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| Algorithm 1 Pseudo code of the hybrid MCICNet-LightGBM model | |
| **Require:** Retinal fundus image dataset , where represents the input image and the corresponding label | |
| **Ensure:** Trained MCICNet-LightGBM model | |
| 1: | **Feature Extraction with MCICNet** |
| 2: | Initialize MCICNet with input |
| 3: | Apply Residual Multi-scale Feature Fusion Module: |
| 4: | **for** each in {32, 64, 128, 256} **do** |
| 5: | Configure involution parameters: group number, kernel size, stride, reduction ratio |
| 6: | Apply Residual Hybrid Convolutional-Involutional Module: |
| 7: | **end for** |
| 8: | Extract feature tensor |
| 9: | **Train LightGBM Classifier** |
| 10: | Prepare training set: |
| 11: | Prepare validation set: |
| 12: | Prepare test set: |
| 13: | Convert to LightGBM dataset: |
| 14: |  |
| 15: |  |
| 16: | Train LightGBM model: |
| 17: |  |
| 18: | **Evaluate Model Performance** |
| 19: | Predict on test set |
| 20: | Compute metrics |
| 21: | **return** Trained MCICNet-LightGBM model |