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# HW1P2 Code and Ablation Log Submission

## Overview
This notebook contains the code and documentation for HW1P2.
## Files Included

## Instructions to Run the Code
1. Install Dependencies
  Ensure you have the required Python packages installed:
  pip install torch torchvision tqdm wandb

2. Run the Notebook

  ### Locally
  Open and run `vishakha_submission.ipynb` in a Jupyter Notebook environment:

  - jupyter notebook vishakha_submission.ipynb

  or execute the notebook in a Python script using:

  - jupyter nbconvert --to script vishakha_submission.ipynb
  python vishakha_submission.py

  ### Running in Google Colab
  - Upload `vishakha_submission.ipynb` to Google Drive.
  - Open Google Colab and click File → Open Notebook.
  - Open the uploaded notebook.
  - If GPU acceleration is needed, navigate to Runtime → Change runtime type and
select GPU.
  - Run all cells in sequence.



## Model Details
- Architecture: Deep fully connected neural network.
- Number of Layers: 11.
- Activation Function: GELU.
- Regularization: Batch Normalization, Dropout (0.25).
- Loss Function: Cross-Entropy Loss.
- Optimizer: AdamW.
- Scheduler: CosineAnnealingLR with `scheduler_mode = min`.
- Weight Initialization: Kaiming Normal.
- Training Epochs(Planned): 45
- Training Epochs(Completed): 38
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- Batch Size: 1024.
- Learning Rate: 0.0005.
- Weight Decay: 1e-4.
- Data Augmentations: Both Frequency Masking and Time Masking (`freq_mask_param = 4`, `time_mask_param = 8`).
- Learning Rate Reduction:
 - Factor: `0.1`
 - Patience: `5 epochs`
 - Minimum LR: `1e-9`

Results
- Final Learning Rate: `4e-05`
- Training Accuracy: `84.97%`
- Training Loss: `0.44405`
- Validation Accuracy: `86.66%`
- Validation Loss: `0.39196`

Experiments and Ablations
The following hyperparameter tuning experiments were conducted:
- Learning Rate Variations: Tested {0.001, 0.0005, 0.0001}.
- Batch Sizes: Compared {1024, 512, 2048}.
- Layer Depth Adjustments: Different network depths were tested.

For more details, refer to:
- WandB Project Link:
https://wandb.ai/vmpathak-carnegie-mellon-university/hw1p2?nw=nwuservmpathak
- Ablations Sheet: Included in the handin.tar file

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