Title: Handwritten Digit Identification using Logistic Regression in PyTorch

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Introduction:

The purpose of this report is to provide a detailed description of the digit identification task using logistic regression. The report will cover the data description, methodology, and conclude with an evaluation of the model's performance.

Data Description:

The dataset used for this task is the MNIST dataset, which consists of handwritten digits ranging from 0 to 9. The dataset is divided into a training set and a test set. The training set contains 60,000 images, while the test set contains 10,000 images. Each image is a grayscale image of size 28x28 pixels.

Methodology:

1. Data Preprocessing:

- The images in the dataset are transformed into tensors using the torchvision.transforms.ToTensor() function.
- The training and test datasets are loaded using the torch.utils.data.DataLoader() function, which provides an efficient way to load the data in batches.

2. Model Architecture:

- The logistic regression model is implemented using the nn.Module class from the PyTorch library.
- The model consists of a single linear layer, nn.Linear(), which takes the input size of 784 (28x28) and outputs 10 classes (digits 0-9).
- The forward() function defines the forward pass of the model, where the input is passed through the linear layer.

3. Training:

- The model is trained using the stochastic gradient descent (SGD) optimizer with a learning rate of 0.001.

- The loss function used is the cross-entropy loss, nn.CrossEntropyLoss(), which is suitable for multi-class classification tasks.
- The training is performed for a total of 5 epochs, with a batch size of 100.
- In each epoch, the model is trained on the training dataset in batches, and the optimizer updates the model's parameters based on the computed loss.

4. Evaluation:

- After training, the model is evaluated on the test dataset.
- The accuracy of the model is calculated by comparing the predicted labels with the ground truth labels.
- The accuracy is calculated as the percentage of correctly classified images out of the total number of test images.

Conclusion:

The logistic regression model achieved an accuracy of 82% on the test dataset. While this accuracy may not be considered high compared to more advanced models available today, it demonstrates the effectiveness of logistic regression for simple digit identification tasks. Logistic regression is a linear model that assumes a linear relationship between the input features and the output classes. Despite its simplicity, it can still provide reasonable results for certain tasks.

In conclusion, this report provided a detailed description of the digit identification task using logistic regression. The data description outlined the MNIST dataset and its division into training and test sets. The methodology section explained the data preprocessing, model architecture, training process, and evaluation. The model achieved an accuracy of 82% on the test dataset, showcasing the effectiveness of logistic regression for digit identification tasks.