Øving 4

16. oktober 2019 16:43

Task 1: Theory [1.5pt]

An digital image is constructed from a image sensor. Typically, an image sensor outputs a continuous voltage waveform that represents the image, and to construct a digital image, we need to convert this continuous signal. This conversion involves two processes: sampling and quantization.

(a) [0.1pt] Explain in one sentence what sampling is.
Digitizing the coordinate values of an image are called sampeling.

(b) [0.1pt] Explain in one sentence what quantization is.
Digitizing the amplitude line is called quantization.

(c) [0.2pt] Looking at an image histogram, how can you see that the image has high contrast?
If the values of the images coves the value range in the histogram, the image has high contrast.

(d) [0.5pt] Perform histogram equalization by hand on the 3-bit (8 intensity levels) image in Figure 1a Your report must include all the steps you did to compute the histogram, the transformation, and the transformed image.

Before

5	0	2	3	4
3	2	0	5	6
4	6	1	1	4

Transformation

		finner prosentvis fordeling	legger sammen prosentene til en skala	ganger bare opp til range scala, og floor	skala etter transf	
r	H[r]	p[r]	F[r]	T[r]	s	H[s]
0	2	0.1333333333	0.1333333333	0	0	2
1	2	0.1333333333	0.2666666667	1	1	2
2	2	0.1333333333	0.4	2	2	2
3	2	0.1333333333	0.5333333333	3	3	2
4	3	0.2	0.7333333333	5	4	0
5	2	0.1333333333	0.8666666667	6	5	3
6	2	0.1333333333	1	7	6	2
7	0	0	1	7	7	2
	15	1				15
		//=B5/15	//D6: =D5+C6	// =FLOOR((D6*7), 1)		

After

6	0	2	3	5
3	2	0	6	7
5	7	1	1	5

(e) [0.1pt] What happens to the dynamic range if we apply a log transform to an image with a large variance in pixel intensities?
The pixel varience is normailized and the both high and low variables become visible.

(f) [0.5pt] Perform spatial convolution by hand on the image in Figure 1a using the kernel in Figure 1b. The convolved image should be 3 ×5. You are free to choose how you handle boundary conditions, and state how you handle them in the report.

Before

5	0	2	3	4

3	2	0	5	6
4	6	1	1	4

Convolutional kernel

0	1	0
1	-4	1
0	1	0

After

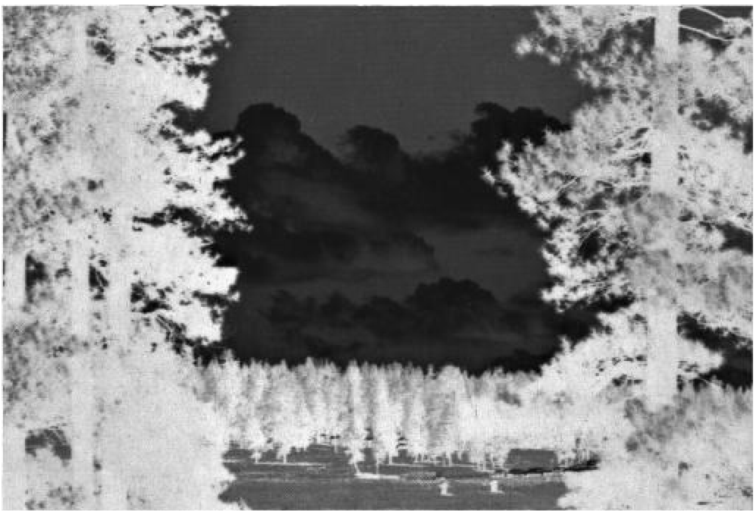
-17	9	-5	-1	-7
-1	1	10	-10	-11
-7	-17	3	6	-9

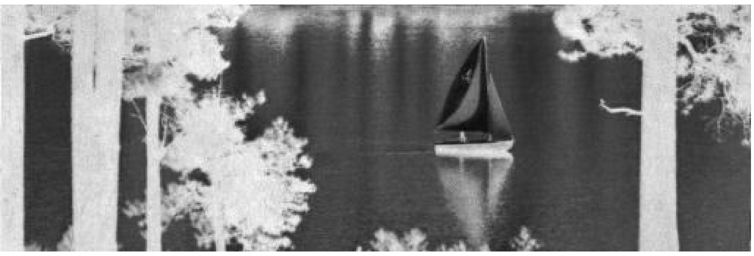
The center of the kernal passes over every value, where the kernel is outside the image the value is set to zero.

Task 2: Programming [1.0pt]

A)

B)





C)
I almost solved this task, but did't have time to finnish it. Look at the code to evaluation.

Task 3

A)
XOR – because XOR is a operation requiering knowing about the other variable, whitch is not possible in a neural network.

B)
A hyperparameter is something that specifies the values of the nevral network. For eksample batch size or learning rate.

C)
To determine the relative probablility of the output result, compeared to other alternatives. This is not possible when the sum of the probability for classification does not equal zero.

D)
Forward pass:

	x	w	*	B,c,b,c
1	-1	-1	1	B1=1
2	0	1	0	C1=2
3	-1	-1	1	B2=-1
4	2	-2	-4	C2=-4

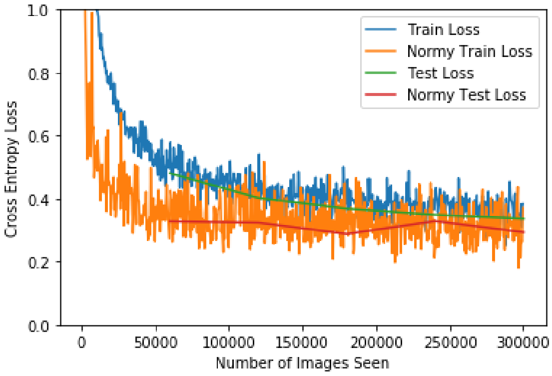
Max: Y=1

Backward pass:
C/w1 = c/y * y/c1 *c1/a1 * a1/w1
C/w2 = c/y * y/c1 *c1/a2 * a2/w2
C/w3 = c/y * y/c1 *c2/a3 * a3/w3
C/w4 = c/y * y/c1 *c2/a4 * a4/w4
C/b1 = c/y * y/c1 *c1/b1
C/b2 = c/y * y/c2 *c2/b2

E)

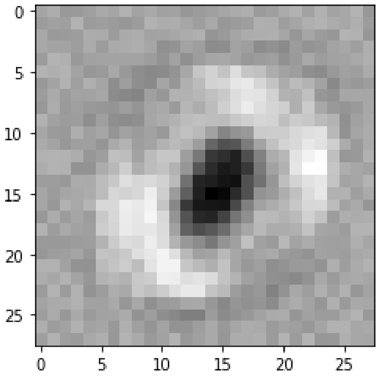
Task 4

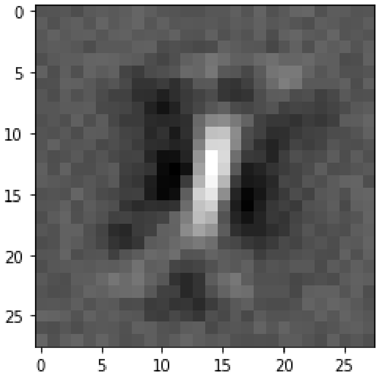
A)

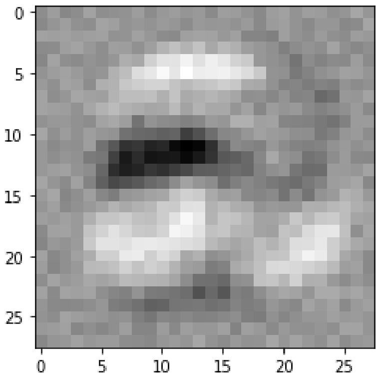


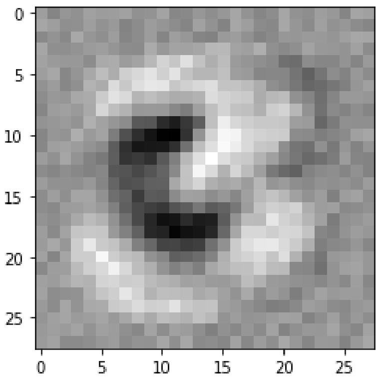
B)

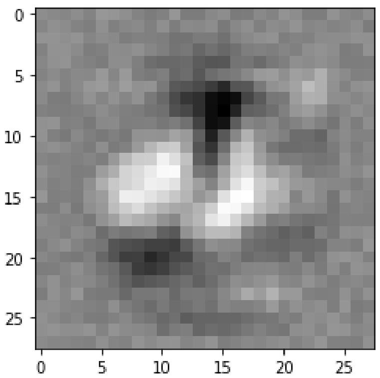
You can see the "reflection" of the numbers below. The areas with high or low value are more defining for the classification. Black means it's important that theres nothing there, white means it's important that somethings there.

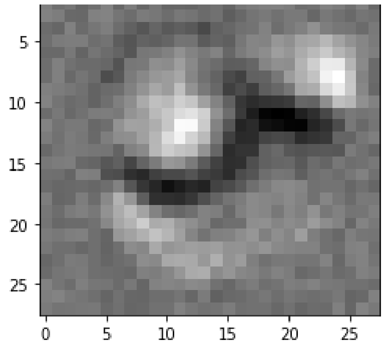


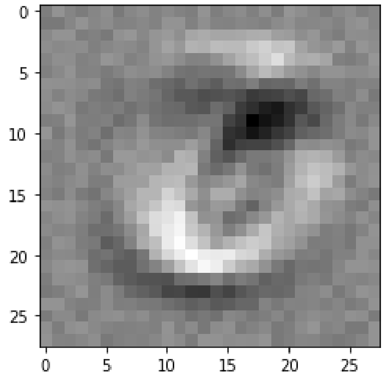


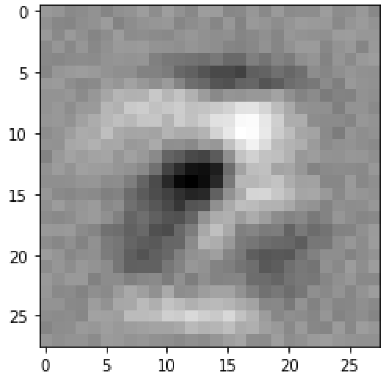


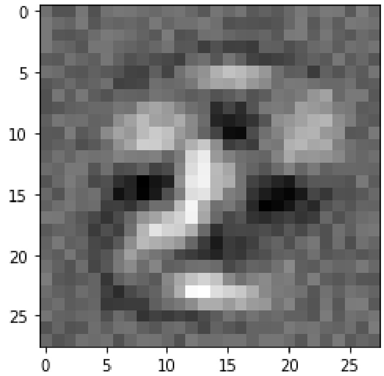


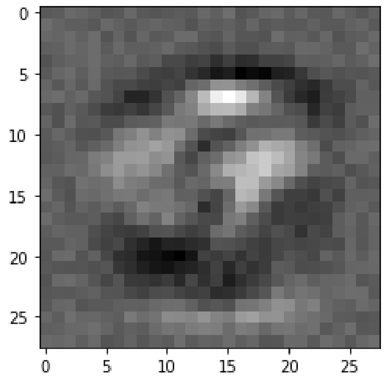












C)

Final Test Cross Entropy Loss: 2.346682923614599. Final Test accuracy: 0.054

The accuracy drops to next to nothing. The steps are too big, instead of training up the weights for a general case the last couple of images determens the values of the weights. I guess the smaller the learning rate the better "average" you end up with, but then agein this would probably require larger data sets.

D)

The hidden layer improves the accuracy, and halfs the amount of errors. From 0.910 to 0.959 in accuracy.