

Linear Algebra for Electrical Engineers

Homework I

Due 09/14 23:59

Please checkout the etl homework announcement for the submission format. Skeleton code is available at this link: <https://github.com/3dvision-snu/linear-algebra-2020-fall>

1. Setting up the colab environment (0.2 point)

Take the screenshot of problem 1 cell in the colab environment and add it to the report. Answer to problem 1 should look as below.

```
#### Problem 1 ####
import numpy as np
%matplotlib inline
from matplotlib import pyplot as plt
print('I love linear algebra')

I love linear algebra
```

2. Interpolation of two basis vectors (0.2 point)

Given two basis vectors $\mathbf{v} = (1, 1)$, $\mathbf{w} = (0, 2)$, linear interpolation of \mathbf{v} and \mathbf{w} is defined as $\{s | s = \alpha\mathbf{v} + \beta\mathbf{w}, \alpha + \beta = 1, \alpha, \beta \geq 0\}$. Plot the vectors of linear interpolation in equal interval using matplotlib library, with 10000 samples. Take the screenshot of the plot and attach it to the report.

3. Correlation Coefficient (0.2 point)

Given vectors $\mathbf{v} = (1, 2, 3)$, $\mathbf{w}_1 = (0, 0, 1)$, $\mathbf{w}_2 = (-1, 2, 2)$, $\mathbf{w}_3 = (3, 5, 3)$, $\mathbf{w}_4 = (4, 4, -3)$, compute the correlation coefficients between \mathbf{v} and \mathbf{w}_i s (4 correlation coefficients in total) using numpy. Take the screenshot of the result and attach it to the report. (Hint: If you use broadcasting, only 3 lines of code will be enough)

4. Net Present Value (0.2 point)

Suppose you are paid annually \$1 and the interest rate is 10%. What is the net present value (sum of salaries accounting interest rate) for 10 years of salary? Compute the result using numpy library.

5. Random Sampling and Plotting (0.2 point)

Suppose that you are a scientist repeating the same experiment 10,000 times to verify your argument. Each experiment comes with data of 100 samples, each sample containing 2-dimensional random values in $[0, 1]^2$ (total of 1,000,000 2-dimensional data). Plot the histogram of **mean of each experiment** with bin size of 100. Since 2 dimensional histograms are hard to draw, plot 2 histograms, each indicating the first and second dimension of data. Take the screenshot of 2 histograms and attach it to the report. The histograms should look something like below. (Hint: use `numpy.mean()` with some axis given as an argument)

