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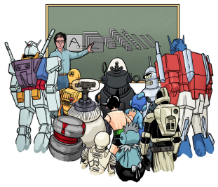

Training Artificial Neural Networks

Ozgur Gulsuna

[a]*Middle East Technical University, Electrical and Electronics Engineering, Ankara, Turkey*

Introduction

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1. Basic Concepts

Here introduce the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 10 pt. Here follows further instructions for authors.

1.1. Which Function ?

An ANNs classifier that is trained with cross-entropy loss approximates the conditional probability distribution function. More specifically, for an input data, the output of the classifier is a probability distribution for the classes. The cross-entorpy loss function is a measure between the predicted probability distribution and the true distribution. The form of the loss function is decreasing, smooth and differentiable, which makes it easier to optimize using gradient-based methods. This form is also known as the negative log-like function.

1.2. Gradient Computation

1.3. Some Training Parameters and Basic Parameter Calculations

1. The batch refers to a subset of the training data that is used to compute the weights for one iteration. More specifically, the batch size is the number of training samples in a batch. The epoch on the other hand refers to the number of times the entire training data is used to update the weights. In training, there are generally multiple epoch iterations where the weights are updated with different batches/subsets of the training data.
2. For the N number of training samples, the number of batches per epoch is N/B, where B is the batch size. A little side note that the solution is rounded up to the higher integer if N/B is not an integer.
3. For the loss calculation iterations, such as SGD, for E number of epochs, the total number of iterations is $E \times N/B$. Again, a practical side note states that the N/B is rounded up to the higher integer.

E-mail address: ozgur.gulsuna@metu.edu.tr

1.4. ***Computing Number of Parameters of ANN Classifiers***

1. Starting from the initial layer of the MLP, we have D_{in} number of input neurons and H_1 number of neurons in first hidden layer. Also there are biases associated with each neuron. Therefore, the number of parameters of the each layer is,

$$\begin{aligned} \text{Input Layer} &= D_{in} \cdot H_1 \ + \ H_1 \\ \text{Hidden Layers} &= H_1 \cdot H_2 + H_2 \\ &\cdots \\ \text{More Hidden Layers} &= H_{k-1} \cdot H_k + H_k \\ \text{Output Layer} &= H_k \cdot D_{out} \ + \ D_{out} \end{aligned}$$

   The total sum can be written as, $D_{in} \cdot H_1 + \sum_{k=2}^{K}(H_{k-1} \cdot H_k + H_k) + H_k \cdot D_{out} + D_{out}$, where K is the number of hidden layers.
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1.5. *Implementing a Convolutional Layer with NumPy*

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Fig. 1. (a) first picture; (b) second picture.

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$$\begin{aligned} X_r &= \dot{Q}''_{rad} \Big/ \left(\dot{Q}''_{rad} + \dot{Q}''_{conv}\right) \\ \rho &= \frac{\vec{E}}{J_c(T = \text{const.}) \cdot \left(P \cdot \left(\frac{\vec{E}}{E_c}\right)^m + (1 - P)\right)} \end{aligned} \tag{1}$$

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References

[1] Filippini, Massimo, and Lester C. Hunt. (2011) "Energy demand and energy efficiency in the OECD countries: a stochastic demand frontier approach." *Energy Journal* **32** (2): 59–80.
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