Data Structures

Lecture 3
Multidimensional Array

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MultiDimensional Array (Initialize)

1. 1D Array

   ```
   array1D = np.zeros(5)
   ```

1. 2D Array

   ```
   array2D = np.zeros((5,2))
   ```

1. 3D Array

   ```
   array3D = np.zeros(?)
   ```

MultiDimensional Array (Initialize)

1. 1D Array

   ```
   array1D = np.array([1,2])
   ```

1. 2D Array

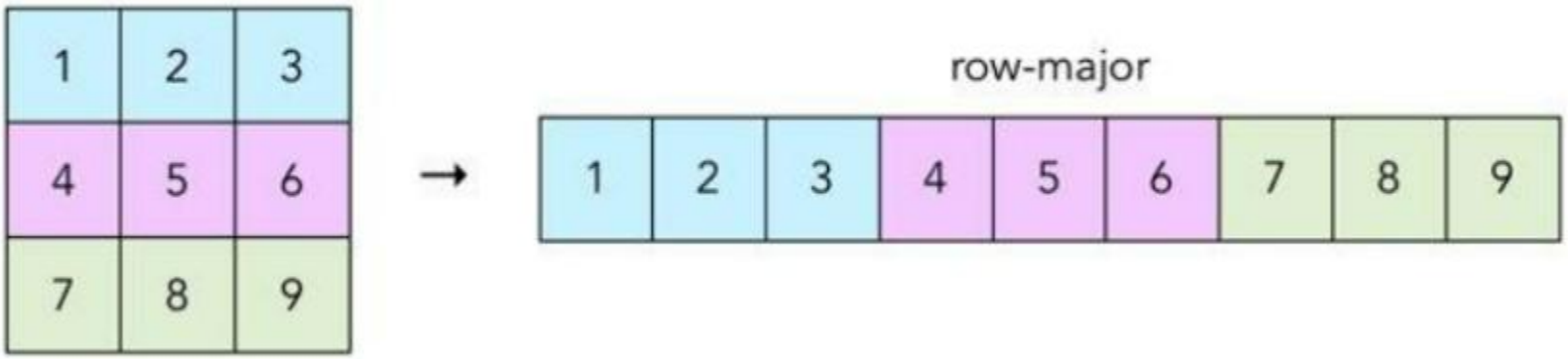
   ```
   array2D = np.array([[1,2], [3,4]])
   ```

1. 3D Array

   ```
   array3D = np.array(?)
   ```

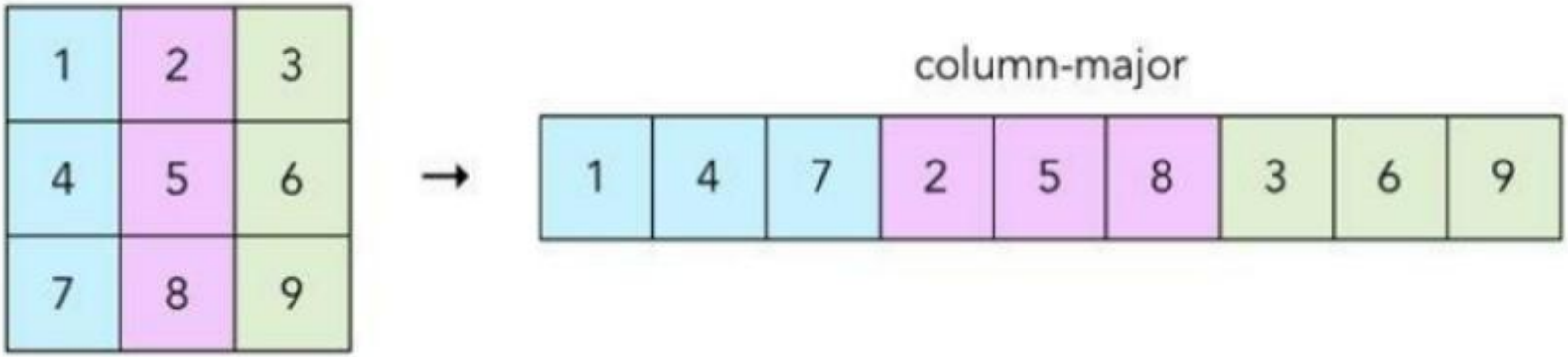
MultiDimensional Array (In Memory)

1. Row Major Ordering



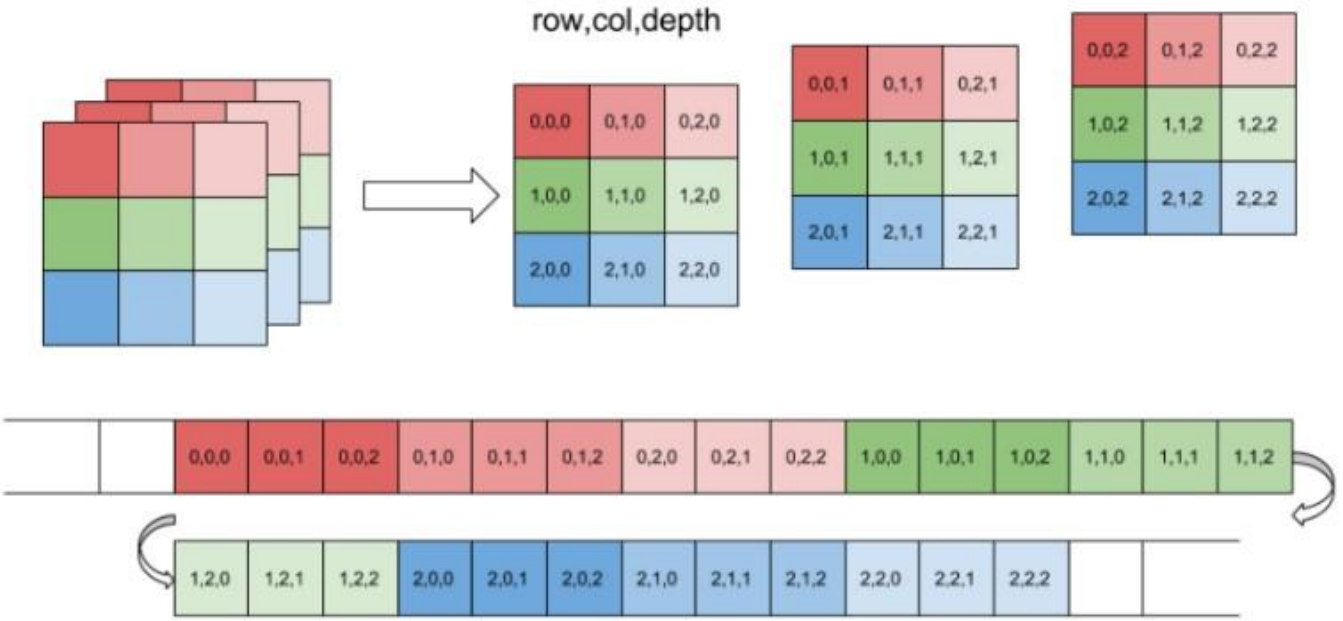
MultiDimensional Array (In Memory)

2. Column Major Ordering



MultiDimensional Array (In Memory)

3D Array



MultiDimensional Array (Index Finding)

3D Array

arr[M][N][O]

arr[1][2][2]

1*N*O + 2*O + 2

MultiDimensional Array (Index Finding)

4D Array

arr[M][N][O][P]

MultiDimensional Array (Reverse Indexing)

3D Array

arr[M][N][O]

M = 4

N= 4

O = 8

Location 111

MultiDimensional Array (Reverse Indexing)

3D Array

$$111 = M * (4*8) + N * 8 + O$$

MultiDimensional Array (Reverse Indexing)

3D Array

$$111 = M * (4*8) + N * 8 + O$$

X = 111//(4*8) = 3 and 111 % (4*8) = 15

Y = 15 // 8 = 1 and 15 % 8 = 7

Z = 7

MultiDimensional Array (Reverse Indexing)

3D Array

96, 107, 60

MultiDimensional Array (Iteration - array)

2D Array

MultiDimensional Array (Iteration - array)

```
import numpy as np

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

for x in arr:
  print(x)
```

MultiDimensional Array (Iteration - element)

2D Array

MultiDimensional Array (Iteration - element)

```
import numpy as np

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

for x in arr:
  for y in x:
    print(y)
```

MultiDimensional Array (Iteration - element)

3D Array

MultiDimensional Array (Iteration - element)

```
import numpy as np

arr = np.array([[[1, 2, 3], [4, 5, 6]],
                [[7, 8, 9], [10, 11, 12]]])

for x in arr:
  for y in x:
    for z in y:
      print(z)
```

MultiDimensional Array (Iteration)

NumPy Array Iterating (w3schools.com)

MultiDimensional Array (Multiply Matrices)

```
matrix1 = [[12,7,3],
          [4 ,5,6],
          [7 ,8,9]]
matrix2 = [[5,8,1],
          [6,7,3],
          [4,5,9]]
```

MultiDimensional Array (Multiply Matrices)

```
for i in range(len(matrix1)):
    for j in range(len(matrix2[0])):
        for k in range(len(matrix2)):

            # resulted matrix
            res[i][j] += matrix1[i][k] * matrix2[k][j]
```

MultiDimensional Array (Multiply Matrices)

Multiply Matrices (Geeks for Geeks)