Documenting Issues and Challenges Encountered with the GazeEstimator Model:

During the implementation and testing of the GazeEstimator model, several challenges were encountered that required careful attention and resolution to ensure the model's effectiveness and reliability. Below are the issues identified along with the corresponding strategies employed to address them:

1. Data Preprocessing Complexity:

- Problem: Preprocessing the GazeCapture dataset involved various steps such as loading images, detecting faces and eyes, and normalizing images. The complexity of these preprocessing tasks led to challenges in ensuring consistency and accuracy.

- Solution: To overcome this challenge, we developed robust preprocessing pipelines using OpenCV and other relevant libraries. Additionally, we thoroughly validated the preprocessing steps to ensure that they effectively extracted relevant information while maintaining data integrity.

2. Face and Eye Detection Accuracy:

- Problem: Face and eye detection, crucial for extracting gaze directions, faced accuracy issues, particularly in cases of occlusions, varied lighting conditions, and head poses.

- Solution: We experimented with different face and eye detection techniques, including both traditional methods like Haar cascades and deep learning-based approaches. Fine-tuning parameters and leveraging ensemble methods helped improve detection accuracy, thereby enhancing the quality of input data for the model.

3. Model Training Convergence:

- Problem: Training the GazeEstimator model using deep learning techniques required careful parameter tuning and architecture design to ensure convergence and optimal performance.

- Solution: We conducted extensive experimentation with different model architectures, hyperparameters, and optimization algorithms. Regularization techniques such as dropout and batch normalization were employed to prevent overfitting and promote model generalization. Additionally, early stopping and learning rate scheduling strategies were implemented to facilitate model convergence.

4. Evaluation Metrics Selection:

- Problem: Choosing appropriate evaluation metrics to assess the model's performance posed challenges due to the multidimensional nature of gaze estimation tasks.

- Solution: We adopted a holistic approach by considering multiple evaluation metrics such as mean absolute error (MAE), root mean square error (RMSE), and angular error. Furthermore, we conducted qualitative analysis by visually inspecting predicted gaze directions against ground truth annotations to gain insights into the model's behavior across different scenarios.