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AI Course

Capstone Project Idea Presentation

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Course	**AI Course**
Team Name	Code HUNTS
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Project Title	Make Unification Simple in Image Classification

Goal

The ultimate aim of this research is mainly to propose the optimal methods for fine-tuning the pre-trained deep learning models towards image classification. The goal is to improve the models' precision and minimize the computational expenses using sequential fine-tuning strategies and determining task arithmetic operations.

Abstract

Transfer learning is a key method necessary for enhancing pre-trained models' results in deep learning models. However, model fine-tuning in the case of the multiple tasks at once leads to the accuracy decrease and general performance degradation. This proposal involves assessing if fine-tuning models on one task at a time produces better results than fine-tuning on more than one task at the same time as has been the norm. MNIST datasets will be employed in the experiments with the aim of fine-tuning models step by step on certain classes chosen with the assessment of the given approach's influence on the accuracy. Thus, through progressive validation of this hypothesis, our work proposes an enhanced procedure for better performance on the task of interest while overcoming the limitations of traditional fine-tuning approaches.

Proposed Method

Dataset Preparation

- The MNIST dataset comprises of 60, 000 samples for training and 10, 000 samples for testing and will be used in this research.
- 3, 4 and 7 classes are chosen to carry out fine tuning experiments, out of thousand samples for each class exclusively used for particular task.
- The rest of the data is stored separately for model calibration and for comparison with baseline results.

Model Design

- Input layer: 784 parts (28×28 pixel for ten images of MNIST)
- Hidden layers: 128 and 64 amps, respectively
- Output layer: 10 units for, the classification of digits 0- 9.
- To benchmark, the model will first be trained on the whole MNIST data to get a starting set of results.

Sequential Fine-Tuning Process

- For fine-tuning, the preprocessed model learnt will be fine-tuned successively for each chosen class of 3, 4, and 7.
- Here, it is proposed that fine-tuning will be carried out for 10 epochs in each of the classes while maintaining information learned from previous tasks.
- The last experiment will result from the combination of all three classes' datasets and the simultaneous updating of the model to contrast with the previous approach.

Evaluation and Metrics

- The models' performances will be measured using accuracy, precision, recall, and F1-score.
- That way, confusion matrices will be helpful driving understanding of classifier's general tendencies of error.
- Instead, actual loss curves and trends of accuracy will be charted in order to understand training dynamics and make sure that sequential fine-tuning works.

Implementation Environment

- To implement and test these theories, several experiments will be performed in the Python programming language; Libraries that will be utilized are; PyTorch, NumPy, Matplotlib, Seaborn.
- Otherwise, the use of Graphics Processing Unit for enabling faster model training and evaluation will be adopted wherever possible.
- The goal of this methodology is to prove the previously formulated hypothesis that sequentially fine-tuning a model on separate tasks leads to better model accuracy and better performance of the model on certain tasks compared to jointly fine-tuning on multiple tasks.

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Comment & Assessment