Biweekly Work Report (Software Engineering Management and Economics)
Time Period: April 7 – April 20
Total Working Hours: 30 hours
Name: Zhengyu Zhou

Ongoing Work

My current focus is on training a visual segmentation model for diabetic retinopathy (DR) lesion detection. This involves extensive literature review, research on advanced segmentation architectures, and practical model implementation and optimization.

Work Summary (April 7 – April 20, 30h)

During the past two weeks, I continued the task of replicating and optimizing the GitHub project **apopli/diabetic-retinopathy** , focusing specifically on its U-Net segmentation network. In the process, I identified several limitations of the original U-Net design, such as its rigid skip connections and mismatched dimensions, which hindered performance. Furthermore, the project uses outdated versions of TensorFlow and other dependencies, leading to poor performance and compatibility issues on both local Windows and Linux environments, as well as on cloud-based GPU platforms.

To address these challenges, I redesigned the model using the more advanced **U-Net++ (UnetPlusPlus)** architecture, incorporating the following improvements:

- **Encoder Backbone:** EfficientNet-B3 pretrained on ImageNet.
- **Output Configuration:** Single-channel (binary) output with a sigmoid activation for pixel-wise classification.
- **Loss Functions:** Combination of Dice Loss (for segmentation quality), Binary Cross-Entropy (BCE), and Focal Loss (to address class imbalance).
- **Optimizer:** AdamW optimizer.
- **Learning Rate Scheduler:** ReduceLROnPlateau based on validation Dice score.
- **Early Stopping:** Implemented with a patience of 10 epochs.

Additionally, I processed the IDRiD dataset by dividing it into 512x512 patches for training. I also developed automated testing modules, including:

- Single Image Prediction and Visualization
- Batch Prediction and Evaluation
- Test Set Evaluation with Error Analysis and Visualization of Best/Worst Cases
- Overlay Comparison for Ground Truth vs. Prediction

After 10 training epochs on small batches of the IDRiD segmentation dataset, the improved model achieved promising segmentation performance, successfully distinguishing pathological features in the images.