Introduction to Data Processing and Representation

(236201)

Winter 2023-2024

**Homework 1**

**Name**: Ran away

**ID:** ????

**Name**: Almog Ben Shaul

**ID**: x

**Theory**

**Question 1 - Solving the problem using the solution**

1. Under the constraints and when

Similarly:

And the optimal value for each will be .

Under the same constraints and when the optimal value will be, for each

1. For general w(x)

Let’s differentiate, with respect to :

Find the minimum:

Thus, for each , will be the optimal.

1. For general w(x), and given :

Let’s differentiate, with respect to :

Like in the lecture, for :

Find the minimum, while notate:

– points in where

– points in where

* The minimum is given when: , meaning at the weighted median of f(x), as the weighted values of f(x) above the optimal equal to the weighted values of f(x) below it.

Then Thus, for each , the optimal will be the weighted median of f(x) in .

1. Let’s define the functions for and look at the optimization problem - :

*for* by the definition of , , therefore:

So:

1. We wish to find , s.t:

Let’s define (given that ), therefore:

1. Given w(x) from the optimizing problem, let’s define:

= and we’ll get:

1. If was indepented of it’d be much easier problem as we won’t take it into account when differentiating, and we’ll get the solution we got in b:
2. Without the assumption of =

may not be defined or the error may diverge to .

But when replacing with fixed (limited) we won’t be able to diverge as we’ll have an upper limit.

1. Algo:
2. Init
3. While
4. *Return*
5. Algo:

1.Init   
2. For

3. return

1. Hmm idk, remind me some kind of gradient decent algo

**Implementation**

**Question 1 – Quantization**

*A person sitting on a couch with a can of beer

Description automatically generated*The image we chose: and it’s 256 gray levels version:

A person sitting on a couch with a can of soda

Description automatically generated

1. Our image histogram:  
    A graph of a graph

   Description automatically generated

The histogram doesn’t seems too uniform.

1. a. MSE with different number of quantization bits:

A graph with a line

Description automatically generated

As excepted, the more bits we have, the smaller the MSE we’ll get.  
We can also see, that where the number of bits is 8, which is the actual amounts of bit the original gray image use – we’ll get 0 MSE, as we’ll get the original gray image again.

A graph with a line and a line

Description automatically generated with medium confidenceA graph with a line and a line

Description automatically generated with medium confidenceb. We chose 1,2,3,4 bits for the representative b values (as the rest are too noisy):

A graph with a blue line

Description automatically generatedA graph with a blue line

Description automatically generated