**Name: Kevin Chacko Abraham**

**Roll No: 13**

**Batch: B**

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**DATA SCIENCE LAB**

**Experiment No.: 1**

**Aim**

Aim: To implement

(a) Matrix operations (using vectorization),

(b) transformation using python and

(c) SVD using Python.

**Procedure**

**a)1 Matrix operations**

import numpy as np

a = np.array([1, 2, 3]) # Create a rank 1 array

print("type: %s" %type(a)) # Prints "<class 'numpy.ndarray'>"

print("shape: %s" %a.shape) # Prints "(3,)"

print(a[0], a[1], a[2]) # Prints "1 2 3"

a[0] = 5 # Change an element of the array

print(a) # Prints "[5, 2, 3]"

b = np.array([[1,2,3],[4,5,6]]) # Create a rank 2 array

print("\n shape of b:",b.shape) # Prints "(2, 3)"

print(b[0, 0], b[0, 1], b[1, 0]) # Prints "1 2 4"

a = np.zeros((2,2)) # Create an array of all zeros

print("All zeros matrix:\n %s" %a) # Prints "[[ 0. 0.] # [ 0. 0.]]"

b = np.ones((1,2)) # Create an array of all ones

print("\nAll ones matrix:\n %s" %b) # Prints "[[ 1. 1.]]"

d = np.eye(2) # Create a 2x2 identity matrix

print("\n identity matrix: \n%s"%d) # Prints "[[ 1. 0.]

# [ 0. 1.]]"

e = np.random.random((2,2)) # Create an array filled with random values

print("\n random matrix: \n%s"%e)

**a)2**

#vectorized sum

print("Vectorized sum example\n")

x = np.array([[1,2],[3,4]])

print("x:\n %s" %x)

print("sum: %s"%np.sum(x))  # Compute sum of all elements; prints "10"

print("sum axis = 0: %s" %np.sum(x, axis=0))  # Compute sum of each column; prints "[4 6]"

print(" sum axis = 1: %s" %np.sum(x, axis=1))  # Compute sum of each row; prints "[3 7]"

#matrix dot product

a = np.arange(10000)

b = np.arange(10000)

dp = np.dot(a,b)

print("Dot product: %s\n" %dp)

#outer product

op = np.outer(a,b)

print("\n Outer product: %s\n" %op)

#elementwise product

ep = np.multiply(a, b)

print("\n Element Wise product: %s \n" %ep)

**b) Matrix transformation**

import numpy as np

x = np.array([[1,2], [3,4]])

print("Original x: \n%s " %x)    # Prints "[[1 2]

            #          [3 4]]"

print("\nTranspose of x: \n%s" %x.T)  # Prints "[[1 3]

            #          [2 4]]"

**c) SVD using python**

# Singular-value decomposition

from numpy import array

from scipy.linalg import svd

# define a matrix

A = array([[1, 2], [3, 4], [5, 6]])

print("A: \n%s" %A)

# SVD

U, s, VT = svd(A)

print("\nU: \n%s" %U)

print("\ns: \n %s" %s)

print("\nV^T: \n %s" %VT)

**Output Screenshot**

type: <class 'numpy.ndarray'>

shape: 3

1 2 3

[5 2 3]

shape of b: (2, 3)

1 2 4

All zeros matrix:

[[0. 0.]

[0. 0.]]

All ones matrix:

[[1. 1.]]

identity matrix:

[[1. 0.]

[0. 1.]]

random matrix:

[[0.19450703 0.60931147]

[0.71466669 0.22569737]]

a.1

Vectorized sum example

x:

[[1 2]

[3 4]]

sum: 10

sum axis = 0: [4 6]

sum axis = 1: [3 7]

Dot product: 333283335000

Outer product: [[ 0 0 0 ... 0 0 0]

[ 0 1 2 ... 9997 9998 9999]

[ 0 2 4 ... 19994 19996 19998]

...

[ 0 9997 19994 ... 99940009 99950006 99960003]

[ 0 9998 19996 ... 99950006 99960004 99970002]

[ 0 9999 19998 ... 99960003 99970002 99980001]]

Element Wise product: [ 0 1 4 ... 99940009 99960004 99980001]

**b)**

Original x:

[[1 2]

[3 4]]

Transpose of x:

[[1 3]

[2 4]]

**C)**

A:

[[1 2]

[3 4]

[5 6]]

U:

[[-0.2298477 0.88346102 0.40824829]

[-0.52474482 0.24078249 -0.81649658]

[-0.81964194 -0.40189603 0.40824829]]

s:

[9.52551809 0.51430058]

V^T:

[[-0.61962948 -0.78489445]

[-0.78489445 0.61962948]]