

Training Day 7 Report

Date: 1 July 2025

Topic: Introduction to NumPy Library

Overview:

The session focused on **NumPy (Numerical Python)**, a powerful Python library used for **numerical computation, array operations, and matrix manipulations**. NumPy is widely used in **data science, machine learning, and scientific computing** due to its efficiency and speed.

Key Concepts Covered:

1. NumPy Basics

Installed and imported NumPy:

```
import numpy as np
```

- **Array creation:**
 - `np.array()` → Creates array from lists.
 - `np.arange(start, end)` → Creates range of values.
 - `reshape()` → Reshapes array dimensions.

```
arr = np.array([[0.0, 0.0], [0.0, 0.0]])  
arr2 = np.array([[1.0]*5]*5)
```

2. Array Properties

- `ndim` → Dimensions of array
- `shape` → Rows & columns
- `size` → Total number of elements

3. Special Arrays

- **Ones Array:** `np.ones((5,5))`
- **Zeros Array:** `np.zeros((3,3))`
- **Range Array:** `np.arange(12,39)`
- Reverse array using slicing `[::-1]`

4. Operations on Arrays

- **Mathematical operations:** addition, subtraction, multiplication with scalars.

Example:

```
a = np.ones((5,5))  
a[1:-1,1:-1] = 0 # Hollow square
```

- **Logical Indexing:**
Arrays can be modified using conditions and slicing.

Sample Programs from Practice:

- ✓ Creating a **5×5 matrix of ones**
- ✓ Creating a **3×3 matrix of zeros**
- ✓ Using `np.arange` for sequences
- ✓ Reversing an array with slicing
- ✓ Creating **patterns (like hollow square, checkerboard)**

Summary:

- Learned to install and import NumPy.
- Explored **array creation methods** (`array`, `arange`, `ones`, `zeros`).
- Practiced **reshaping, slicing, and reversing arrays**.
- Created **patterns using NumPy arrays**.
- Understood the importance of **NumPy in numerical and data computations**.

Learning Outcomes:

- ✓ Ability to create and manipulate **1D and 2D arrays**.
- ✓ Understanding of **array properties (ndim, shape, size)**.
- ✓ Knowledge of **special arrays (zeros, ones, arange)**.
- ✓ Ability to apply **slicing and indexing** to manipulate array values.
- ✓ Learned to generate **patterns like hollow squares and checkerboards** using NumPy.