# Melanoma Classification Using ResNet18 and Dermoscopy Images

## Methodology

1. Dataset Preparation  
   - Training set limited to 500 images to meet task constraints.  
   - Two strategies were evaluated:  
    • Balanced (50/50): 250 melanoma and 250 non-melanoma images.  
    - Resulted in higher sensitivity (recall), with lower specificity.  
    • Unbalanced (natural distribution): ~93 melanoma and ~407 non-melanoma.  
    - Achieved higher accuracy and specificity, but lower recall.  
   - Validation and test sets were used as-is, with no resampling.
2. Image Preprocessing

- Images resized to 224×224.  
- Normalized using ImageNet statistics:  
 mean = [0.485, 0.456, 0.406], std = [0.229, 0.224, 0.225].  
- Preprocessing performed with OpenCV at load time.  
- No additional data augmentation applied for simplicity.

1. Model Architecture

- Used ResNet18, modified for binary classification.  
- Final layer changed to output a single logit.  
- Pretrained ImageNet weights used as initialization.

1. Training Setup

- Loss function: BCEWithLogitsLoss.  
- Optimizer: Adam with learning rate = 1e-4.  
- Scheduler: ReduceLROnPlateau based on validation AUC.  
- Batch size: 32.  
- Best model saved by validation AUC.

## Evaluation (Test Set)

The final model was evaluated on the fixed test set using a 0.5 classification threshold:  
- AUC: 0.809  
- Accuracy: 72.2%  
- Sensitivity (Recall): 71.8%  
- Specificity: 72.3%

## Key Decisions

- Adam optimizer was chosen for ease of tuning and stable convergence.  
- Data augmentation was skipped to reduce code complexity.  
- Both balanced and unbalanced training strategies were tested.  
- Balanced training improved recall but reduced specificity, while unbalanced training improved accuracy and specificity but had lower recall.  
- Balanced setup was used for final evaluation due to its higher sensitivity.