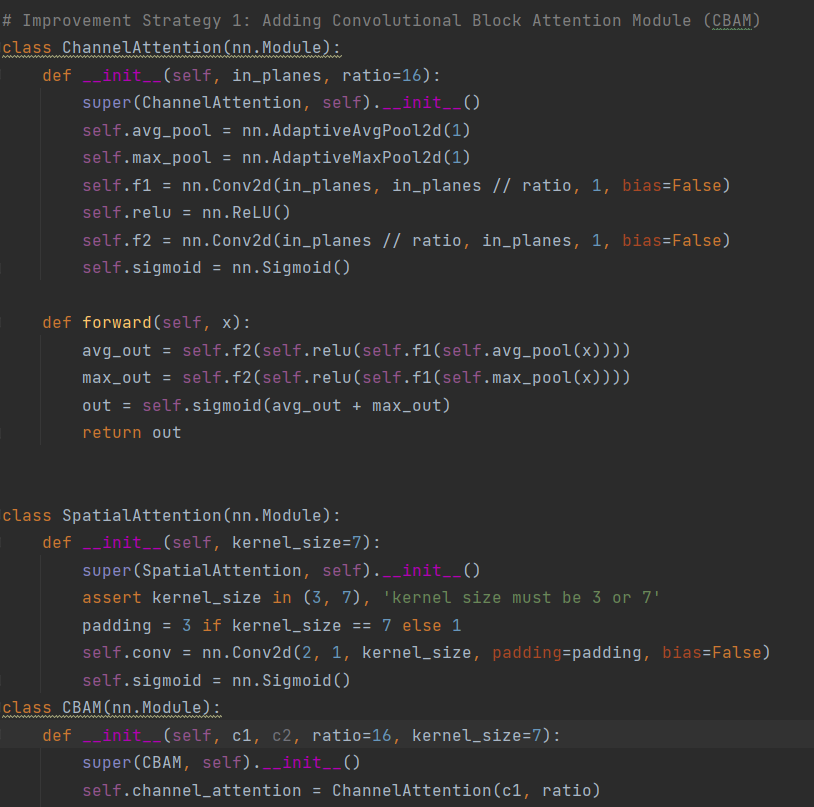
**Explanation of Software Source Code**

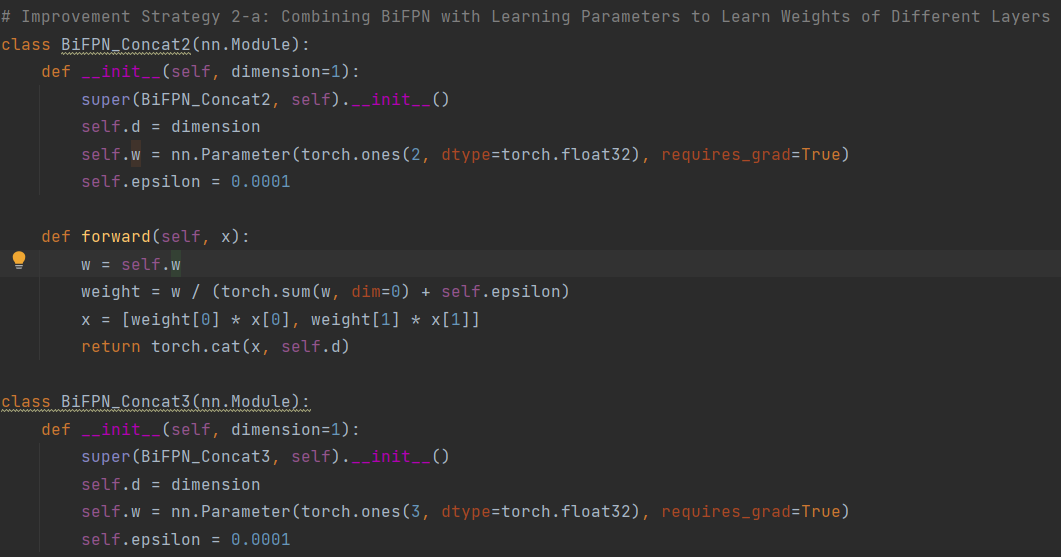
In order to address the challenges faced by optical remote sensing images in complex scenes, such as multi-scale, small targets, and dense arrangement, which can result in poor detection performance, including missed and false detection, this paper proposes improvements to the YOLOv5 model.

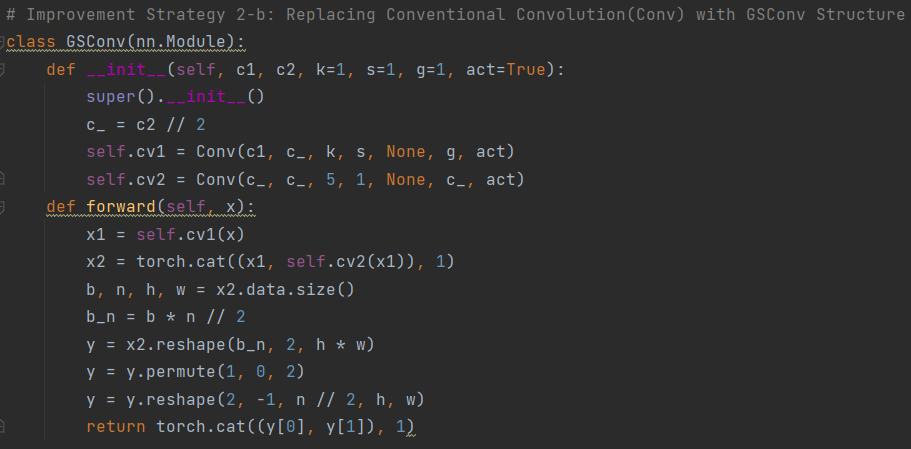
The experiment was conducted in the Windows 11 operating system environment, utilizing the GeForce RTX 3050 GPU, programmed in Python 3.7 on the Pycharm platform, with the Pytorch 1.7.1 deep learning framework, and using CUDA and CuDNN versions 11.0 and 8.0 respectively, where the model was built and network training was carried out. A selection of the improved code is shown below.

(1) Improvement Strategy 1: Add the Convolutional Block Attention Module (CBAM) in the *common.py* to enhance the extraction of target-adaptive optimal features.

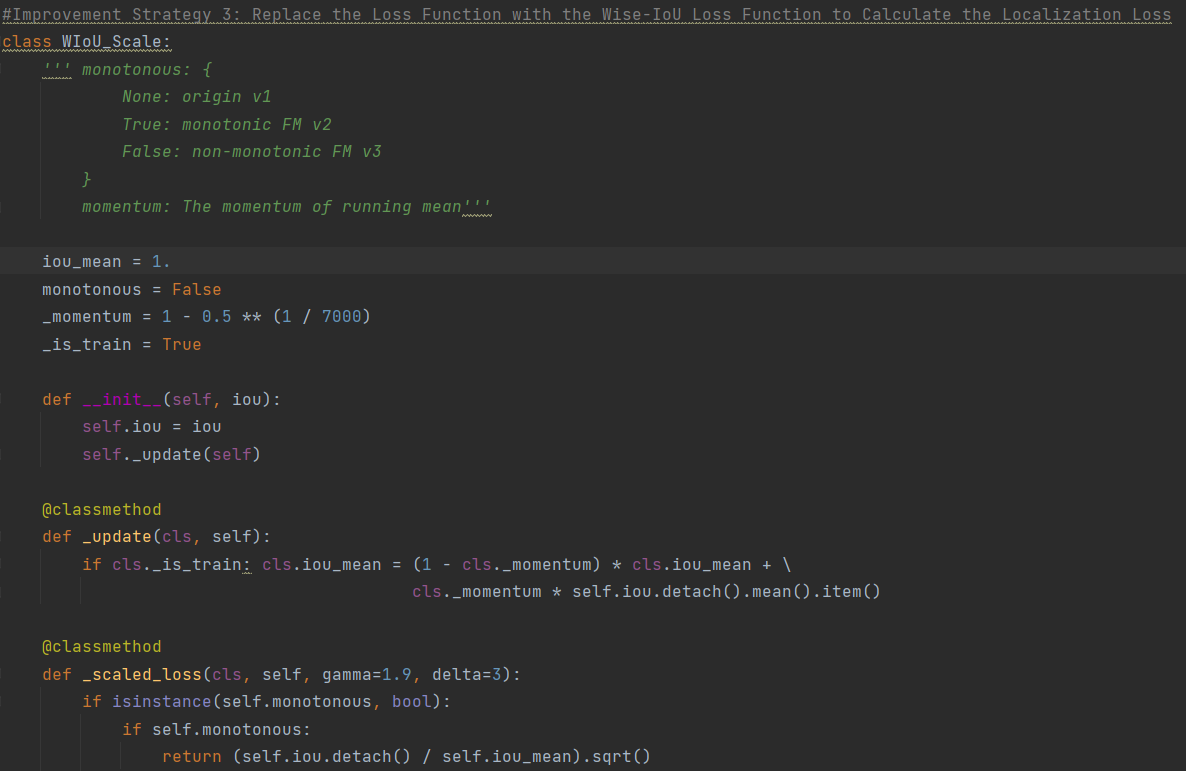


(2) Improvement Strategy 2: Inspired by the Weighted Bi-directional Feature Pyramid Network (BiFPN), introduce cross-layer connection channel and lightweight GSConv structure in the *common.py* to achieve higher-level multi-scale feature fusion and reduce the number of model parameters.





(3) Improvement Strategy 3: Replace the original G-IoU loss function with the Wise-IoU loss function in the *metrics.py* to calculate the localization loss, and assign reasonable gradient gains to cope with differences in image quality.



(4) During the preprocessing stage of experimental data, a median and bilateral filter method is used for noise reduction to reduce interference from ripples and waves and highlight the information of ship features.

