Homework – 1
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Problem Statement:

Evaluate the effectiveness of replacing sigmoid functions by piecewise linear functions consisting of a fixed number (n>2) of linear segments, each of which has a constant gradient, and only the first and last segments have gradient 0.

Implemented Details:

-   Used Diabetes Data Set from UCI database which uses class variable to show whether person has diabetes or not based 8 attributes
-   Used 'Keras' library. It uses sequential feedforward network and backpropagation. Using those build 8-16-1 feedforward neural networks.

    First build model and used "Sigmoid" as activation function using backpropagation. Then for linear piecewise function n=4 linear segments, first plotted points on sigmoid and using those points calculated equations for line segments. Then for each equation of line defined one function. Then used "Keras backend switch" to check range of values regarding specific values which divides plot in equal number (here its 4). Then called this custom activation function inside "Dense". Then trained model with training data and results are noted.
    Similar process followed for linear piecewise functions with n = (6, 8, 10, 12, 14).

Best Results and Computation efforts:

Activation Function	Accuracy	Loss
Sigmoid	77.92%	0.1484
Piecewise Linear (n=4)	65.58%	0.2025
Piecewise Linear (n=6)	66.88%	0.1902
Piecewise Linear (n=8)	66.88%	0.194
Piecewise Linear (n=10)	70.78%	0.2317
Piecewise Linear (n=12)	68.83%	0.2401
Piecewise Linear (n=14)	69.48%	0.1998

- Accuracy and Loss (Mean Square Error) were noted for each of different model. While training each model values for batch size = 10 and epochs = 150 are used.

Comparison Conclusion:

- After comparing results from both of activation functions that is sigmoid and linear piecewise (n = (4,6,8,10,12,14)), we can see that accuracy of model which uses sigmoid activation function is better that piecewise linear functions. Loss is also comparatively lower for sigmoid function.
- Even though we have plotted linear piecewise functions on sigmoid still these are linear segments in shape of sigmoid. So we are not getting exact same performance as sigmoid. Piecewise linear functions are easier to compute than nonlinear function but performance of nonlinear function is proved to be better.