# Computer Vision and Pattern Recognition

## Assignment-2

## Topic: Activation Function

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1. Step Activation Function:
   - The step activation function returns 0 for any input value less than or equal to 0, and 1 for any input value greater than 0.
   - The step function is useful for binary classification problems and simple linear regression models.
   - The step function is not differentiable, making it difficult to use with gradient-based optimization algorithms such as backpropagation.
2. Sigmoid Activation Function:
   - The sigmoid activation function returns a value between 0 and 1 for any input value, making it useful for binary classification problems.
   - The sigmoid function suffers from the vanishing gradient problem, which can slow down or prevent convergence during training.
   - The sigmoid function has a simple mathematical form and is easy to implement using NumPy.
3. Tanh Activation Function:
   - The tanh activation function returns a value between -1 and 1 for any input value, making it useful for both binary classification and regression problems.
   - The tanh function suffers from the vanishing gradient problem, which can slow down or prevent convergence during training.
   - The tanh function has a more complex mathematical form than the sigmoid function but is still easy to implement using NumPy.
4. ReLU Activation Function:
   - The ReLU activation function returns 0 for all negative input values and the input value itself for all positive input values, making it useful for improving the performance of deep neural networks.
   - The ReLU function does not suffer from the vanishing gradient problem, and its sparsity property can help with reducing overfitting.
   - The ReLU function is easy to implement using NumPy, and its derivative can be computed analytically.
5. ELU Activation Function:
   - The ELU activation function is similar to the ReLU function, but it returns a small negative value for any negative input value, making it useful for reducing the vanishing gradient problem.
   - The ELU function has a more complex mathematical form than the ReLU function, but it is still easy to implement using NumPy.
   - The ELU function has been shown to outperform the ReLU function on some deep learning tasks.
6. SELU Activation Function:
   - The SELU activation function is a self-normalizing version of the ReLU function, designed to reduce the vanishing and exploding gradient problem in deep neural networks. o  The SELU function has a more complex mathematical form than the ReLU function or ELU function, but it is still easy to implement using NumPy.

- The SELU function has been shown to outperform other activation functions on some deep learning tasks.

Each of these activation functions has its own strengths and weaknesses and can be implemented using NumPy. The choice of activation function depends on the specific problem and the architecture of the neural network being used. While the ReLU activation function is currently the most commonly used activation function in deep learning, recent research has shown that other activation functions, such as the ELU and SELU functions, can outperform ReLU on some tasks.