b
UNIVERSITÄT
BERN

UNIVERSITÄT BERN

HS2020: 11072 Advanced Networking and Future Internet

Theoretical Exercises 10

Jesutofunmi Ademiposi Ajayi
Lucas Pacheco
November 23, 2020

Instructions

Submit your exercises in PDF format in the corresponding task on ILIAS by sunday, 15.11.2020 at 23:55.

Question 1 (2 points)

Traditional image compression techniques make use of DCT, quantization, and especial encoding, and a zig-zag DCT coefficient order. Why are a special encoding and the use of zig-zag order necessary for the compression? Would the compression be possible using only DCT and quantization?

Question 2 (2 points)

Given the following character frequency in a piece of text:

```
n 14
a 13
d 12
e 22
v 10
c 9
t 8
k 7
i 6
g 5
space 4
w 3
o 2
r 1
```

Question 2 (2 points)

2.1 Find the huffman encoding representation of the characters.
2.2 Find the arithmetic encoding for these same characters, consider 10 bits of precision. How many bit are necessary to encode the string “advanced networking” under each encoding?

Question 3 (2 points)

What are the roles of each type of frame in traditional video encoding (I, P, and B), and what kind of information is encoded in each of the types?
Different frame losses have different effects in overall video res-construction, what is the effect of loss o frames I, P, and B?

Question 4 (2 points)

How can motion estimation be achieved with the use of Macro-Blocks (block-matching algorithm)? Describe in details.

Question 5 (2 points)

Explain the components and steps in MPEG-1 encoding and decoding according to the diagrams below.

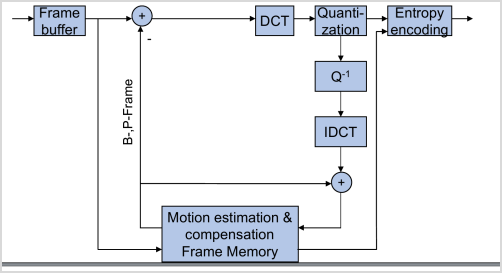

Figure: MPEG-1 Encoder

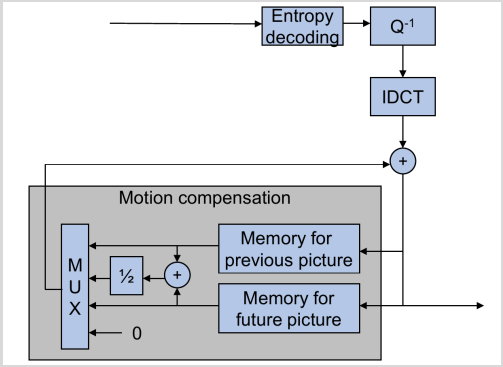

Figure: MPEG-1 Decoder

Question 6 (Bonus, 4 points)

Ps.: This question is not mandatory for the exercise, and is worth 2 extra points in this week's theoretical exercise.

1. Download the files from this link and enter the environment (`source env/bin/activate`, or install the dependencies from the requirements file `pip3 install -r requirements.`)
2. In the directory you are going to find the codes for standard JPEG encoding steps (blockwise DCT, quantization, and reconstruction with inverse DCT).
3. Execute the code and analyze the outputs, explain the importance of each step.
4. Test the execution with other quantization matrixes (examples in https://gist.github.com/lsiddd/5a49303dfb992850cded8890fe75161e), how can you explain the reconstructed outputs?

Questions?

UNIVERSITÄT BERN

contact me at lucas.pacheco@inf.unibe.ch.