

Experiment 19

Aim: - Develop a Python script to create two arrays of the same shape and perform element-wise addition, subtraction, multiplication, and division. Calculate the dot product and cross product of two vectors.

Theory

1. Element-wise Operations

Given two arrays of the same shape, NumPy performs operations on corresponding elements:

- Addition: $C = A + B$
- Subtraction: $C = A - B$
- Multiplication: $C = A \times B$
- Division: $C = A/B$

2. Dot Product

The dot product of two vectors **A** and **B** is:

$$A \cdot B = A_1B_1 + A_2B_2 + A_3B_3 + \dots + A_nB_n$$

Used in physics, AI, and computer graphics.

3. Cross Product

The cross product of two 3D vectors results in a perpendicular vector:

$$A \times B = (A_2B_3 - A_3B_2, A_3B_1 - A_1B_3, A_1B_2 - A_2B_1)$$

Used in physics and 3D modeling.

Algorithm: Array Operations & Vector Products

1. Initialize Two Arrays

- Create two NumPy arrays of the same shape.

2. Perform Element-wise Operations

- Addition: Add corresponding elements of both arrays.
- Subtraction: Subtract corresponding elements of both arrays.

- Multiplication: Multiply corresponding elements of both arrays.
- Division: Divide corresponding elements of both arrays.

3. Print the Results

- Display the results of all element-wise operations.

4. Define Two Vectors

- Create two 1D NumPy arrays (vectors).

5. Compute Dot Product

- Use the dot function to calculate the dot product of the two vectors.

6. Compute Cross Product

- Use the cross function to calculate the cross product of the two vectors.

7. Print the Results

- Display the dot product and cross product.

Code

```
import numpy as np
```

```
# Creating two arrays of the same shape
```

```
array1 = np.array([[1, 2, 3], [4, 5, 6]])
```

```
array2 = np.array([[6, 5, 4], [3, 2, 1]])
```

```
# Element-wise operations
```

```
addition = array1 + array2
```

```
subtraction = array1 - array2
```

```
multiplication = array1 * array2
```

```
division = array1 / array2
```

```
# Printing results
```

```
print("Element-wise Addition:\n", addition)
```

```
print("Element-wise Subtraction:\n", subtraction)
print("Element-wise Multiplication:\n", multiplication)
print("Element-wise Division:\n", division)
```

```
# Define two vectors
vector1 = np.array([1, 2, 3])
vector2 = np.array([4, 5, 6])
```

```
# Dot product
dot_product = np.dot(vector1, vector2)
print("Dot Product:", dot_product)
```

```
# Cross product
cross_product = np.cross(vector1, vector2)
print("Cross Product:\n", cross_product)
```

Ouput