

# 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，以及預設的閾值，來檢測鏡頭的變化，如果差異的值超過閾值，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閾值時，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
```

```

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

```

#### 4. 偵測效能

```

Execution time:1.93 seconds
Shot transition intervals (frames):
285
340
383
406~408
419~423
456
683
685
687
703
722
808
833~835
837~838
843~846
849~851
859
868
876~877
879~883
885
897
909
911
921
933
940~941
943
958~959
963~966
969
973
976
986
996
1004
1006~1010
1012
1038
1049~1051
1113
1129
1131
1135
1137
1139
1141
1143~1144
1159
1173
1199
1206~1207
1210~1213
1217~1220
1235
1257~1259
1270
1290
1294~1295
1298
1300
1303~1304
1308~1309
1313~1314
1319
1322
1324
1375
1412
1447
1538
1582
1614
1634~1638
1640
1642
1649
1651
1653
1655
1657~1658
1660
1662
1681

Execution time: 0.52 seconds
Shot change frame numbers:
73
235
301
370
451
861
1281

```

# hw2\_2\_climate

## 1.程式執行環境

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Python 版本

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安裝的庫

- import cv2
- import numpy as np
- import time

## 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。

```

#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

```
Execution time: 13.11 seconds
Shot transition intervals (frames):
19
49~132
134~144
146
150
152
155~158
174~175
189~233
235~236
252~253
278
285~286
290~291
301~312
314~324
326~330
332~342
345~371
388~390
392~395
451~452
585
861
1281
1283
1285
1287~1379
```

## 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

```
Detection run time: 2.15 seconds

Comparing detected boundaries with TXT boundaries:
93: Match found
157: Match found
232: Match found
314: Match found
355: Match found
454: No match
455: No match
456: No match
457: No match
458: No match
459: No match
460: No match
461: No match
462: No match
463: No match
464: No match
465: No match
466: No match
688: No match
886: No match
887: No match
898: No match
899: No match
900: No match
901: No match
902: No match
903: No match
904: No match
905: No match
906: No match
908: No match
909: No match
910: No match
911: No match
912: No match
913: No match
914: No match
915: No match
916: No match
919: No match
920: No match
984: No match
1021: Match found
1237: Match found
1401: Match found
1555: Match found

Correct matches: 9/46
```