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Leveraging transfer learning for enhanced image classification: a case study with MNIST and EMNIST datasets (Potential title)

MASTERS THESIS PROPOSAL

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Abstract:

Transfer learning has emerged as a powerful technique in the realm of deep learning, offering a paradigm shift in the efficiency and effectiveness of model training. This thesis explores the application of transfer learning in the context of image classification, focusing on Convolutional Neural Networks (CNNs). Specifically, the study aims to showcase the advantages of transfer learning by constructing a CNN initially trained on the widely used MNIST dataset and subsequently fine-tuning it on a subset of the Extended MNIST (EMNIST) dataset.

Introduction:

The introduction will provide a comprehensive overview of the significance of image classification, the challenges posed by limited labeled data, and the potential of transfer learning to address these challenges. Emphasis will be placed on the popularity of the MNIST dataset as a benchmark for image classification and the motivation for leveraging transfer learning to enhance model performance.

Literature Review:

The literature review will delve into the theoretical foundations of transfer learning, exploring its principles and various strategies. Relevant studies and advancements in transfer learning for image classification will be discussed, highlighting key methodologies and successful applications. This section will lay the groundwork for the proposed approach in the thesis.

Methodology:

Dataset Selection and Preprocessing:

- An overview of the MNIST and EMNIST datasets will be provided.
- The rationale behind selecting MNIST as the source domain and a subset of EMNIST as the target domain will be explained.
- The preprocessing steps to prepare the data for model training will be detailed.

Base CNN Architecture:

- The architecture of the base CNN trained on the MNIST dataset will be presented.
- The hyper parameters and design choices will be discussed, emphasizing the simplicity and efficiency of the baseline model.

Transfer Learning Approach:

- The transfer learning strategy will be described, specifically focusing on fine-tuning the pre-trained MNIST model on the selected subset of EMNIST.
- The rationale for choosing transfer learning over training a new model from scratch will be explained.

Expected Results:

MNIST Prediction Performance:

- The proposal anticipates evaluating and comparing the performance of the base CNN and the fine-tuned model on the MNIST test set.
- The proposal aims to showcase the potential improvement achieved through transfer learning.

EMNIST Prediction Performance:

- The proposal aims to assess the fine-tuned model on the EMNIST subset, demonstrating its adaptability to new domains.
- The proposal intends to highlight the enhanced performance compared to a model trained solely on EMNIST.

Discussion:

A thorough discussion of the expected results will engage with the practical implications and potential applications of transfer learning in image classification. Anticipated challenges during the experiment will be addressed, and potential avenues for further research and improvement will be proposed.

Conclusion:

The conclusion will summarize the key anticipated findings and contributions of the thesis, reinforcing the expected efficiency of transfer learning in enhancing image classification performance. Reflections on the anticipated broader implications of the study and its relevance to real-world applications will be included.

References:

Relevant literature and studies that will inform the proposed methodology and discussion throughout the thesis will be cited.

Appendix:

Any additional materials, code snippets, or supplementary information to support the transparency and reproducibility of the research will be included.