

Assignment 1

Digital Signal Analysis & Applications

January 14, 2019

- **Deadline is 23rd January 2019, 11:55 PM**
- All questions are compulsory. Follow the instructions carefully.
- All coding questions have to be done in MATLAB only.
- Ensure that submitted assignment is your original work. Please do not copy any part from any source including your friends, seniors and/or the internet. If any such attempt is caught then serious action will be taken.
- The submission - Roll number.zip - should contain the below files in the directory roll number with only 6 files : *q1.m*, *q2.m*, *q4.m*, *q5.m*, *Report.pdf*
- Report should contain details of algorithm implementation, results and observations and answers to the subjective questions (if any).
- You are expected to use vector operations in all your matlab codes.

Problem 1.

As we all know youtube has a speed increase and speed decrease button. When it is done for the sound we call it as either time stretching or speed reading. Now the task is to take your audio signal, increase and decrease the speed of signal by 2 times. Plot the signal and analyze the differences. (Note: Frequency of signal has to be constant)

Problem 2.

This problem has three parts:

- Read a wav file in MATLAB. It is originally sampled at 44.1kHz and has digitized at 24 bits. Play the sound. Also, record your own voice for this question.
- Subsample to 24kHz, 16kHz, 8kHz and 4kHz. Play the sound.
- Simulate it in three different environments using the concepts and examples considered in the class. You can download impulse response characterizing the system (environment) from the internet (use freely available resources like [cxsde](#)).

Problem 3.

Write a code in Matlab to spot the face given in *F1.jpg* inside the image *Faces.jpg*. Comment on whether your above approach would work if *Faces.jpg* is noisy. How would you modify your approach to incorporate noisy images like *F2.jpg*?

Problem 4.

Kishan is developing a software for image processing tools. While making it he got into a problem of resizing the image and comes to you for help. You have to make a function *RESIZE* which enlarges an image by a given extent. *RESIZE* takes two arguments *A* (Image matrix) and *X* (times the original image should be resized) (*X* is always a positive integer). It should return an image matrix *B* of the desired size. Resizing can be done using interpolation. Try to implement the above using:

- Nearest Neighbour Interpolation and
- Bilinear Interpolation.

Test your code on the following cases: 1) $X = 5$, 2) $X = 10$

Use the following images for testing purposes

1. Make a 300x300 size image using black and white curves on any software. It should have at least 1 ellipse and 1 polygon.
2. A black and white image of your choice.
3. A colored image of your choice.

Problem 5.

You have to read the file *sa_re_ga_ma.mp3* from the src directory. You can denoise it using [smoothdata](#) try various params and report the result that which method gave the best result and why?

Note: Try analysing the results using plot and also add plots in your answer report.