Assignment Title: Image Classification Project (ASII)

Course: Artificial Intelligence Techniques (CSY3025-STD)

Overview:

In this assignment, you are tasked with developing an image classification model. You will choose a dataset of your interest, which could be related to classifying grocery items, animals, plants, or any other objects. The goal is to apply the concepts learned in class to a real-world problem, exploring how machine learning can be utilized to automate and improve decision-making processes through image recognition.

Objectives:

1. **Dataset Selection**: Choose an appropriate image dataset. This dataset can be from any domain (e.g., groceries, wildlife, vehicles, etc.) and should be sufficiently complex to allow meaningful learning and classification but not so difficult as to be infeasible for an introductory course project.

2. **Model Development**: Design and train a machine learning model capable of classifying images from your chosen dataset. You may use any machine learning framework (e.g., TensorFlow, PyTorch) and model architecture (e.g., CNN, transfer learning with pre-trained models).

3. **Technical Report**: Write a comprehensive technical report detailing your approach, model selection, training process, challenges faced, and the results obtained.

Assignment Tasks:

Task 1: Dataset Selection

- Research and select an image dataset.

- Provide a summary of the dataset including the size, variety of images, and number of categories.

- Explain why this dataset was chosen and what makes it suitable for an image classification task.

Task 2: Model Development

- Preprocess the dataset for training. This includes tasks such as resizing images, normalizing pixel values, and splitting the dataset into training, validation, and testing sets.

- Develop the image classification model using an appropriate machine learning framework.

- Train the model, optimizing for accuracy. Document the training process including any hyperparameters tuned, the training/validation accuracy, and loss metrics.

- Test the model on the testing set and report the accuracy achieved.

Task 3: Technical Report

- Introduction: Describe the problem statement and the significance of the task.

- Methodology: Detail the steps taken from data preprocessing to model training.

- Results and Discussion: Present the results of the model testing. Discuss any issues encountered during the project and how they were addressed.

- Conclusion: Summarize the project outcomes and propose future work or improvements that could enhance the model's performance.

Deliverables:

1. **Code**: Complete source code of your project including data preprocessing, model training, and evaluation scripts.

2. **Dataset Description**: Documentation of the dataset used.

3. **Technical Report**: A detailed report as described in Task 3.

Evaluation Criteria:

- Correctness and completeness of the implemented solution.

- Ability to effectively preprocess and utilize the dataset.

- Clarity and depth of the technical report.

- Innovation in approach and problem-solving.

Submission Details:

- **Deadline**: 19th May 2024 (23:59)

- **Submission Format**: Zip file containing all the source code, dataset description, and PDF of the technical report.

Additional Notes:

- Ensure your code is well-commented to explain your logic and approach.

- The technical report should be well-structured, making use of figures, tables, and references where applicable.

Rubric for Image Classification Project

Total Points: 100

1. Dataset Selection (15 Points)

- **5 points**: Adequate description of the dataset (size, variety, categories).

- **5 points**: Rationale for dataset choice is well-explained and justifies its suitability for the project.

- **5 points**: Documentation reflects thorough research and understanding of the dataset's potential and limitations.

2. Data Preprocessing (10 Points)

- **5 points**: Effective and appropriate preprocessing techniques are applied.

- **5 points**: Clear documentation and justification for the choices of preprocessing methods.

3. Model Development and Implementation (30 Points)

- **10 points**: Correct implementation of the model using a suitable machine learning framework.

- **10 points**: Model architecture is well-suited for the task and is properly justified.

- **10 points**: Proper use of training, validation, and testing splits; effective use of hyperparameter tuning.

4. Model Performance and Testing (20 Points)

- **10 points**: Achieves satisfactory performance metrics on the testing set (accuracy, precision, recall, F1-score as applicable).

- **10 points**: Comprehensive analysis of the model results, with a discussion of any misclassifications, errors, or unusual findings.

5. Technical Report (20 Points)

- **5 points**: Clarity and structure of the report (introduction, methodology, results and discussion, conclusion).

- **5 points**: Depth of discussion on methodology and the training process.

- **5 points**: Critical analysis in the results and discussion, including insights into model behavior and problem-solving strategies.

- **5 points**: Quality of writing, including grammar, punctuation, and usage of figures and tables to enhance readability and understanding.

6. Code Quality and Organization (5 Points)

- **5 points**: Code is well-organized, commented, and easy to understand and replicate.