Assignment

Neural Networks and Deep Learning (ECS659P/ECS7026P)

Neural Network Architecture for CIFAR-10 Image Classification

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Introduction

In this, i have outlined the overall development and performance of a convolutional neural network (CNN) made to classify images from the CIFAR-10 dataset.The CIFAR-10 dataset consists of 60,000 32x32 color images in 10 classes, with 6,000 images per class.

1.Dataprocess and loading

- In transform_train, random horizontal flips and crops are used to erich the data; in transform_test, normalisatio is simply used to ensure that the testing sttings accurately mirror real-world scenarios.

- Normalisation is also used in training to accelerate the convergence of the model. Two sets are subjected to these transforms: the test set, which is also loaded using the CIFAR-10 fuction, and the CIFAR-10 training set, which is loaded using the
Torchvision.datasets.

- CIFAR10 fuction. With trainloader and testloader, they are passed to the training and test sets, which set up the datasets' inputs using batches of 128 and 100, respectively. The initial training set is configured to shuffle the data in order to improve the model's ability to generalise during training.

2. Neural Network Architecture

The neural network architecture that is derived from nn that is trained and saved using PyTorch.A module with a specific architecture for image classification uses two convolutional layers each, followed by batch normalisatio and ReLU activation to detect features in input images. After each activation, the network reduces the image's spatial dimensions using max pooling. The network then uses two dense layers to create predictions, one of which transfers the extracted features into dimensionality 512 after they have been flattened. The final layer transfers the extracted features into ten classes, which are representative of typical CIFAR-10 categories. The fields with the highest activation are identified as one of the ten classes. With batch normalisatio and pooling to stabilise and accelerate the learning process, the architecture is very effective and reflects good learning practises.

3.Optimizing Neural Network

- criterion = nn.CrossEntropyLoss(): it was used to setup the loss function for multi-class classification.

- optimizer, stochastic gradient descent, utilises a moderate learning rate and momentum to guarantee smooth and efficient convergence, while weight decay, which targets large weights, as it helps reduce overfitting.

- Scheduler By lowering the learning rate as training goes on to prevent overshooting minima, this learning rate scheduler helps to fine-tune the model by reducing the learning rate by a factor of 0.1 every 5 epochs.
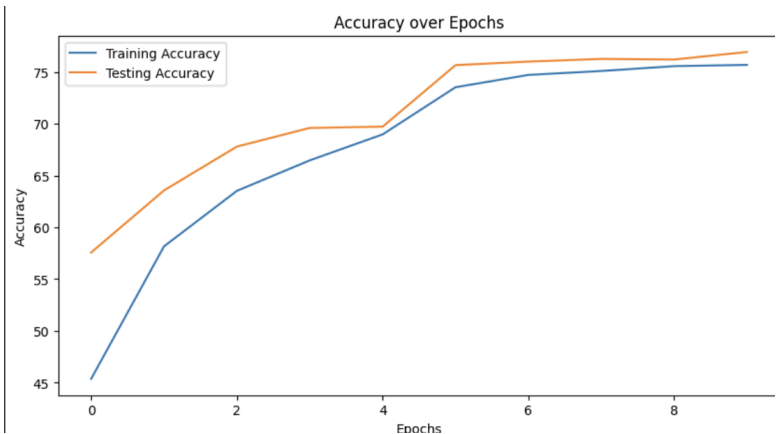
4.Training and evaluation

- The complete process to train and evaluate a neural network model is handled by the function "train_and_evaluate.

- This functions in two main parts, training and testing, over a predetermined number of epochs. The model is put in train mode, batches of data are analysed, losses are computed according to a predetermined criterion, and backpropagation is used to update the model's parameters.

- To evaluate generalisation, it at the same tracks training accuracy and, after switching to evaluation mode, computes testing accuracy without recording gradients.

5.Results

The model demonstrates increasing proficiency on the training data as the training accuracy rises from 45.38% to 75.67% by the tenth epoch. Simultaneously, the testing accuracy increases from 57.57% to 76.92%, suggesting that the model is successfully extrapolating its predictions to data that has not yet been seen.

Specific Learning Differences Cover Note

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Guidelines for markers assessing coursework and examinations of students diagnosed with Specific Learning Differences (SpLDs).

As far as the learning outcomes for the module allow, examiners are asked to mark exam/essay scripts sympathetically, ignoring the types of errors that students with SpLDs make and to focus on content and the student's understanding of the subject.

SpLDs may affect student performance in written work in the following ways:

- Spelling, grammar and punctuation may be less accurate than expected
- Organisation of ideas may be confused, affecting the overall structure of written work, despite including appropriate and interesting content
- Proof reading may be weak with some errors undetected, particularly homophones and homonyms which can avoid spell checkers

Under examination conditions, these difficulties are likely to be exacerbated, particularly towards the end of scripts.

When marking, please ensure the following guidance is adhered to:

- Scan the text for content to gain an overview of the work, to avoid making a judgement based on the structure alone or any minor spelling and grammar errors
- Do not comment solely on spelling and grammar issues, SpLD students are usually aware of this already. If you feel this is a major problem which has affected the sense of the writing, then please encourage the student to use their study skills support from DDS to help with this.
- Include positive and constructive comments amongst the feedback so that students can acknowledge their strengths but work with specialist study skills tutors on developing new strategies for areas of difficulty.
- Use clear English providing specific examples of what is right or wrong, to ensure that the student knows what to improve upon for future work

Colleagues in Schools and Institutes are asked to encourage students with specific learning differences to access the support provided by the Disability and Dyslexia Service if they have any concerns about a students work.

For more information regarding marking guidelines see the Institutional Marking Practices for Dyslexic Students on the DDS webpage.

Disability and Dyslexia Service
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