**MNIST naïve bayes**

This is what has been done in the implementation, the code starts by importing necessary libraries such as NumPy and MNIST. It also imports the sample function from the random module.

The NaiveBayes class is defined, which represents the Naive Bayes classifier. It has methods for fitting the model (fit and fit2), making predictions (predict and predict2), and calculating the posterior probability density function.

The fit method is used to train the model using the training data. It calculates the mean and variance of each feature for each class, as well as the class priors.

The predict method is used to predict the class labels for a given set of samples. It computes the posterior probabilities for each class and returns the class label with the highest probability.

The accuracy function calculates the accuracy of the predicted labels by comparing them to the true labels.

The code loads the MNIST dataset and splits it into training and testing sets. An instance of the NaiveBayes class is created with a specified Laplace smoothing parameter. And the model is trained using the training data. Then predictions are made on the testing data, the accuracy of the predictions is calculated and printed. The result is written to a file called "outputNaive\_bayes.txt".

**Logistic regression MNIST**

Here is what has been done in the implementation of Logistic regression: The code starts by importing the necessary libraries: NumPy and MNIST. The sigmoid function is defined, which calculates the sigmoid activation function. The LogisticRegression class is defined, which represents the logistic regression classifier. It has methods for initialization (\_\_init\_\_), fitting the model (fit), and making predictions (predict).

The fit method is used to train the logistic regression model using the provided training data. It initializes the weights and bias, converts the labels into one encoded form, and performed gradient descent to update the weights and bias iteratively. The predict method is uses to predict the class labels for a given set of samples. It calculates the predictions using the learned weights and bias, applies the sigmoid activation function, and returns the class label with the highest probability.

The code sets the learning rate and loads the MNIST dataset. Later an instance of the LogisticRegression class is created with a specified learning rate. And the model is trained using the training data.

Predictions are made on the testing data. By using our accuracy function we calculate the accuracy of our predictions by comparing them to the true labels.

The accuracy is printed in a file called "outputLogistic-regression.txt".