

SSY316 - Python 3

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November 2023

1 Bayesian Network

For this assignment, we wanted to model a Bayesian network using the library pgmpy. We were given a set of information of the relationship between the variables: M, U, R, B, S and in the code you can see that it passed. The next question was to compute the probability $p(R)$ and $p(R|M)$ and the answers we got were:

$$\begin{aligned} p(R=0) &= 0.0901 & p(R=1) &= 0.9099 \\ p(R=0|M) &= 0.7894 & p(R=1|M) &= 0.2106 \end{aligned}$$

The next thing was to find interesting qualities of the model and some qualities we looked at was the independence of certain variables. These were:

- R's dependencies: None
- S's dependencies: ($S \perp U, M \text{ --- } B, R$)
- M's dependencies: ($M \perp B, U$)

2 Denoise an image using Ising model algorithm

The next part of the assignment was to try and denoise an image using the Ising model. The main task was to minimize the energy function below which means that given a noisy image y , find the original underlying image x .

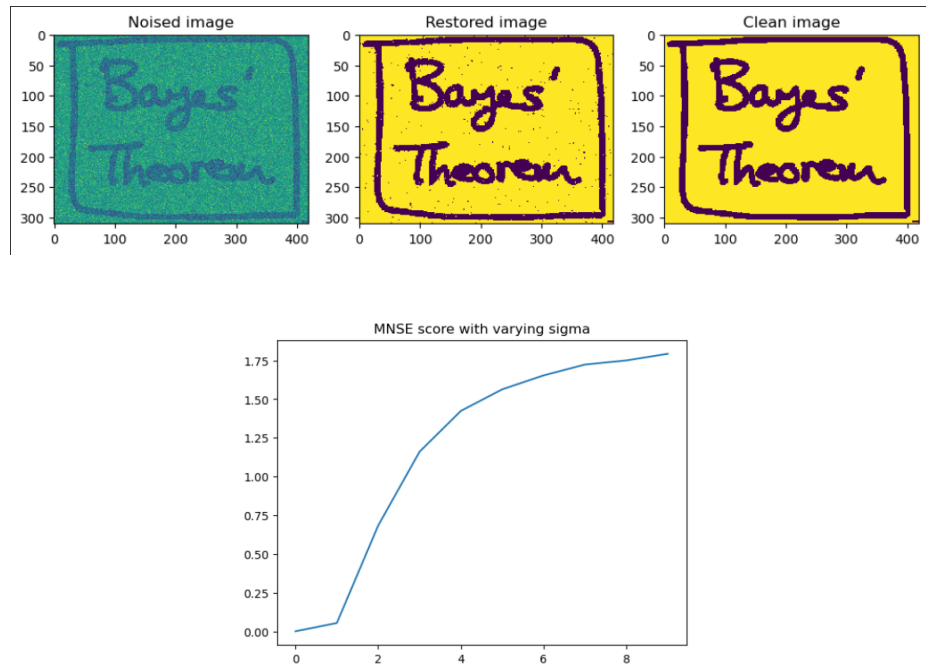
$$E(x, y) = h \sum_i x_i - \beta \sum_{i,j} x_i x_j - \eta \sum_i x_i y_i$$

This function utilizes three parameters: h, η , and β .

The parameter h is the prior belief a state x_i has. The parameter η is the interaction between neighbors. The parameter β expresses the correlation between x and y .

After implementing and running the algorithm we managed to get a denoised image and the result can be seen in figure 2

The task was also to evaluate the model and plot the MNSE scores with varying noise levels and the result can be seen in figure 2



Lastly, we wanted to investigate the MNSE scores by modifying the parameters h, η , and β , and the result we got can be seen in figure 2

