

Report - Assignment 1

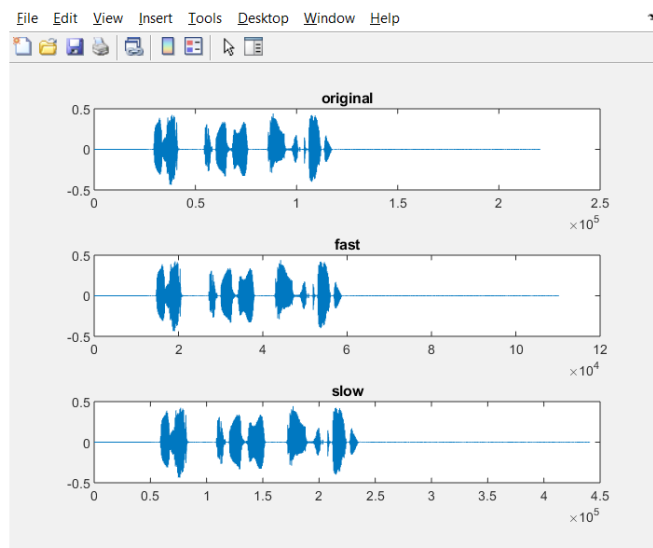
Digital Signal Analysis & Applications

Question 1:

i. I have used `downsample` to take alternate values in the audio data array. As a result the size of array decreases, and speed of audio signal increases.

ii. `Resample` function has been used to double the sampling and playing at original sampling frequency we get a half of original speed

(Resampling the data changes the frequency).



Question 2:

- i. Uncomment first part to record your voice.
- ii. I am using `audioplayer` to play/store at different frequencies.
- iii. I have used convolution to stimulate different environments like Small Church , Hot Hall and BigHall.

Question 3:

Normalized Correlation has been used to solve this problem.
The point/part which has the brightest spot or greatest value is chosen.

Image F1.jpg has a max correlation value of 0.9997.

Image F2.jpg has a max correlation value of 0.9849.

As F2.jpg is noisy so many points will have value close to the max correlation value. This may lead to incorrect answers, so the accuracy decreases.

We can improve accuracy by using smoothing functions to reduce noise in images.

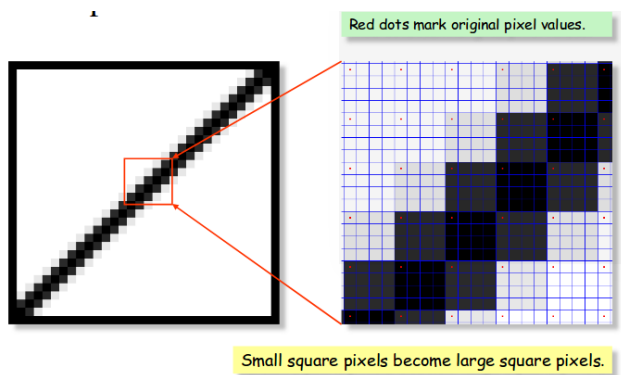
We can use functions like imnoise.

Certain filters, such as averaging or Gaussian filters, are appropriate for this purpose. For example, an averaging filter is useful for removing grain noise from a photograph. Because each pixel gets set to the average of the pixels in its neighborhood, local variations caused by grain are reduced.

Question 4:

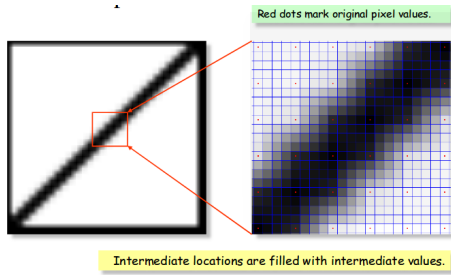
Nearest Neighbor Interpolation

The “Nearest Neighbor” algorithm is a generalization of pixel replication and decimation.



Bilinear Interpolation

In "Bilinear Interpolation" we fill the Intermediate locations with intermediate values.



Conclusion

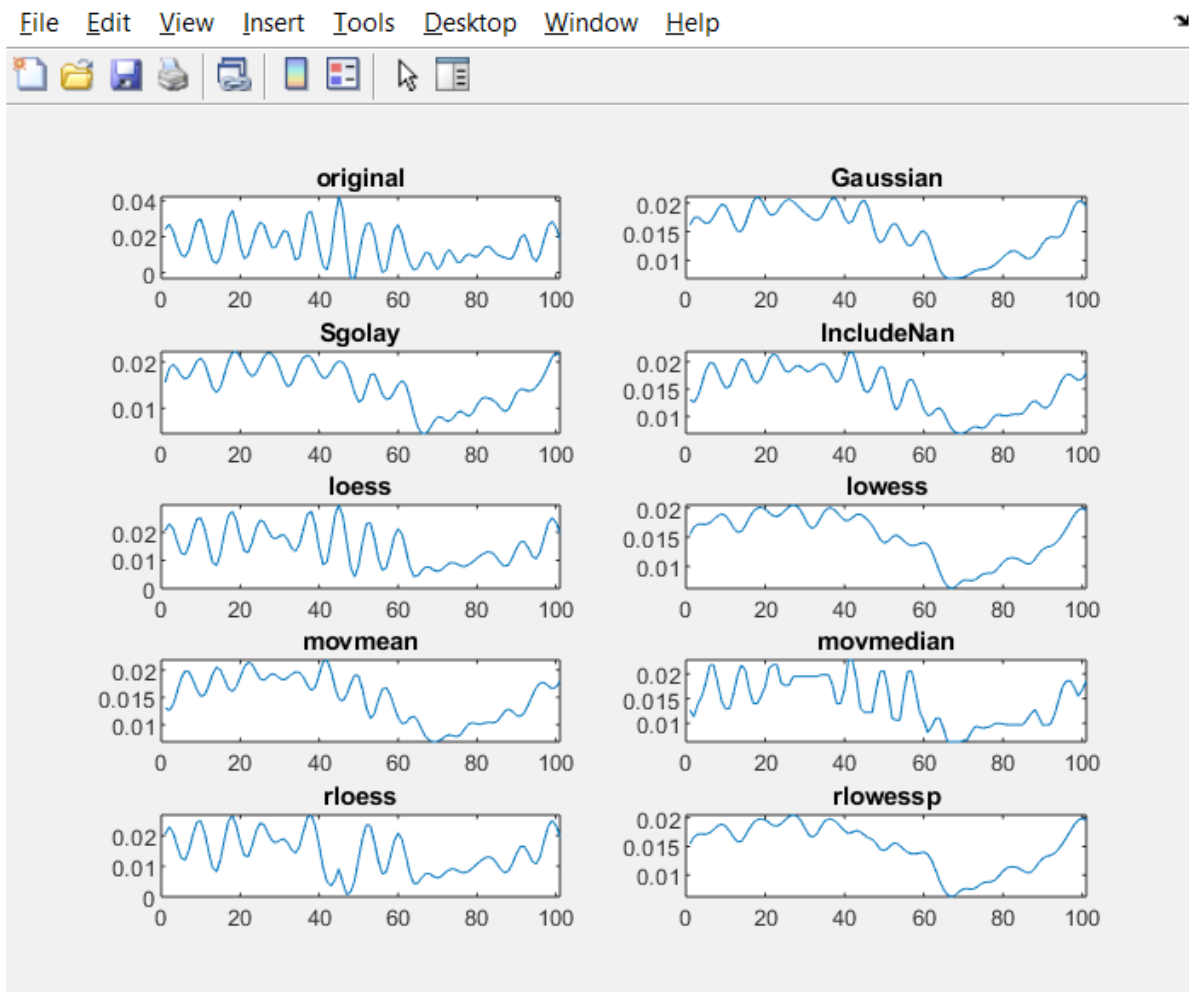
If we compare the output of both the functions. The Image with Bilinear Interpolation is better.

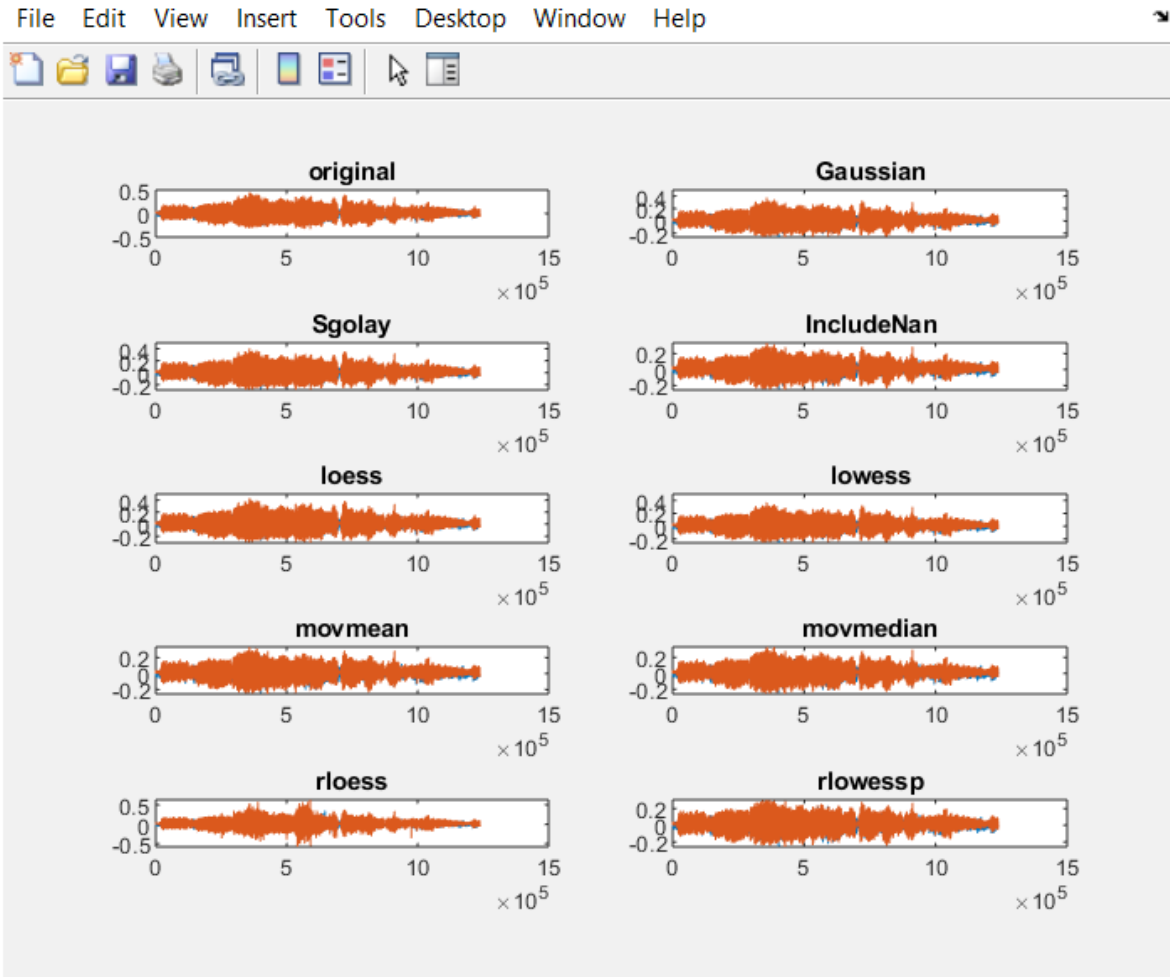
In Nearest neighbour interpolation algorithm value of the output cell is determined by the nearest cell center on the input grid. The algorithm is the most simple and fast algorithm. Nearest Neighbor is best used for categorical data like land-use classification or slope classification. It has the advantages of fast speed, but it can bring significant distortion.

Bilinear Interpolation uses a weighted average of the four nearest cell centers. The closer an input cell center is to the output cell center, the higher the influence of its value is on the output cell value. This means that the output value could be different than the nearest input, but is always within the same range of values as the input.

Bilinear interpolation method is more complex than the nearest neighbour method, and so it has larger calculation. It has no gray discontinuity defects and has satisfactory results.

Question 5:





The Sgolay filter is the best one to filter data as it is very efficient in smoothing the data in case of varying the data.

Savitzky-Golay smoothing filters (also called digital smoothing polynomial filters or least squares smoothing filters) are typically used to “smooth out” a noisy signal whose frequency span (without noise) is large. In this type of application, Savitzky-Golay smoothing filters perform much better than standard averaging FIR filters, which tend to filter out a significant portion of the signal's high frequency content along with the noise. Although Savitzky-Golay filters are more effective at preserving the pertinent high frequency components of the signal, they are less successful than standard averaging FIR filters at rejecting noise when noise levels are particularly high. The particular formulation of Savitzky-Golay filters preserves various moment orders better than other smoothing methods, which tend to preserve peak widths and heights better than Savitzky-Golay.