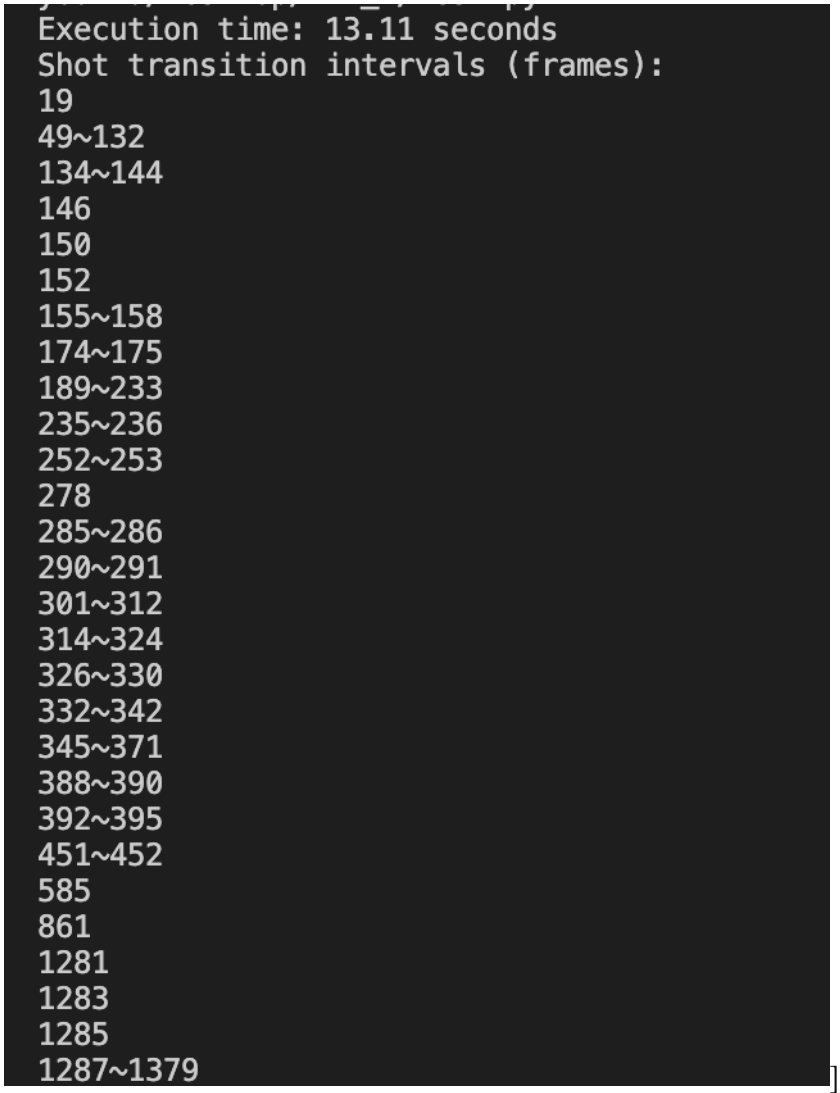
```python
#鏡頭變化的幀數列表
    def detect_shot_boundaries(self, video_path):
        cap = cv2.VideoCapture(video_path)
        prev_frame = None
        shot_boundaries = []
        frame_number = 0
        start_time = time.time()

        while True:
            ret, frame = cap.read()
            if not ret:
                break

            frame_number += 1
            gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
            hist = cv2.calcHist([gray], [0], None, [256], [0, 256]) # 計算灰度直方圖

            if prev_frame is not None:
                diff = self.histogram_diff(prev_hist, hist)
                if diff > self.threshold:   # 如果直方圖差異超過閾值，表示鏡頭變化
                    shot_boundaries.append(frame_number)

            prev_frame = frame # 更新前一幀
            prev_hist = hist # 更新前一幀的直方圖
```

4. 偵測效能

```
Execution time: 2.05 seconds
Shot transition intervals (frames):
93
157
232
314
355
454~466
688
886~887
898~906
908~916
919~920
984
1021
1237
1401
1555
```

3/18，我嘗試使用 Optical Flow 加入鏡頭邊界檢測中，利用相鄰幀間的關聯性來識別連續幀之間的對應關係，從而提高檢測的準確性。但是，結果並未達到預期。技術能夠精細捕捉幀間細微的變動，同時也使得處理時間顯著增長。當遇到鏡頭平移等動作，或是畫面中文字的出現時，這些情況會被認為是為鏡頭變換，影響了整體的檢測效率與準確度。

hw2_1_newsmqp



]

hw2_1_ngcmpeg

```
Execution time: 93.57 seconds
Shot transition intervals (frames):
110~119
121~122
125
127~159
161~163
165~168
171
173~174
177~178
180~181
183~184
186
189
191~243
245
249
252
255
258
264
280
283
285
295
301
307
325
330~331
337
340~341
343~344
346~350
352~356
358~362
364~368
370~371
373~374
376~447
456
461
467
469
473
479
485
491
497
503
509
515
536~551
554
582~614
616~668
673
675
681
681
683~685
687~691
693~696
699
701
703
719
722~725
727~829
831~835
837~838
840~841
843~846
849~853
855~868
870~874
876~877
879~883
885~889
891~895
897~901
903~907
909~925
927~931
933~937
939~943
945~949
951~955
957~961
963~967
969~974
976~980
982~986
988~992
994~998
1000~1004
1006~1010
1012~1016
1018
1020~1022
1024~1028
1030~1034
1036~1041
1043~1045
1047~1056
1090~1100
1102~1106
1108
1110
1112~1113
1116~1119
1121~1125
1127~1129
1131
1133~1135
1137~1141
1143~1147
1149~1153
1155~1177
```

hw2_2_climate

```
Execution time: 106.16 seconds
Shot transition intervals (frames):
2~92
156
159~221
231
313~354
471
618~622
624~690
777
789~792
794~798
801
803~804
807~810
813~816
819~822
825~828
830~834
837~840
843~846
848~852
854~858
860~864
866~870
872~876
878~882
884~886
911
913~915
1020
1029
1212~1219
1227
1233
1236
1271
1293~1294
1354~1356
1366~1367
1400
1554
1646
```

3/20 號 程式新增跟答案的比對 hw2_1_newsmqp

```
Execution time: 0.47 seconds

Comparing detected boundaries with TXT boundaries:
Match found: 73
Match found: 235
Match found: 301
Match found: 370
No match for: 451
Match found: 452
Match found: 861
Match found: 1281

Correct matches: 7/8
```

3/20 號 程式新增跟答案的比對 hw2_1_ngcmpeg

```
Execution time: 1.94 seconds

Comparing detected boundaries with TXT boundaries:
Match found: 285
Match found: 340
Match found: 383
Match found: 406
Match found: 407
Match found: 408
Match found: 419
Match found: 420
Match found: 421
Match found: 422
Match found: 423
Match found: 456
Match found: 683
No match for: 685
No match for: 687
Match found: 703
Match found: 722
Match found: 808
Match found: 833
Match found: 834
Match found: 835
Match found: 837
Match found: 838
Match found: 843
Match found: 844
Match found: 845
Match found: 846
Match found: 849
Match found: 850
Match found: 851
Match found: 859
Match found: 868
Match found: 876
No match for: 877
No match for: 879
No match for: 880
No match for: 881
No match for: 882
No match for: 883
Match found: 885
Match found: 897
Match found: 909
No match for: 911
Match found: 921
Match found: 933
No match for: 940
No match for: 941
Match found: 943
Match found: 958
No match for: 959
Match found: 963
No match for: 964
Match found: 965
No match for: 966
Match found: 969
No match for: 973
Match found: 976
Match found: 986
No match for: 996
Match found: 1004
Match found: 1006
Match found: 1007
Match found: 1008
Match found: 1009
```

```
No match for: 1010
No match for: 1012
Match found: 1038
Match found: 1049
Match found: 1050
Match found: 1051
No match for: 1113
No match for: 1129
No match for: 1131
No match for: 1135
No match for: 1137
No match for: 1139
No match for: 1141
No match for: 1143
No match for: 1144
No match for: 1159
No match for: 1173
No match for: 1190
No match for: 1206
No match for: 1207
No match for: 1210
No match for: 1211
No match for: 1212
No match for: 1213
No match for: 1217
No match for: 1218
No match for: 1219
No match for: 1220
No match for: 1235
No match for: 1257
No match for: 1258
No match for: 1259
No match for: 1270
No match for: 1290
No match for: 1294
No match for: 1295
No match for: 1298
No match for: 1300
No match for: 1303
No match for: 1304
No match for: 1308
No match for: 1309
No match for: 1313
No match for: 1314
No match for: 1319
No match for: 1322
No match for: 1324
No match for: 1375
No match for: 1412
No match for: 1447
No match for: 1538
No match for: 1582
No match for: 1614
No match for: 1634
No match for: 1635
No match for: 1636
No match for: 1637
No match for: 1638
No match for: 1640
No match for: 1642
No match for: 1649
No match for: 1651
No match for: 1653
No match for: 1655
No match for: 1657
No match for: 1658
No match for: 1660
No match for: 1662
No match for: 1681

Correct matches: 52/133
```

3/20 號 程式新增跟答案的比對 hw2_2_climate