COMPSYS 721 Machine Intelligence and Deep Learning

Project 1: Face Recognition (30% of Final Mark)

Due Date: 16th Sept (Monday Week 8) 5pm

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Project Overview

Face recognition has been a significant area of research within computer vision and machine learning, with applications ranging from surveillance systems to biometric authentication and emotion recognition on social media. Over the past decade, traditional computer vision approaches have been augmented by deep learning techniques, greatly enhancing face recognition capabilities.

This project will engage you in studying, implementing, and analyzing the strengths and weaknesses of well-known deep neural network models, using face recognition as a real-world example with a publicly available dataset.

Project Steps

Step 1: Literature Review and Model Selection

- **Baseline Models:** Consider four popular models: GoogleNet, ResNet, VGG, and Inception v4.
- **Additional Model:** Optionally, select an additional model based on your literature review. Justify why this model is a worthy comparison to the baseline models.
- **Qualitative Comparison:** Perform a qualitative comparison of these models. This should be a literature-based analysis, with no need to run experiments at this stage.

Step 2: Dataset Analysis

- **Primary Dataset:** Use the LFW (Labeled Faces in the Wild) dataset. (https://vis-www.cs.umass.edu/lfw/). The dataset is already provided on Canvas, and you must use this version.
- **Additional Datasets:** Research and find three other publicly available human face datasets. Perform a qualitative comparison of these datasets, discussing their strengths and weaknesses in relation to LFW.

Step 3: Model Implementation and Evaluation

- **Model Selection:** Based on your qualitative analysis, select two models for implementation.
- **Data Preparation:** Use only the top 10 classes (ranked in descending order of the number of images) from the LFW dataset for your experiments.
- **Hyperparameter Tuning:** Detail your approach to tune your model hyperparameters.

- **Performance Evaluation:** Design and run quantitative analyses to evaluate and compare the models' performances using the LFW dataset.

Bonus Opportunity: Implement and evaluate an additional model of your choice for an extra 2% bonus mark (capped at full marks).

Deliverables

1. **Report (25%)** - Up to 6 pages:
    - **Literature Review (10%):**
        - Conduct a literature review of at least 4 reputable good papers.
        - Provide a qualitative comparison of the 4 baselines and (optional) a self-selected model.
    - **Dataset Review (5%):**
        - Review the LFW dataset and compare it with three other datasets.
    - **Methodology (5%):**
        - Detailed method descriptions for the two selected models for implementation.
    - **Performance Comparison (5%):**
        - Present and discuss the quantitative performance results using the LFW dataset.
2. **Code (5%)**:
    - Provide well-documented code used for the experiments.

Marking Schedule

1. **Literature Review (10%)**
    - Depth of research and understanding of models (5%)
    - Quality of qualitative comparison (5%)
2. **Dataset Review (5%)**
    - Comprehensive analysis of LFW and other datasets (3%)
    - Quality of comparison and insights (2%)
3. **Methodology (5%)**
    - Clarity and detail of the selected models' methodology (3%)
    - Justification for model choices and hyperparameter tuning (2%)
4. **Performance Comparison (5%)**
    - Design and execution of experiments (2%)
    - Quality of quantitative analysis and discussion of results (3%)
5. **Code (5%)**
    - Functionality and accuracy (2%)
    - Code quality and documentation (3%)

Bonus Marks (2%): For implementing and evaluating an additional model beyond the baseline models.