ADSP HW3 P109421405 鄭閔軒

1.

Python getMusic.py 操作說明

我們提供以下參數做輸入

```
    "--score", type=str,
    help="Please input your score list 1 Do 2 Re 3 Mi 4 Fa 5 so 6 La 7 Si -999 is rest(comma separate)")
```

逗號分隔旋律(不須空白) -999 為無聲音休止符處

```
    "--beat", type=str, default="default_beat",
    help="Please assign list beat of score(comma separate/same size with beat)")
```

拍子長短(可輸入小數於 List)

```
    "--sharp", type=str, default="default_sharp",
    help="Please assign list sharp use 0 1 to represent whether sharp corresponding score(comma separate/same size with beat)")
```

升調(升調與否 0,1 表示)，因輸入 1,2,3,4,5,6,7 並無法表現升調

```
    "--num_octave", type=int, default="0",
    help="Get high octave frequency music")
```

高幾個八度 預設為 0

```
    "--name", type=str, default="music",
    help="Please assign your output wav name")
```

輸出的檔案名稱(不用加上.wav)

```
    "--bpm", type=int, default="120",
    help="Please assign your music BPM")
```

節奏快慢 beats per minute

輸入方式

python getMusic.py --score 1,2,3,4,5,-999,-999,-999,6,7 --beat 1,1,1,1,1,1,1,1,1,1 --sharp 0,0,0,0,0,0,0,0,0,0 --num_octave 2 --name test --bpm 120

Python pkg

Numpy

Scipy

2.

(a) 以中文為例，部份字只具有母音，而無子音。導致無法以 Amplitude 作為分詞依據。

(b) 以共振觀點，若一繩長 $L = \frac{\lambda}{2}n \ (n \in N)$ 皆有共振

$f = \frac{170}{L}n \ (n = 1, 2, 3, \dots)$ 在 f_{base} 倍數處皆有共振產生

3.

(a) 1. Beat Interval fixed

2. Same melody replay again ，3f。

3. Energy in the frames is concenerated at f0, 2f.

(b) 1. the color is uniform within a region

2. Edges can be represent by line, arcs, curves.

4. (a) In YC_bC_r, Y is more important than C_b and C_r Information.

We can reduce raw YC_bC_r image 4:4:4 (3MN pixels M means height N mean width) to 4:2:2 (2MN pixels) or even to 4:2:0 ($\frac{3}{2}$MN pixels).

Trough reduce C_b and C_r channel pixels to compress image.

(b) 4:2:0 use $MN + \frac{1}{2}MN + 0 = \frac{3}{2}MN$ pixels

$$\text{Compression ratio} = \frac{3MN}{\frac{3}{2}MN} = 2 \quad \#$$

5、

(a) 1. DCT 對大部份影像皆能近似 KLT (near optimal)

2. independent of the input

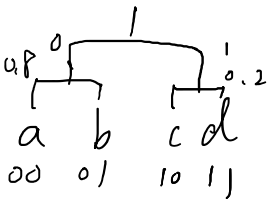
3. real output

(b) lossless : (ii) DC difference

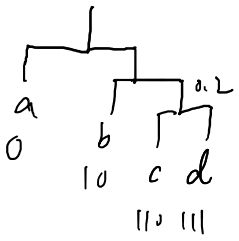
(v) the Huffman code

(6) $P(x = "a") = 0.5$ $P(x = "b") = 0.3$ $P(x = "c") = 0.1$

(a) $P(x = "d") = 0.1$



$1.6 + 0.4 = 2$ (avg. bit length)



$0.5 + (0.3 \times 2) + (0.2 \times 3) = 1.6$ (avg. bit length) #

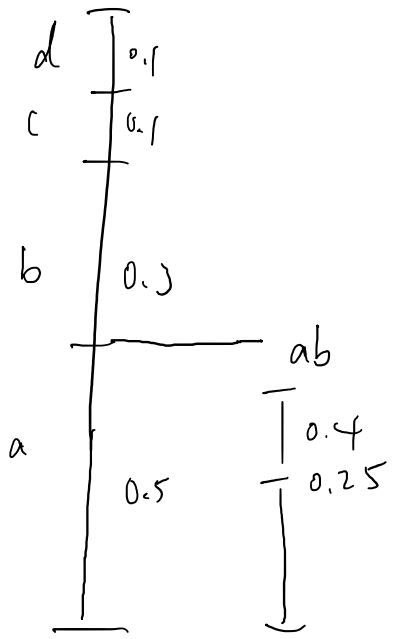
(b)

$$0.5 \times \ln 2 + 0.3 \times \ln \frac{10}{3} + 0.1 \times \ln 10 + 0.1 \times \ln 10$$

$$= 1.1682\,8$$

(c)

Arithmetic Coding "aba"



ab lower = 0.25 upper = 0.4

aba lower = 0.25 upper = 0.325

$0.25 \quad \frac{4}{16} \quad \frac{5}{16} \quad 0.325$

$lower \le C \cdot k^{-b} < (C+1)\, k^{-b} \le upper$

$k = 2 \quad b = 4 \quad C = 4$

$4_{(2,4)} = 0100$

(d)

$$ceil\left(N \cdot \frac{entropy}{\log k}\right) \le b \le floor\left(N \cdot \frac{entropy}{\log k} + \log_k 2 + 1\right)$$

Binary system $k = 2$

$$N \cdot \frac{entropy}{\log k} = 100{,}000 \cdot \frac{1.16828}{\ln 2} = 168547.2$$

arithmetic code

$$168548 \le b \le 168549$$

#

7. NRMSE

(1) vocal amplitude different

(2) vocal signal delay

(3) vocal signal frequency slightly change will cause error.

Bonus: 對於256點信號最多有 p(Height) 128Hz q(width) 128Hz (0,5)

最高頻為雜訊圖片