AI | ML Development

Task #2: Image Classification for Self-Driving Cars

Scenario:

You are a machine learning engineer at a company developing self-driving cars. Your objective is to build a machine learning model that can accurately classify different objects (cars, pedestrians, traffic lights, etc.) in real-time from the car's camera feed. This is a crucial component for enabling the car to navigate its surroundings safely.

Task Description:

Your task involves the following steps:

1. **Data Collection and Exploration:**

   Obtain a dataset of images captured by a self-driving car camera. The dataset should contain labeled images with various objects present in traffic scenes (cars, pedestrians, traffic lights, signs, etc.). Explore the dataset to understand the distribution of different classes and identify any potential challenges.

2. **Data Preprocessing:**

   Preprocess the image data to improve model performance. This may involve resizing images, normalizing pixel values, and data augmentation techniques (flipping, cropping, etc.) to increase the size and diversity of the training data.

3. **Model Selection and Training:**

   Select appropriate deep learning models for image classification, such as Convolutional Neural Networks (CNNs) like VGG16 or ResNet. Train the model(s) using the preprocessed data and evaluate their performance on a validation set using metrics like accuracy, precision, recall, and F1-score for each class.

4. **Model Optimization:**

   Analyze the model's performance and identify areas for improvement. This might involve techniques like hyperparameter tuning, exploring different model

architectures, or addressing class imbalance issues if certain object categories are underrepresented in the data.

5. **Model Evaluation and Deployment:**

   Evaluate the final model on a holdout test set to assess its generalization performance in real-world scenarios. If satisfied with the model's accuracy and robustness, prepare it for deployment (if possible) on the self-driving car's embedded system for real-time object classification.

Submission Requirements:

- Organize your code into well-documented Python scripts or Jupyter notebooks. Include clear comments explaining key steps and decisions made during model development.

- Create a virtual environment for your project and perform all coding within this environment. Submit the entire virtual environment folder along with your code for evaluation.

- Provide a README file with instructions on how to activate the virtual environment, run the code, install dependencies, and reproduce the results. Include any additional notes or considerations for reviewers.

- Write a report summarizing your approach, including details on data collection, preprocessing steps, model architecture, training process, evaluation metrics, and any challenges faced. Discuss the implications of your findings and potential future directions for improvement, such as exploring different model architectures or incorporating real-time constraints.

Deadline:

The deadline for completing tasks and submitting final deliverables is June 21, 2024.

Submission Process for Internship Tasks

Interns are required to submit their completed tasks via email. Please follow the instructions below to ensure your submission is correctly formatted and complete.

1. **Email Submission:**

   - Send an email to: submission@xpacetechnologies.com

2. **Email Subject Format:**

- Use the following format for the subject of your email: ID+TaskName
- For example: "AIMLINT-240324-XTxxxx+ImageClassification"

3. **Email Body:**

- Include a brief introduction of yourself and a summary of the project. Mention your full name, internship ID, and a short description of the task you are submitting.

4. **Attachments:**

- Attach a PDF file containing the project documentation.