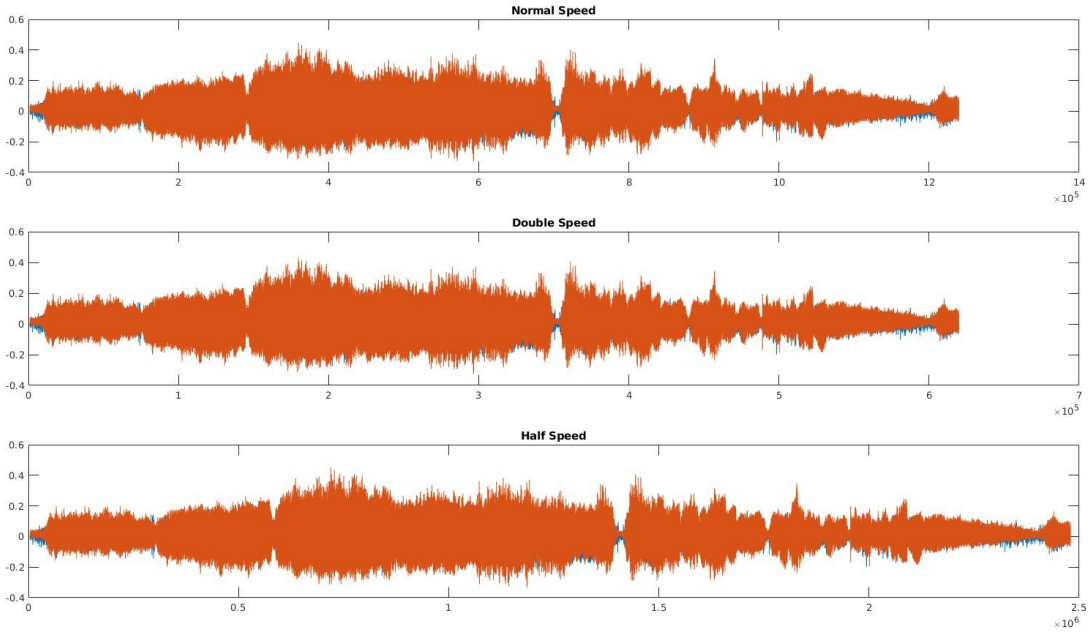
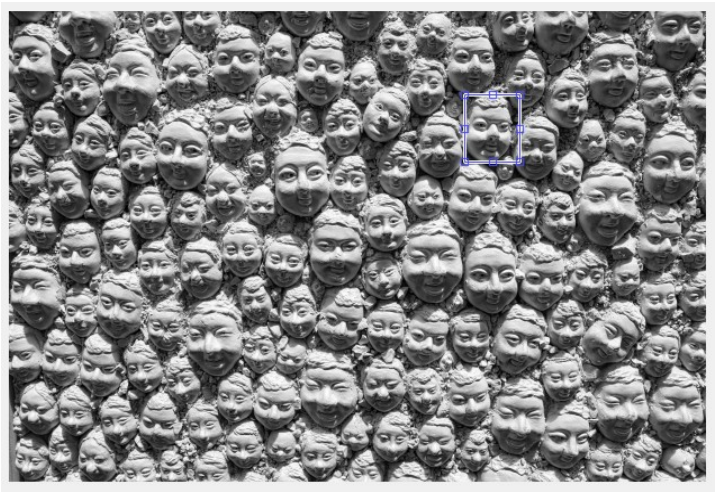
Problem – 1



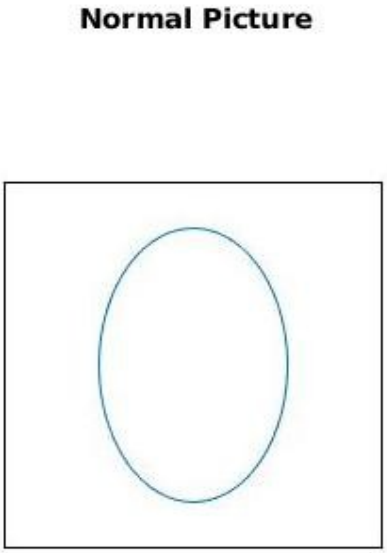
Here the frequency change is visible, there are places where some data is lost but most of the data is preserved because .wav format already samples the data in very high frequency . While we reduce the number of samples data is lost and when we are increasing the number of samples noise is added to the data for that we can use FIR Filters.

Problem – 3.

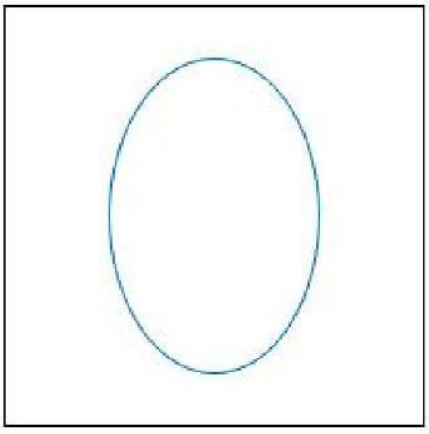


The problem can be modeled like searching a small matrice in an larger matrix. And it can be easily obtained by doing correlation between the two matrices where we will easily get the matrix or a very similar matrix of multiplying the smaller matrix over the larger one and the one which has the largest score will be the require image. So even if the smaller image is noisey it can be obtained or we can try removing the noise by recovering some of the intermediate data points by methods like moving point average. And then like the previous method we can locate the smaller matrix in that larger matrix.

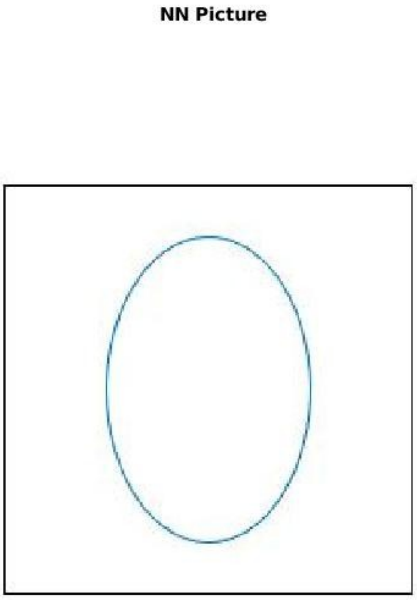
Normal Picture



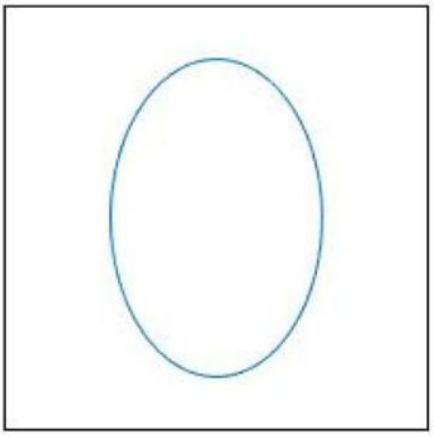
Nearest Neighbour 5x



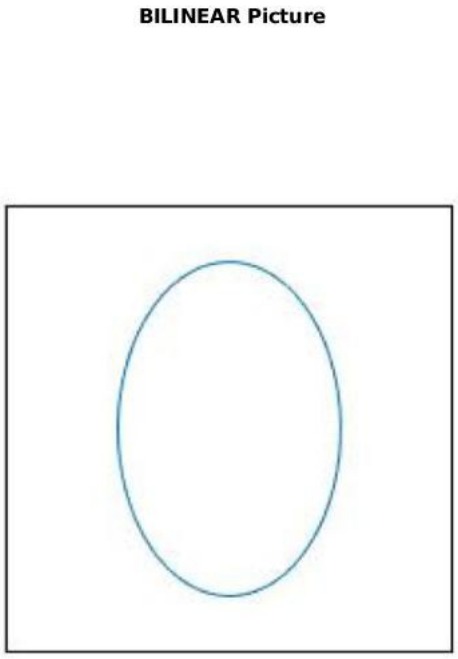
Nearest Neighbour 10x



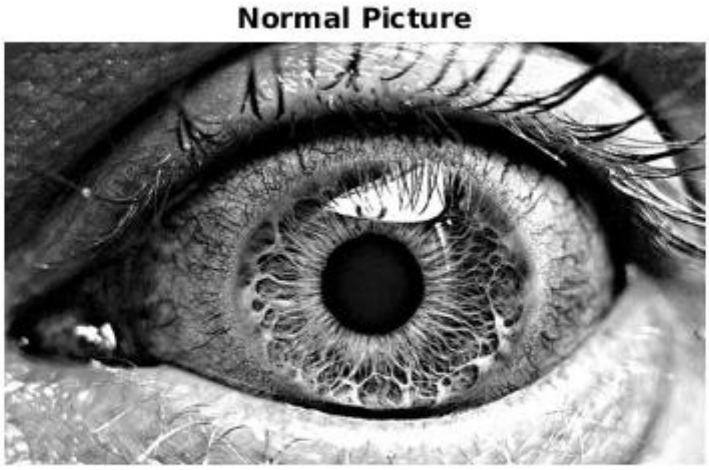
Bilinear Interpolation 5x



Bilinear Interpolation 10x



Normal Picture



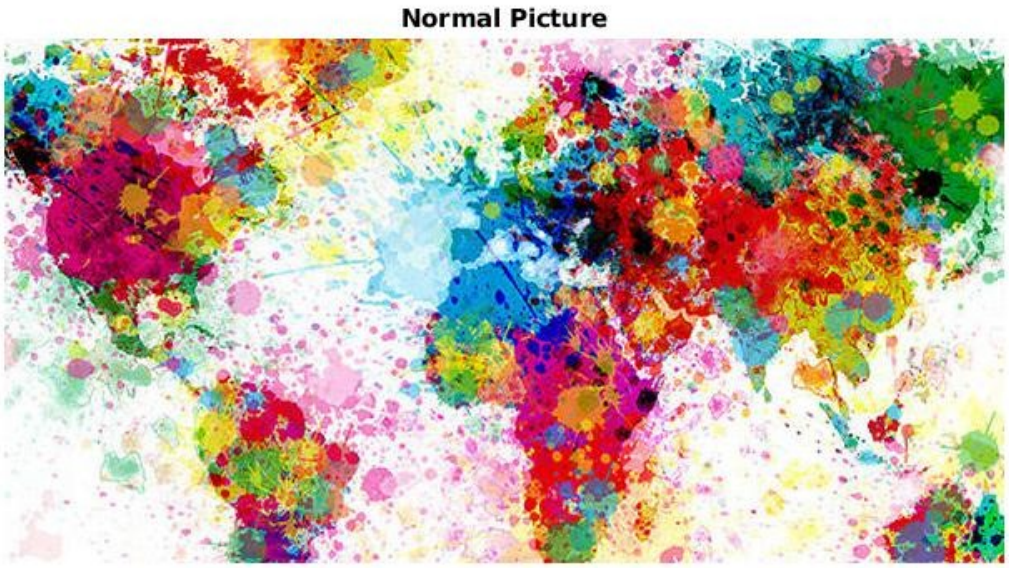
Nearest Neighbour 5x

Nearest Neighbour 10x

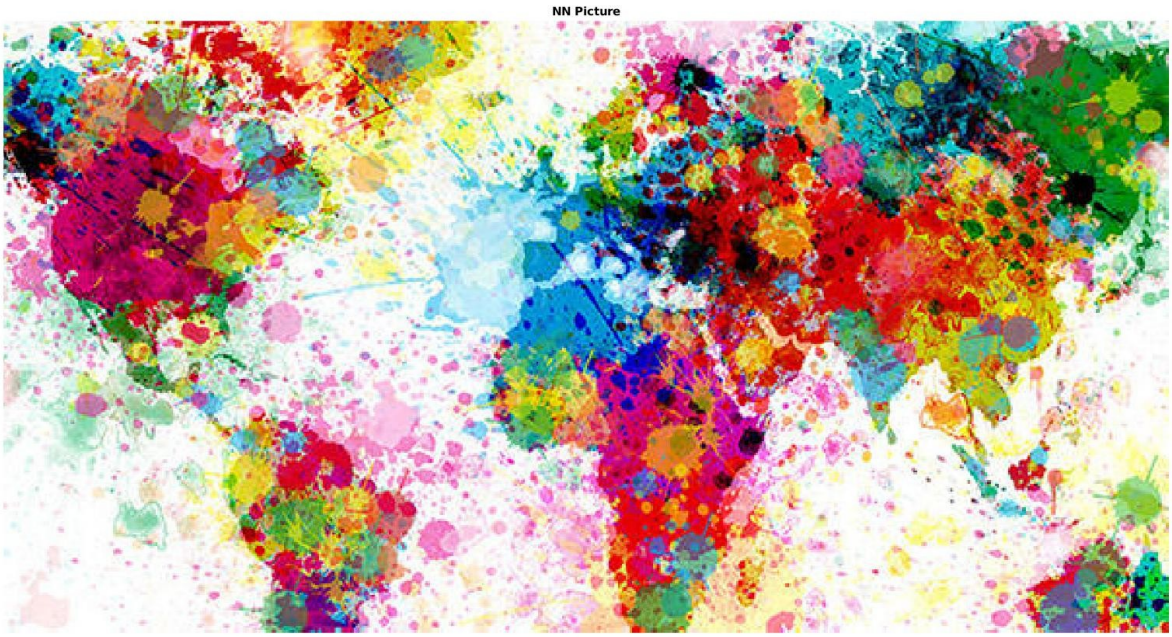
Bilinear Interpolation 5x

Bilinear Interpolation 10x

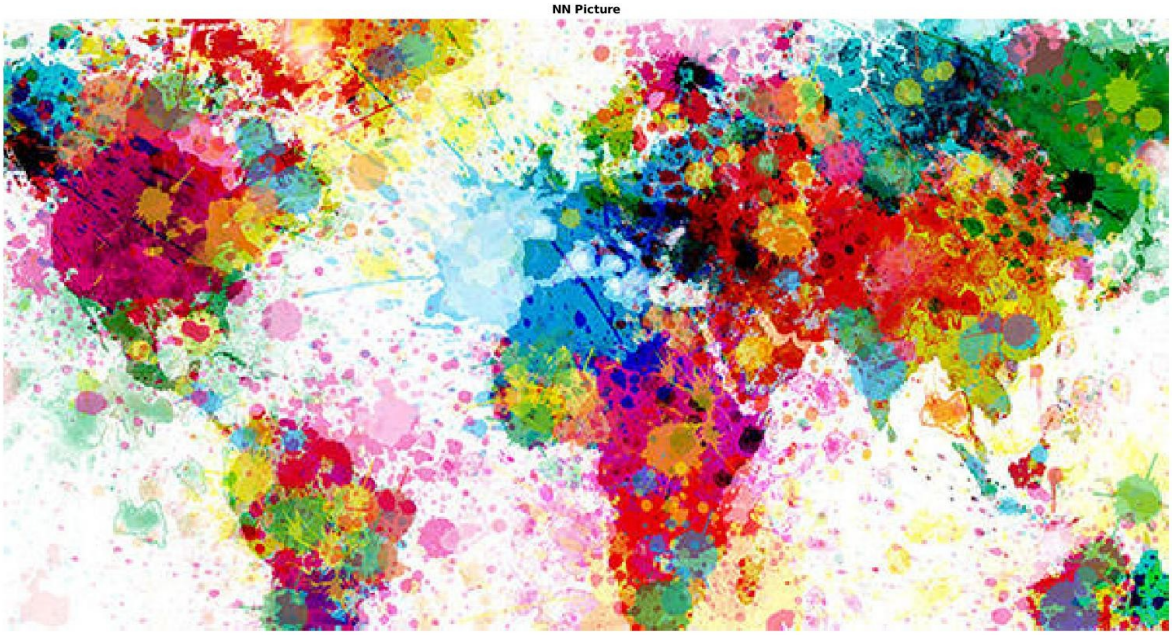
Normal Picture



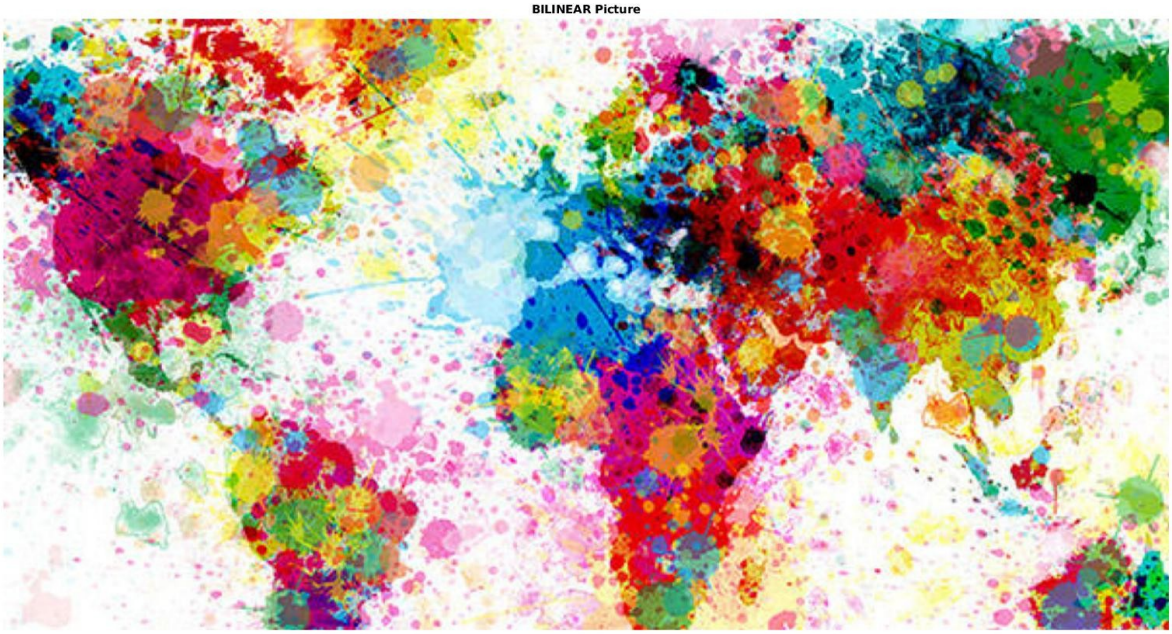
Nearest Neighbour 5x



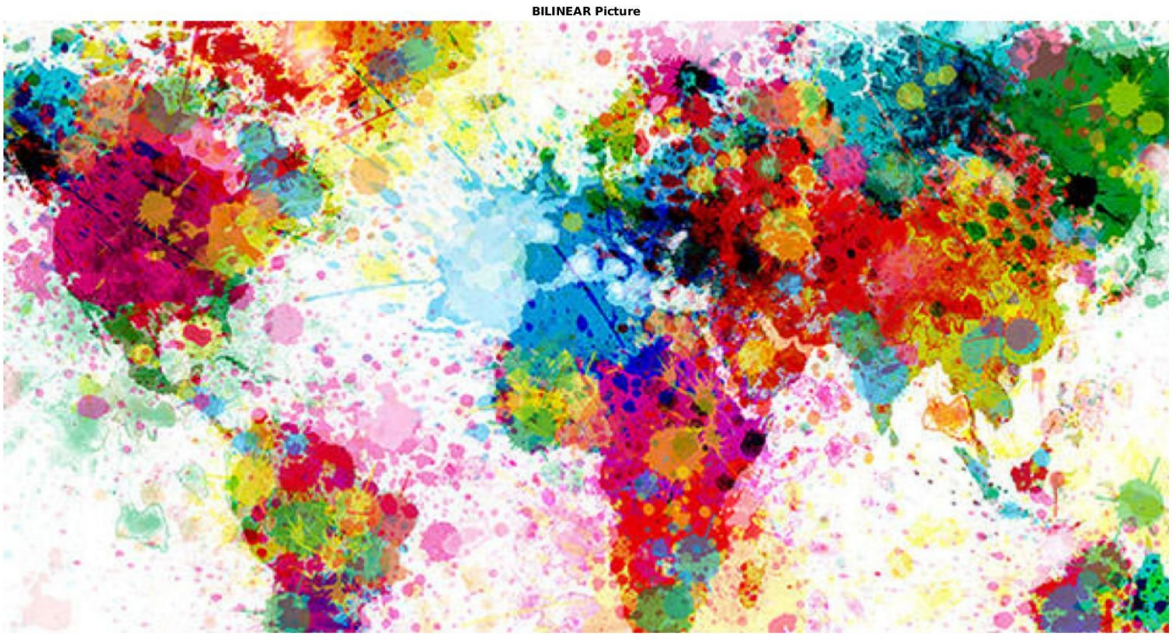
Nearest Neighbour 10x



Bilinear Interpolation 5x



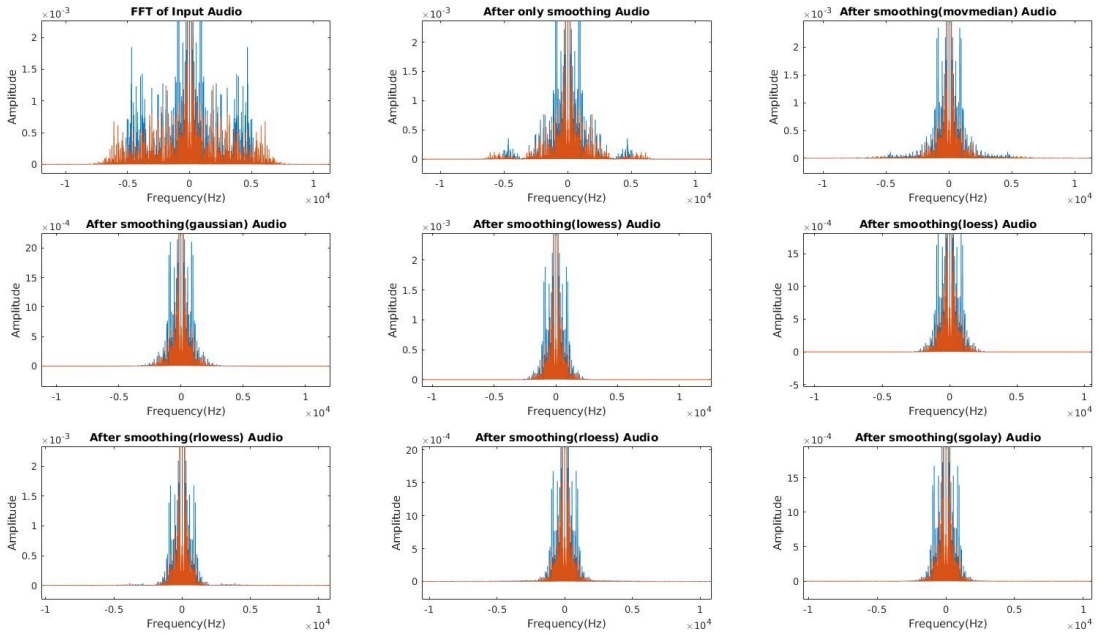
Bilinear Interpolation 10x



In this epansion according to me Bilinear Interpolation worked the better than Nearest neighbour. And the difference can be clearly seen in First image type where the curves are expanded the 10x of bilinear Interpolation worked better than the 5x of Nearest neighbour.

Although some sharpness is lost in the Bilinear Interpolation but in case of Nearest neighbour it is just like Increasing the size of pixel.

Problem – 5



When it comes to analysing signals it is a mere waste of time to just look at the time series signal and say that what we have is a smoother signal or not. For that Frequency domain analysis is very usefull, Basically noise can be any High frequency signal which is coming from outside so we can deduce that the signal with less high frequency signals is more smooth.As here in the firgure I have plotted the Fourier transform of the signal when passed through the filters and the first one on the top – left is the most noisy one. It is the original signal. The used filters are mentioned above the diagram and it is evident that the filters in last row did really well. The sgloy filter worked the best in this case closely followed by rloess.