



KANIKA CHOUHAN

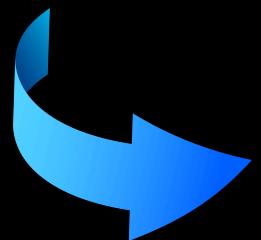
Key Numpy Functions in Data Analysis



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1. Array Creation

- **np.array():** Converts a list, tuple, or other data structure into a NumPy array. It forms the foundation for working with arrays in NumPy.
- **np.zeros():** Creates an array filled with zeros. Commonly used to initialize arrays when you know the shape but not the content.
- **np.ones():** Similar to zeros(), but fills the array with ones instead. Useful for initializing arrays where a default value of 1 is required.
- **np.arange():** Generates an array of evenly spaced values within a given range. Useful for creating sequences of numbers.
- **np.linspace():** Generates a specified number of evenly spaced numbers over a given interval, useful for defining ranges with a specific number of elements.



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```
import numpy as np

# Create a 1D array from a list
arr = np.array([1, 2, 3, 4, 5])

# Create an array of zeros
arr_zeros = np.zeros((3, 3))

# Create an array of ones
arr_ones = np.ones((2, 4))

# Create an array with a range of numbers
arr_range = np.arange(0, 10, 2)

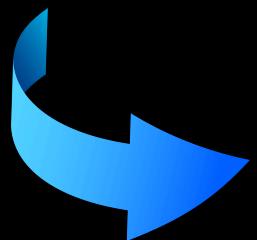
# Create an array of evenly spaced numbers
arr_linspace = np.linspace(0, 1, 5)
```



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2. Mathematical Operations

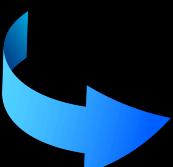
- **np.add():** Performs element-wise addition of two arrays.
- **np.subtract():** Performs element-wise subtraction of one array from another.
- **np.multiply():** Multiplies elements of two arrays element by element for scalar or matrix multiplication.
- **np.divide():** Divides elements of one array by the corresponding elements in another.
- **np.exp():** Computes the exponential (e^x) of each element in the array.
- **np.sqrt():** Computes the square root of each element in the array..
- **np.log():** Computes the natural logarithm (base e) of each element in the array.



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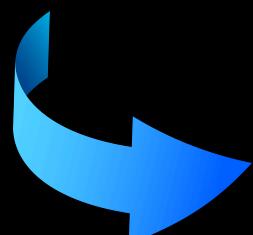
```
# Element-wise addition  
arr_sum = np.add(arr1, arr2)  
  
# Element-wise subtraction  
arr_diff = np.subtract(arr1, arr2)  
  
# Element-wise multiplication  
arr_mult = np.multiply(arr1, arr2)  
  
# Element-wise division  
arr_div = np.divide(arr1, arr2)  
  
# Exponentiation  
arr_exp = np.exp(arr)  
  
# Square root of each element  
arr_sqrt = np.sqrt(arr)  
  
# Logarithm of each element  
arr_log = np.log(arr)
```



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3. Statistical Functions

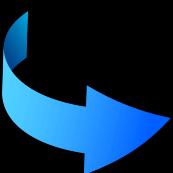
- **np.mean(): Calculates the arithmetic mean (average) of the array elements.** It's useful for summarizing the central tendency of data.
- **np.median(): Finds the median of the array, which is helpful when you want to analyze the midpoint of the data distribution.**
- **np.std(): Computes the standard deviation, a measure of how spread out the data is.** Often used for variability analysis.
- **np.var(): Calculates the variance, another measure of the spread of data, often used in conjunction with standard deviation.**
- **np.min(): Finds the minimum value within the array,**
- **np.max(): Finds the maximum value in the array,**
- **np.sum(): Adds up all the elements in the array.**



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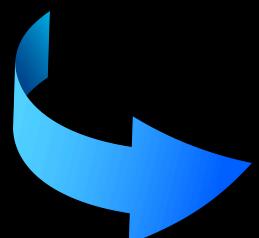
```
# Mean of the array  
mean_val = np.mean(arr)  
  
# Median of the array  
median_val = np.median(arr)  
  
# Standard deviation  
std_val = np.std(arr)  
  
# Variance of the array  
var_val = np.var(arr)  
  
# Minimum value in the array  
min_val = np.min(arr)  
  
# Maximum value in the array  
max_val = np.max(arr)  
  
# Sum of all elements in the array  
total_sum = np.sum(arr)
```



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4. Array Reshaping

- **np.reshape():** Reshapes an array i. e. modify the dimensions without changing its data,
- **np.flatten():** Converts a multi-dimensional array into a one-dimensional array.
- **np.concatenate():** Joins two or more arrays along an existing axis.
- **np.vstack():** Stacks arrays vertically (row-wise), useful for combining arrays into a larger 2D array.
- **np.hstack():** Stacks arrays horizontally (column-wise), helping to append arrays side-by-side for analysis.
- **np.transpose():** Swaps the axes of an array
- **np.sort():** Sorts the elements of an array,





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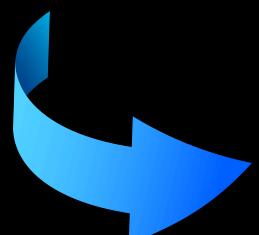
```
# Reshape array  
arr_reshaped = np.reshape(arr, (3, 2))  
  
# Flatten the array to 1D  
arr_flattened = arr.flatten()  
  
# Concatenate two arrays  
arr_concat = np.concatenate((arr1, arr2))  
  
# Stack arrays vertically (row-wise)  
arr_vstack = np.vstack((arr1, arr2))  
  
# Stack arrays horizontally (column-wise)  
arr_hstack = np.hstack((arr1, arr2))  
  
# Transpose of the array  
arr_transpose = np.transpose(arr)  
  
# Sort elements in the array  
arr_sorted = np.sort(arr)
```

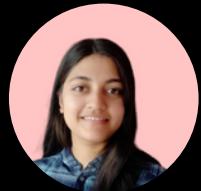


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5. Random No. Generation

- **np.random.rand():** Generates an array of random floats between 0 and 1.
- **np.random.randint():** Generates random integers within a specified range.
- **np.random.randn():** Produces random numbers from the standard normal distribution (mean=0, std=1), essential for modeling statistical processes.
- **np.random.shuffle():** Randomly shuffles the elements of an array along the first axis.
- **np.random.choice():** Selects random elements from an array.





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```
# Generate random numbers between 0 and 1
rand_arr = np.random.rand(3, 3)

# Generate random integers within a range
rand_int_arr = np.random.randint(0, 10, size=(3, 3))

# Generate random numbers from a normal distribution
rand_normal_arr = np.random.randn(3, 3)

# Shuffle the array in-place
np.random.shuffle(arr)

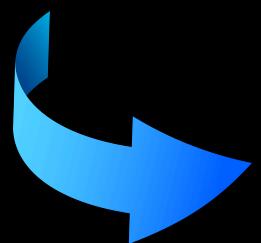
# Generate a random choice from an array
rand_choice = np.random.choice(arr)
```

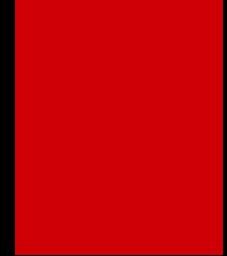
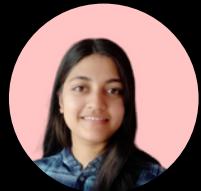


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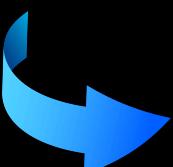
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6. Linear Algebra

- **np.dot():** Computes the dot product between two arrays (vectors or matrices).
- **np.matmul():** Performs matrix multiplication between two 2D arrays,
- **np.equal():** Compares two arrays element by element and returns a boolean array indicating where elements are equal.
- **np.cumsum():** Returns the cumulative sum of array elements, useful in financial and time-series analysis where cumulative totals matter.
- **np.cumprod():** Returns the cumulative product of array elements, often used in statistical models and simulations.





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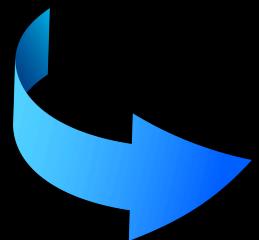
```
# Dot product of two arrays  
dot_product = np.dot(arr1, arr2)  
  
# Matrix multiplication  
mat_mult = np.matmul(arr1, arr2)  
  
# Element-wise comparison (returning boolean array)  
arr_equal = np.equal(arr1, arr2)  
  
# Cumulative sum of elements  
cumsum_arr = np.cumsum(arr)  
  
# Cumulative product of elements  
cumprod_arr = np.cumprod(arr)
```

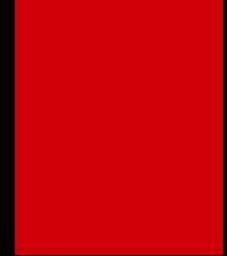


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7. Indexing & Slicing

- **np.array[index]:** Accesses elements in an array by index, a basic but essential operation for working with data in NumPy.
- **array[start:end]:** Slices arrays, allowing you to extract subarrays or specific ranges of data.
- **Boolean Indexing:** Filters an array using a condition to return a subset of elements that meet that condition. This is useful for data filtering and cleaning.
- **Fancy Indexing:** Selects specific elements using lists or arrays of indices, providing more flexibility for subsetting data.



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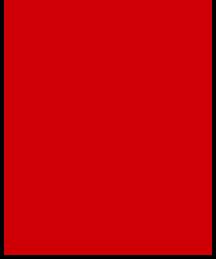


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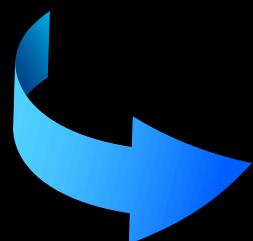
```
# Index a specific element  
element = arr[2]  
  
# Slice the array  
arr_slice = arr[1:4]  
  
# Boolean indexing (filtering based on a condition)  
arr_bool = arr[arr > 2]  
  
# Fancy indexing  
arr_fancy = arr[[0, 2, 4]]
```

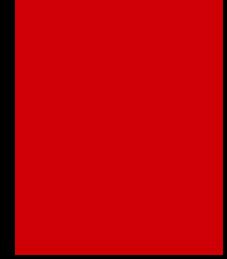


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8. Broadcasting

- **Broadcasting:**
- **A powerful feature that allows NumPy to perform element-wise operations between arrays of different shapes.**
- **This reduces the need for manual array resizing and simplifies code.**
- **For example, adding a scalar to an array adds the scalar to each element of the array automatically.**



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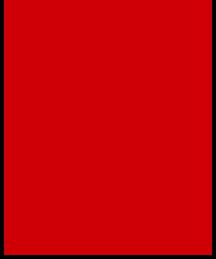


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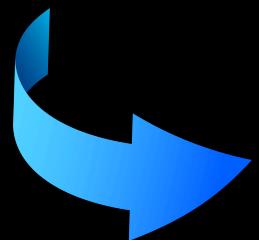
```
# Broadcasting: add a scalar to each element in the array
arr_broadcast = arr + 10
```



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