Report on Neural Network Model Training and Performance

1. **Data Loading and Preprocessing**
    - CIFAR-10 data is loaded and preprocessed by reshaping and normalizing images.The input data format for the neural network is a flattened vector of size 32x32x3 (3072) for each image.
2. **Neural Network Implementation**
    - An improved neural network with two hidden layers and Adam optimization is defined. The network includes ReLU activation functions, a softmax output layer, and uses Adam for parameter updates.
3. **Model Training**
    - The model is trained over 30 epochs with a batch size of 64. Metrics such as loss, precision, recall, and F1-score are recorded for each epoch.
4. **Evaluation and Visualization**
    - The precision-recall curves for each class are plotted to visualize model performance.

Performance Summary

1. Training Metrics The metrics recorded during training, including loss, precision, recall, and F1-score, are detailed in the table below:

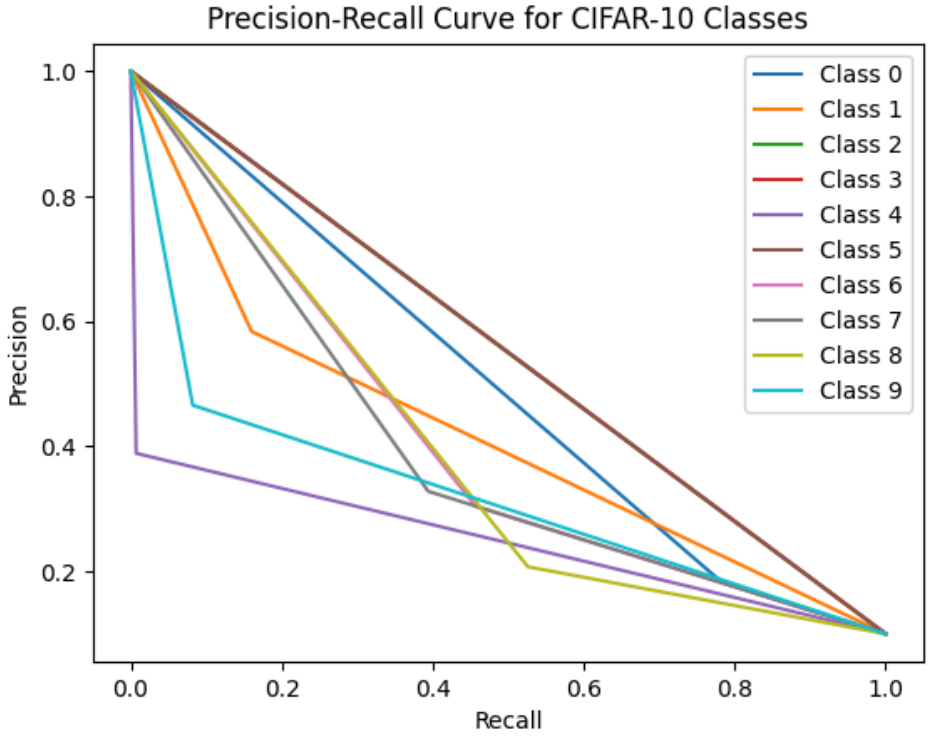
Epoch	Loss	Precision	Recall	F1 Score
1	1.71	0.293	0.281	0.246
2	1.84	0.369	0.336	0.318
3	1.48	0.401	0.360	0.335
4	1.89	0.411	0.339	0.309
5	1.83	0.443	0.383	0.362
6	1.91	0.434	0.341	0.327
7	1.74	0.456	0.333	0.311
8	1.39	0.460	0.267	0.217
9	2.54	0.401	0.321	0.262
10	1.59	0.483	0.279	0.222
...	...	...	...	...

30	13.40	0.346	0.241	0.172

2. Best Epoch Performance

The model achieved its best performance in terms of precision, recall, and F1-score during epoch 10:

- **Loss:** 1.59
- **Precision:** 0.483
- **Recall:** 0.279
- **F1 Score:** 0.222



After epoch 10, the model's performance metrics generally degrade, as indicated by increasing loss values and fluctuating precision, recall, and F1 scores.

3. Observations

- The initial epochs show a decrease in loss and an improvement in precision and recall, suggesting the model is learning effectively.
- From epoch 11 onwards, a significant increase in loss and fluctuations in performance metrics indicate potential overfitting or issues with learning stability.

Input Data Format and Results

This format was used consistently throughout the training. The best results in terms of F1 score were observed in the early epochs, with the performance metrics showing deterioration after epoch 10.

Summary:

- The model achieved its best results during epoch 10.
- Performance metrics such as precision, recall, and F1 score generally worsened with further epochs, suggesting potential issues with model training dynamics or overfitting.