**DATA SCIENCE – BWT – WEEK – 8**

**TASK – 19**

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**Introduction to Neural Networks , Tensor Operations**

**Introduction to Neural Networks**

Neural networks are a subset of machine learning and are the foundation of deep learning algorithms. They are inspired by the structure and function of the human brain, consisting of interconnected layers of nodes (or neurons), each performing a specific computation. The primary goal of a neural network is to learn from data, recognize patterns, and make decisions based on that learning.

**Key Concepts:**

1. **Neuron (Node):** The basic unit of a neural network that receives input, processes it, and passes it to the next layer.
2. **Layers:** Neural networks consist of an input layer, hidden layers, and an output layer.

* **Input Layer:** Receives the initial data.
* **Hidden Layers:** Intermediate layers that perform complex computations and transformations.
* **Output Layer:** Produces the final prediction or decision.

1. **Weights and Biases:** Weights are parameters that adjust the input data's significance. Biases shift the input to help the model fit better.
2. **Activation Function:** Introduces non-linearity into the network, allowing it to learn more complex patterns.

**Tensor Operations in Neural Networks**

Tensors are multidimensional arrays used as the fundamental data structure in neural networks. They generalize scalars (0D), vectors (1D), and matrices (2D) to higher dimensions.

**Key Tensor Operations:**

1. **Tensor Creation:** Tensors can be created from lists, arrays, or directly using libraries like NumPy or TensorFlow.
2. **Element-wise Operations:** Operations applied to each element of the tensor independently, such as addition, subtraction, multiplication, and division.
3. **Matrix Multiplication:** A crucial operation in neural networks, particularly in connecting layers.
4. **Reshaping:** Changing the shape of a tensor without altering its data.
5. **Broadcasting:** Automatically expanding tensors to have compatible shapes for element-wise operations.

**Conclusion:**

Neural networks use tensors to handle the data and perform operations necessary for learning and prediction. Understanding tensor operations is essential for building and optimizing neural networks, enabling them to process complex, high-dimensional data efficiently.