**Name:** Ho Gia Khiem

**Student ID:** 520K0341

**Class:** 20K50301

**Basic Neural Networks**

**Topic:** Learning Stages for Multilayer Perceptron for Regression and Classification Problems

**Subject:** Deep Learning

**I. Backpropagation algorithms with Mean Square Error**

***1. What is Mean Square Error in neural networks?***

The Mean Square Error measures how close a regression line is to a set of data points. It is a risk function corresponding to the expected value of the squared error loss. Mean square error is calculated by taking the average, specifically the mean, of errors squared from data as it relates to a function.

***2. How is Mean Square Error calculated for neural networks?***

The error is calculated by subtracting the output from the target, then the mean square error is calculated. Note that mean square error can be called with only one argument, because the other arguments are ignored. Mean square error supports those ignored arguments to conform to the standard performance function argument list.

***3. Calculation***

To calculate the mean square error in neural networks, we use the following formula:

**II. Backpropagation algorithms with Cost Function (for regression)**

***1. What is Cost Function?***

The cost function is the technique of evaluating “the performance of the algorithm/model”. It takes both predicted outputs by the model and actual outputs and calculates how much wrong the model was in its prediction. It outputs a higher number if the predictions differ a lot from the actual values.

***2. How is Cost Function calculated in neural networks?***

For neural networks, each layer will have a cost function, and each cost function will have its own least minimum error value. Depending on where we start, we can arrive at a unique value for the minimum error. We need to find the minimum value out of all local minima. This value is called the global minima.

***3. Calculation***

To calculate the cost function (for regression), we use the following formula:

**Notes:**

Hypothesis:

Parameters: ,

**III. Backpropagation algorithms with Cross-Entropy Cost Function (for classification)**

***1. What is Cross-Entropy Cost Function?***

Cross-entropy is commonly used in Machine Learning is a loss function. Cross-entropy is a measure from the field of information theory, building upon entropy and generally calculating the difference between two probability distributions.

***2. Cross-Entropy Cost Function for classification***

The average level of uncertainty refers to the error. Cross-entropy builds upon the idea of information theory entropy and measures the difference between two probability distributions for a given random variable/set of events. Cross-entropy can be applied in both binary and multiclass classification problems.

***3. Calculation***

To calculate the cross-entropy cost function for classification, we use the following formula:

**Notes:**

The cross-entropy formula takes in two distributions (the true distribution) and (the estimated distribution), which are defined over the discrete variable .