CSE 344: Computer Vision

Homework 16 ; Arka Sarkar 2018222

Question : Differentiate between Multi-class classification and Multi-label classification.

Answer :

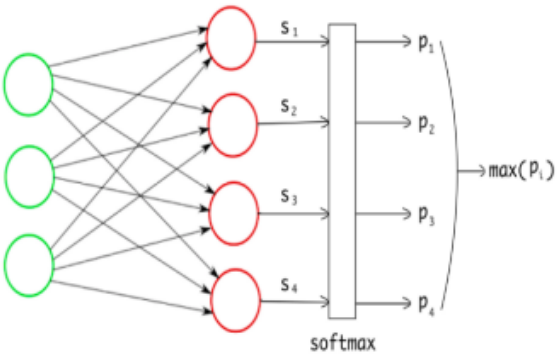
Multiclass classification is a classification task with more than two classes.. Multiclass classification only assigns one label to each sample. For training purposes of a multiclass classification problem , each label is represented as a one hot vector with only a single 1 (that is the positive class) and all other zeros.

Eg : label = [0 0 0 0 0 1 0 0 0 0 0] is a one hot vector with single 1.

An example of a Multi Class Classification : Given an image - Classification between dog, cat, human and frog. (An image can have only one label).

The final layer of the deep learning network in multiclass classification is always the softmax layer. The softmax layer converts the final layer values into probabilities to compare with the ground truth label.

Loss function that is used is the Categorical Cross Entropy Loss.



$$\sigma(\vec{z})_i = \frac{e^{z_i}}{\sum_{j=1}^{K} e^{z_j}}$$

Softmax Layer (MultiClass)

$$-\sum_{c=1}^{M} y_{o,c} \log(p_{o,c})$$

Loss Function (MultiClass)

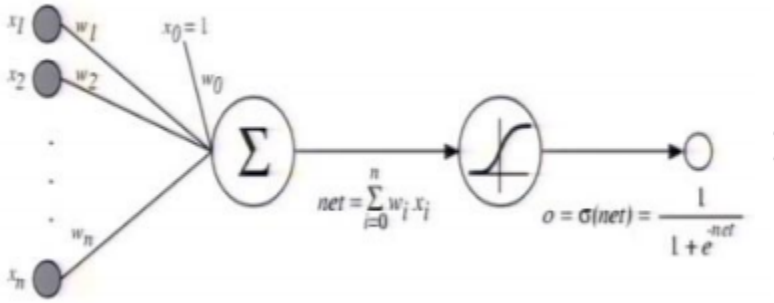
Multilabel classification is a classification which assigns each to sample to one or multiple labels. The labels are not mutually exclusive and one sample can have multiple topics. For training a multi-label classification problem the labels are represented as a One-hot Encoded Target Vector with multiple 1s.

Eg : label = [0 0 1 0 0 1 1 0 0 0 0] is a one hot vector with multiple 1.

An example of a Multi Label Classification : Given an image - Identify the various objects present in the image from cars,humans, birds, traffic signs (An image can have multiple labels).

The final layer of the deep learning network in Multilabel classification always has the sigmoid activation function.The Sigmoid activation function converts output of each neuron between 0 and 1 independent of the other neuron outputs.

Loss function that is used is the Binary Cross Entropy Loss.



Sigmoid Activation in the last Layer (Multilabel)

$$\text{Loss} = -\frac{1}{\text{output size}} \sum_{i=1}^{\text{output size}} y_i \cdot \log \hat{y}_i + (1 - y_i) \cdot \log (1 - \hat{y}_i)$$

Loss Function (Multilabel)