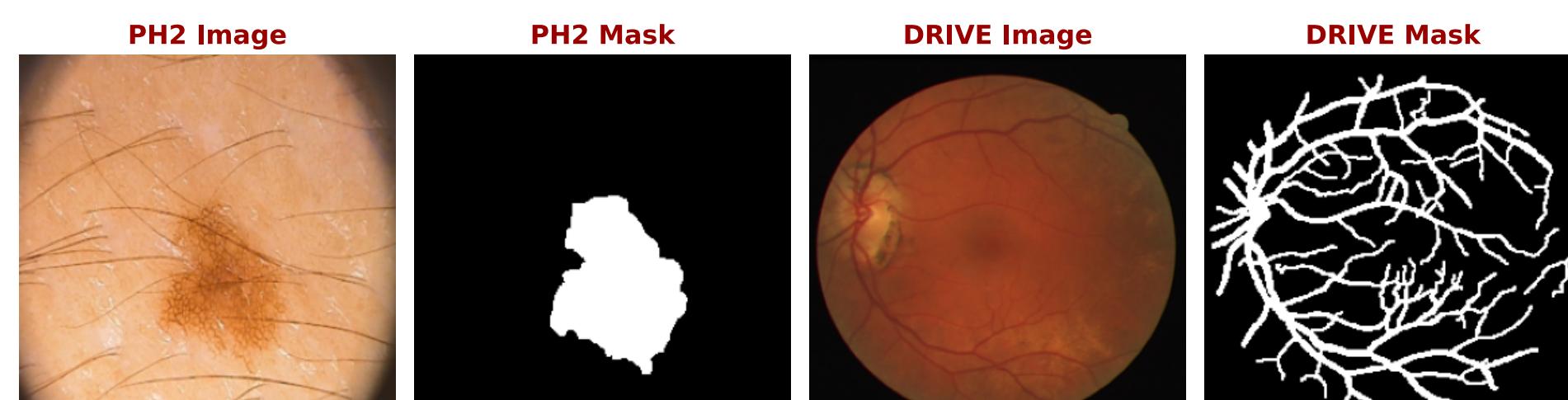


Image Segmentation of Retinal Images and Skin Lesions

Jone Egon Steinhoff, Lukas Rasocha, Mads Prip & Petr Boska Nylander

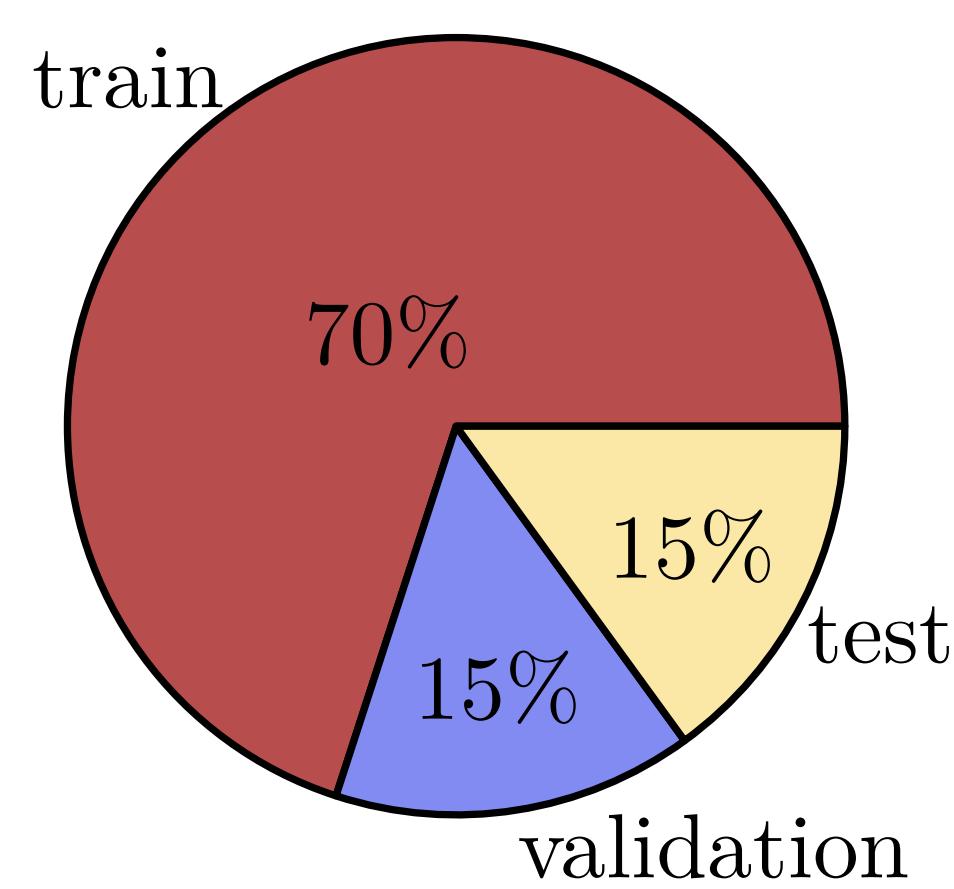
Objective

This project focuses on developing a generic segmentation architecture applicable to two distinct datasets. The PH2 skin lesion dataset and the DRIVE retinal blood vessel dataset.



Data Preprocessing

Split the data into train, validation and test



Apply normalization

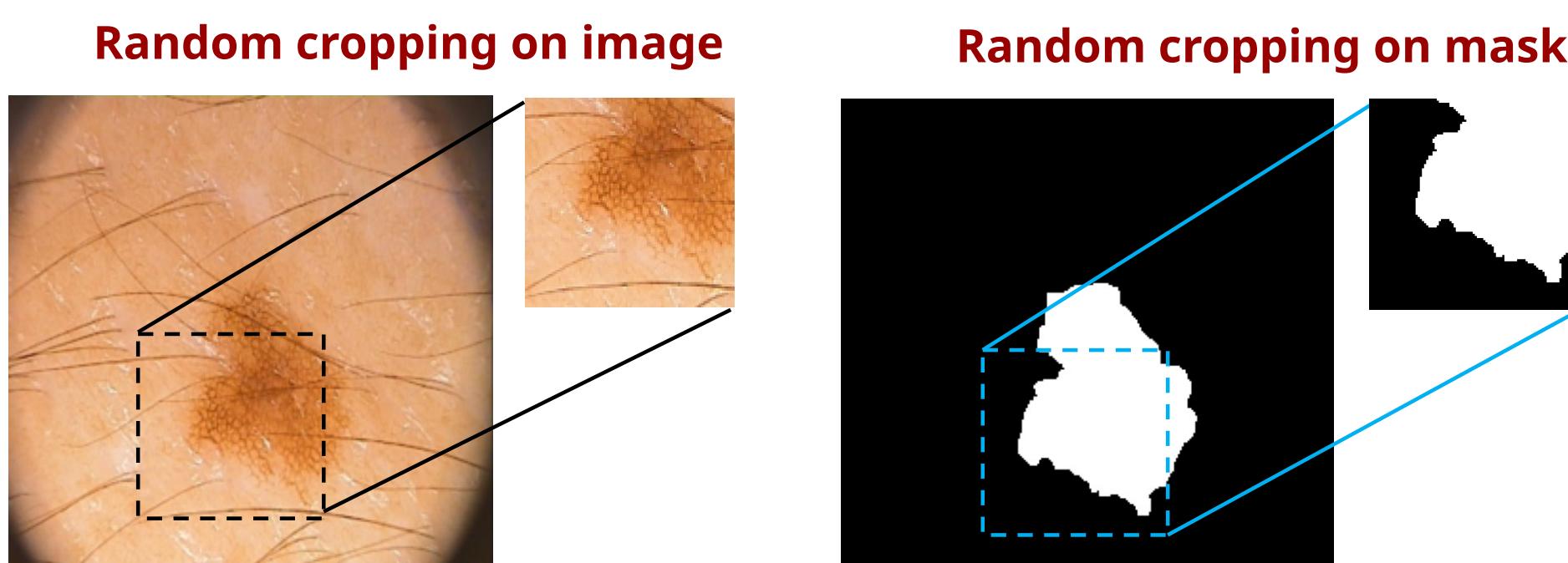
DRIVE:

- $\mu_D = [0.482, 0.262, 0.155]^T$
- $\sigma_D = [0.336, 0.184, 0.103]^T$

PH2:

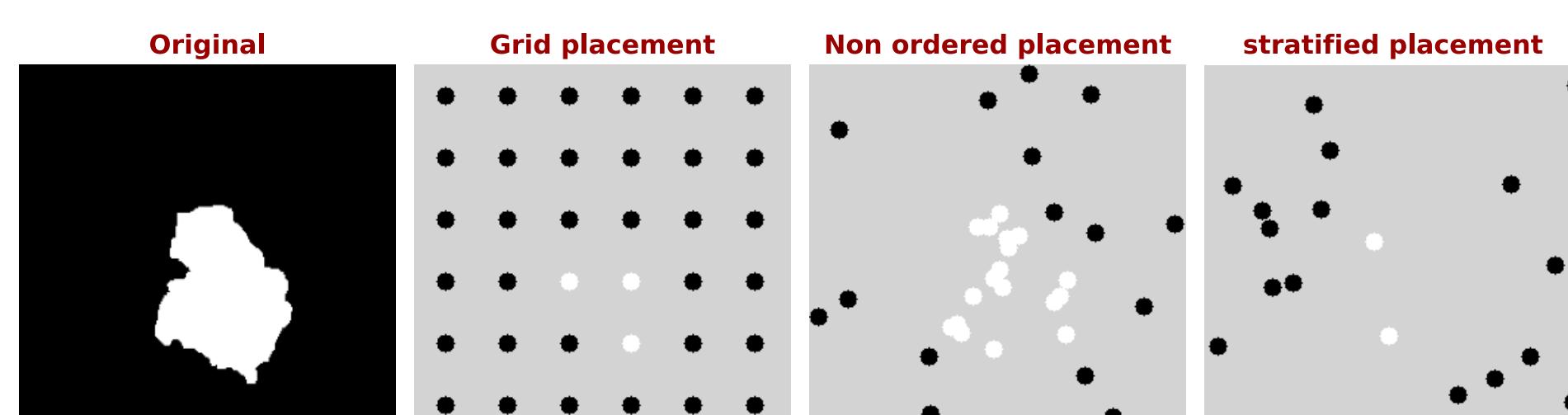
- $\mu_P = [0.482, 0.262, 0.155]^T$
- $\sigma_P = [0.336, 0.184, 0.103]^T$

Random cropping



Weak Supervision

Placement methods: Grid placement, Non ordered placement & stratified placement



Conclusions and Future Work

Focal Loss was the most effective, though small dataset sizes limited evaluation accuracy. Cross-validation could have been used instead, but was constrained by computational and time resources.

For Weak Supervision, one of the best models performed comparably to the fully supervised models using a **stratified strategy** with 15 clicks.

References

Used LLMs to help explain complicated concepts, for debugging code and generating plots

Training Process

Setup

Models: EncDec and UNet

Learning Rate: 0.001

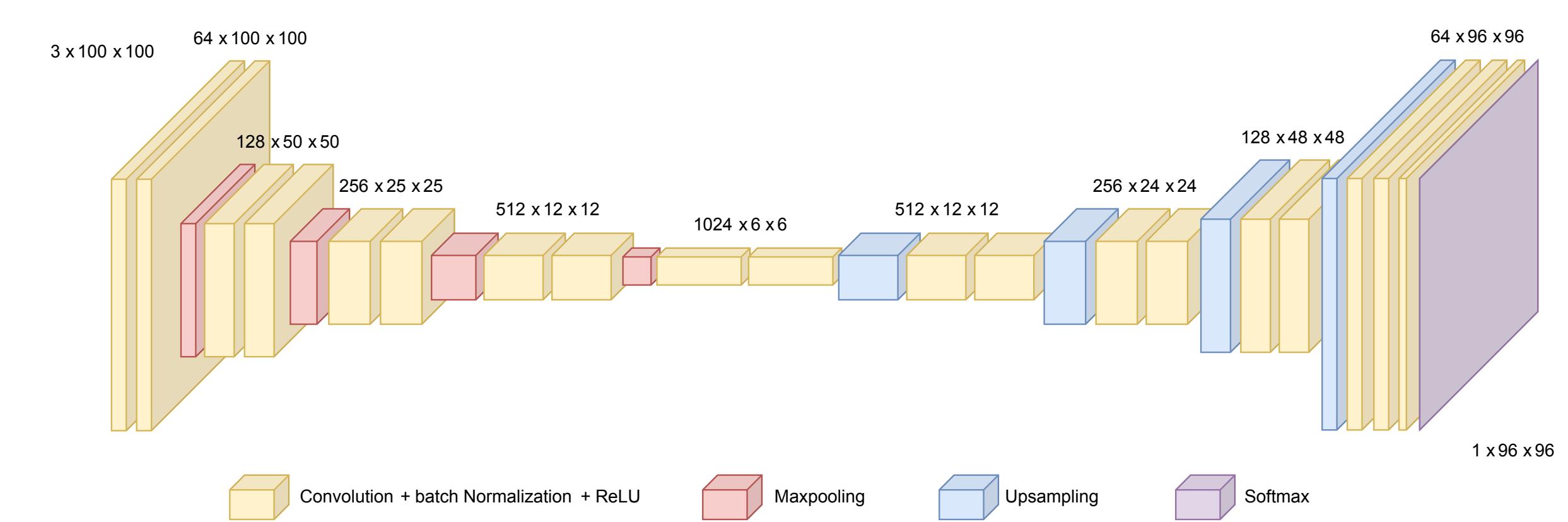
Optimizer: Adam

Loss Functions:

Binary Cross-Entropy (BCE),
Focal Loss, Masked BCE,
Weighted BCE

Epochs : 1500

Crop Size: 256



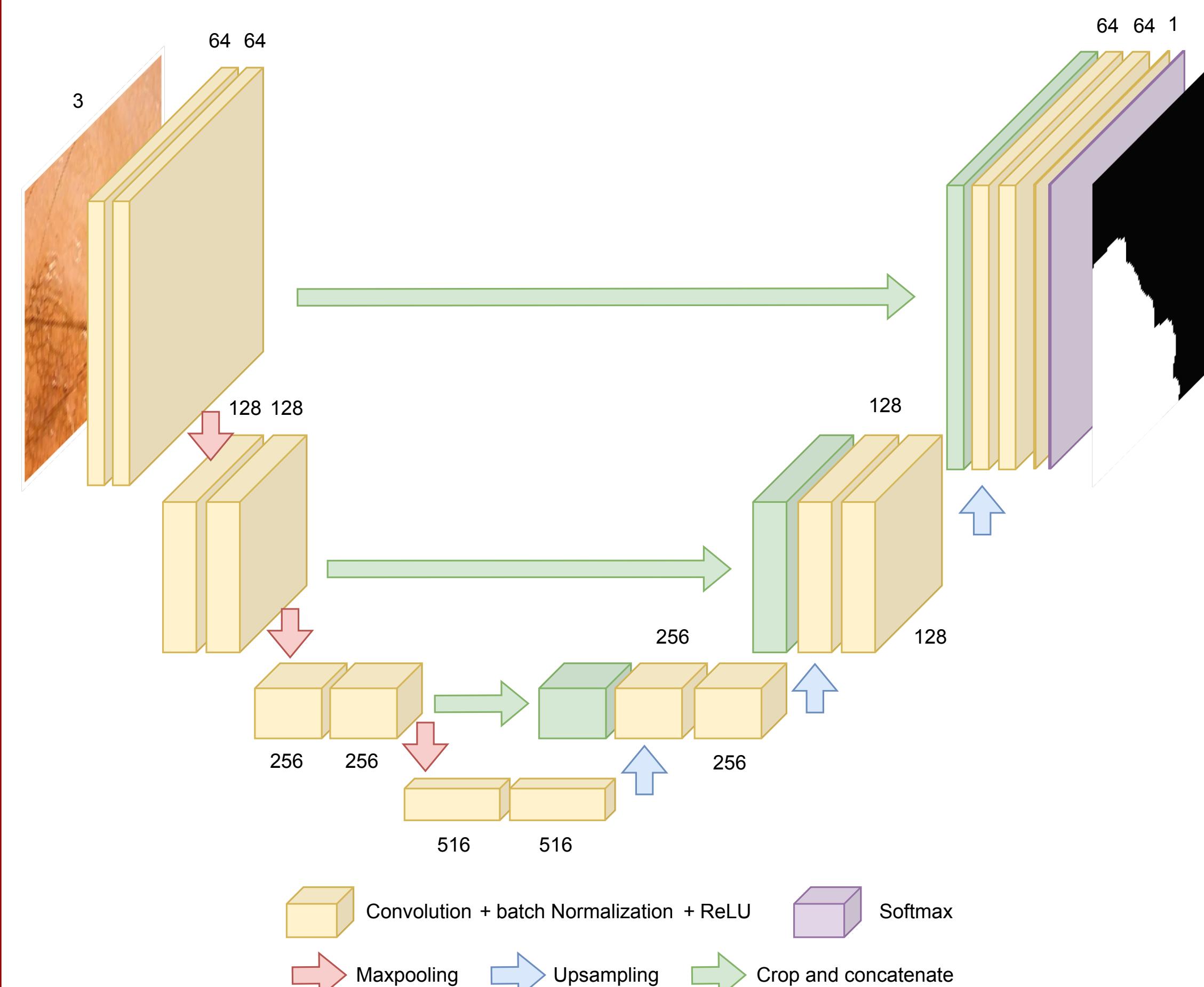
Ablation Study

Compared the impact of different loss functions and padding options on segmentation prediction for both datasets

Compared different sampling strategies for weak supervision together with a different amount of simulated clicks

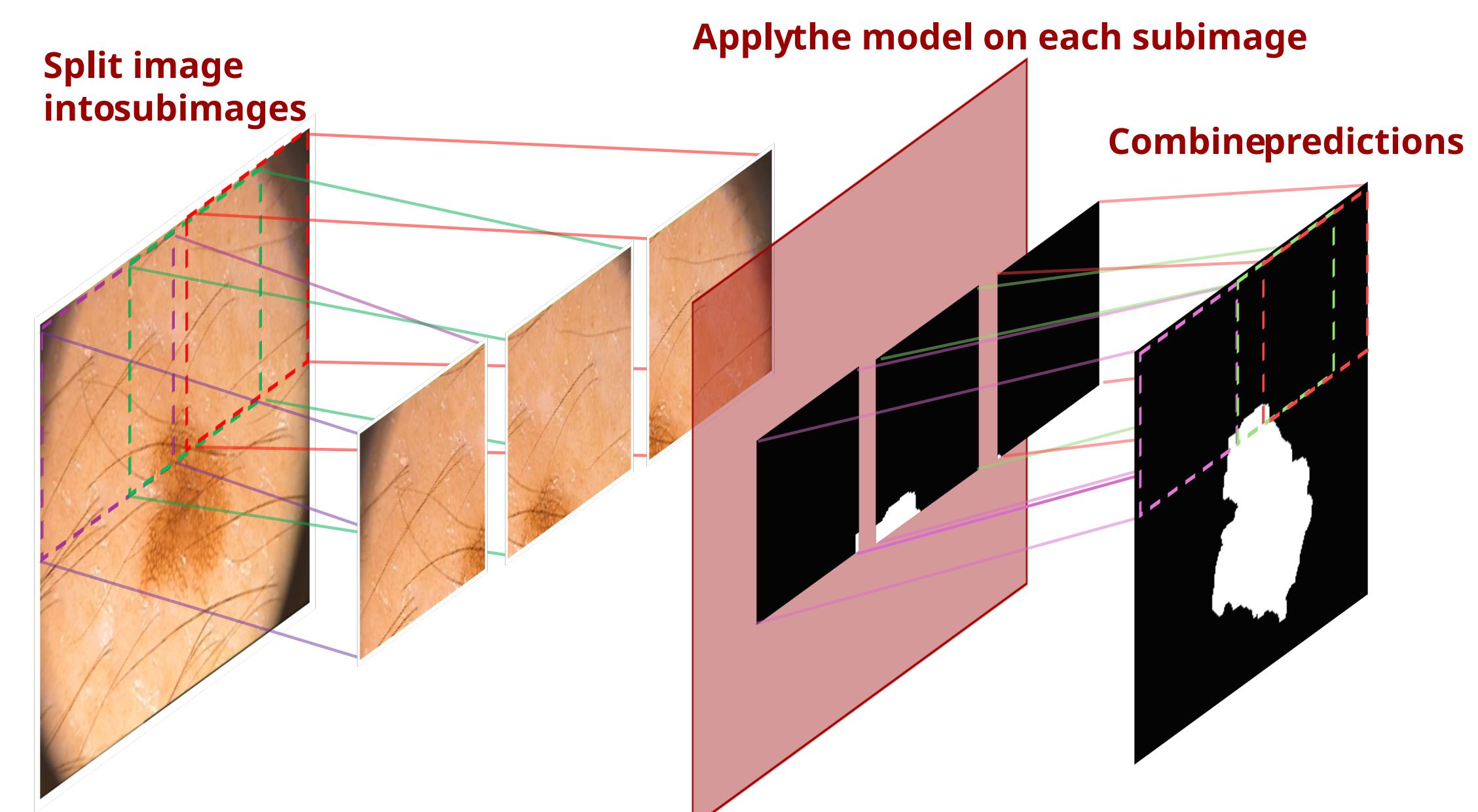
Evaluation Metrics:

Intersection over Union
Accuracy
Specificity
Sensitivity
Dice Overlap

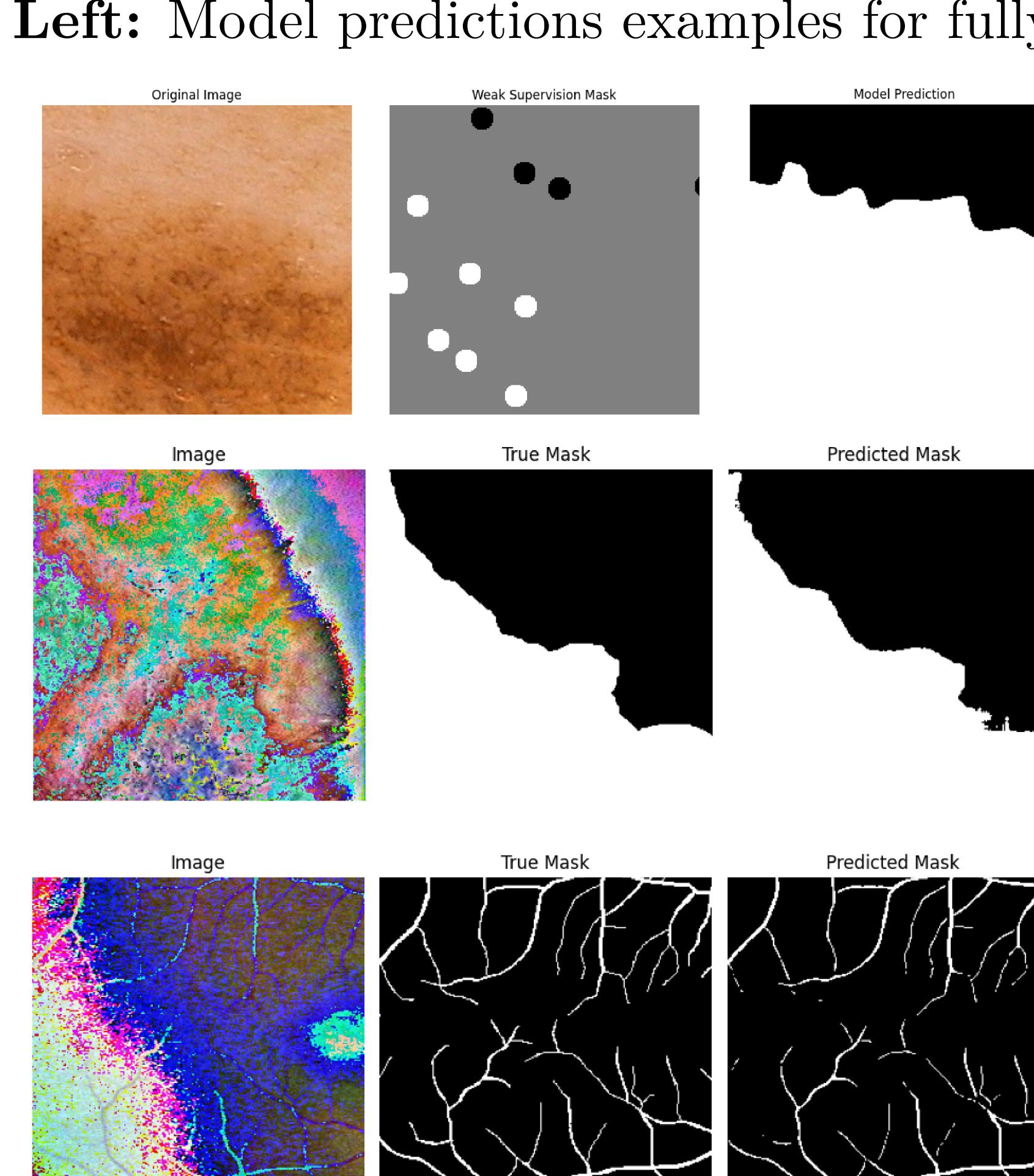


Prevent shortcut learning

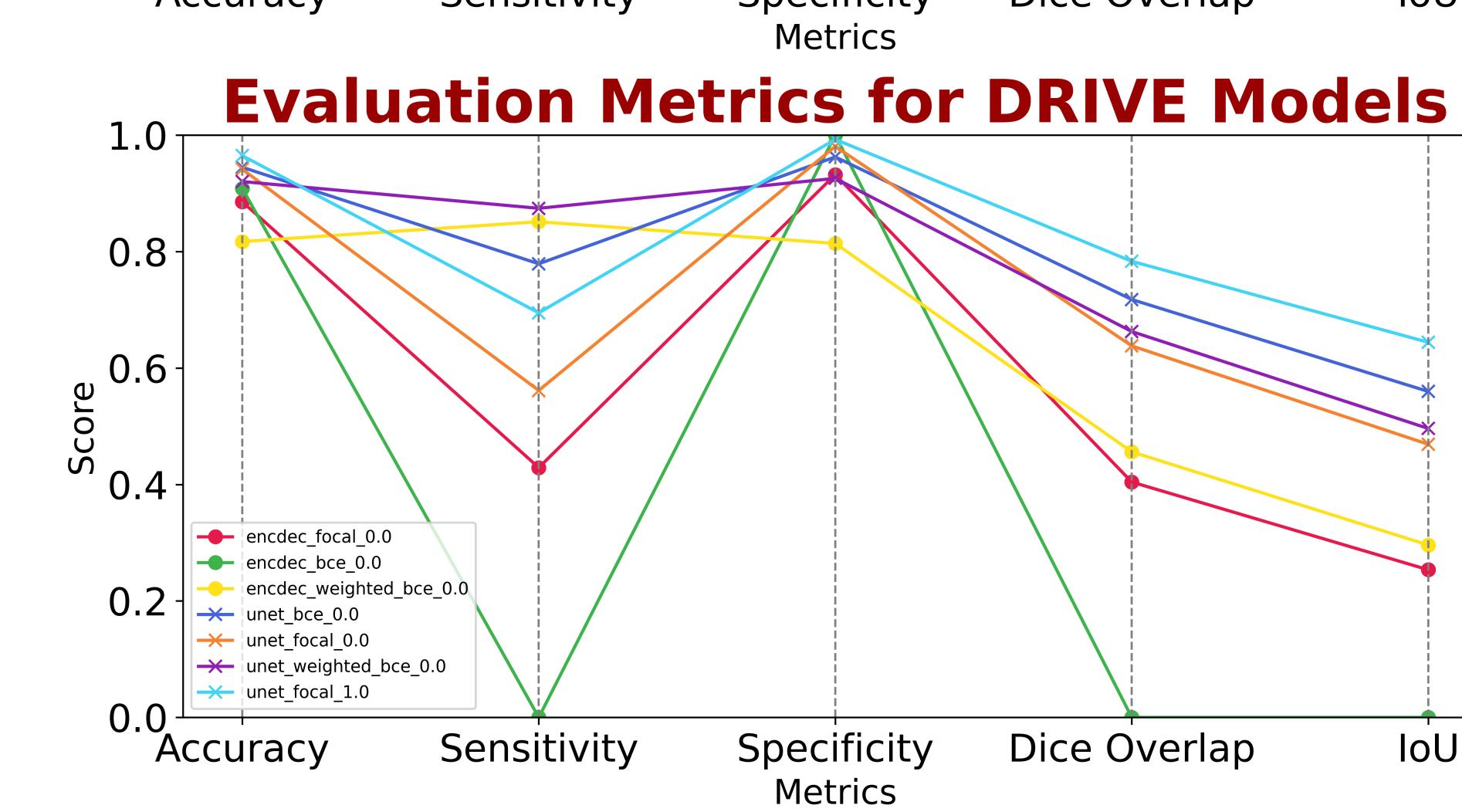
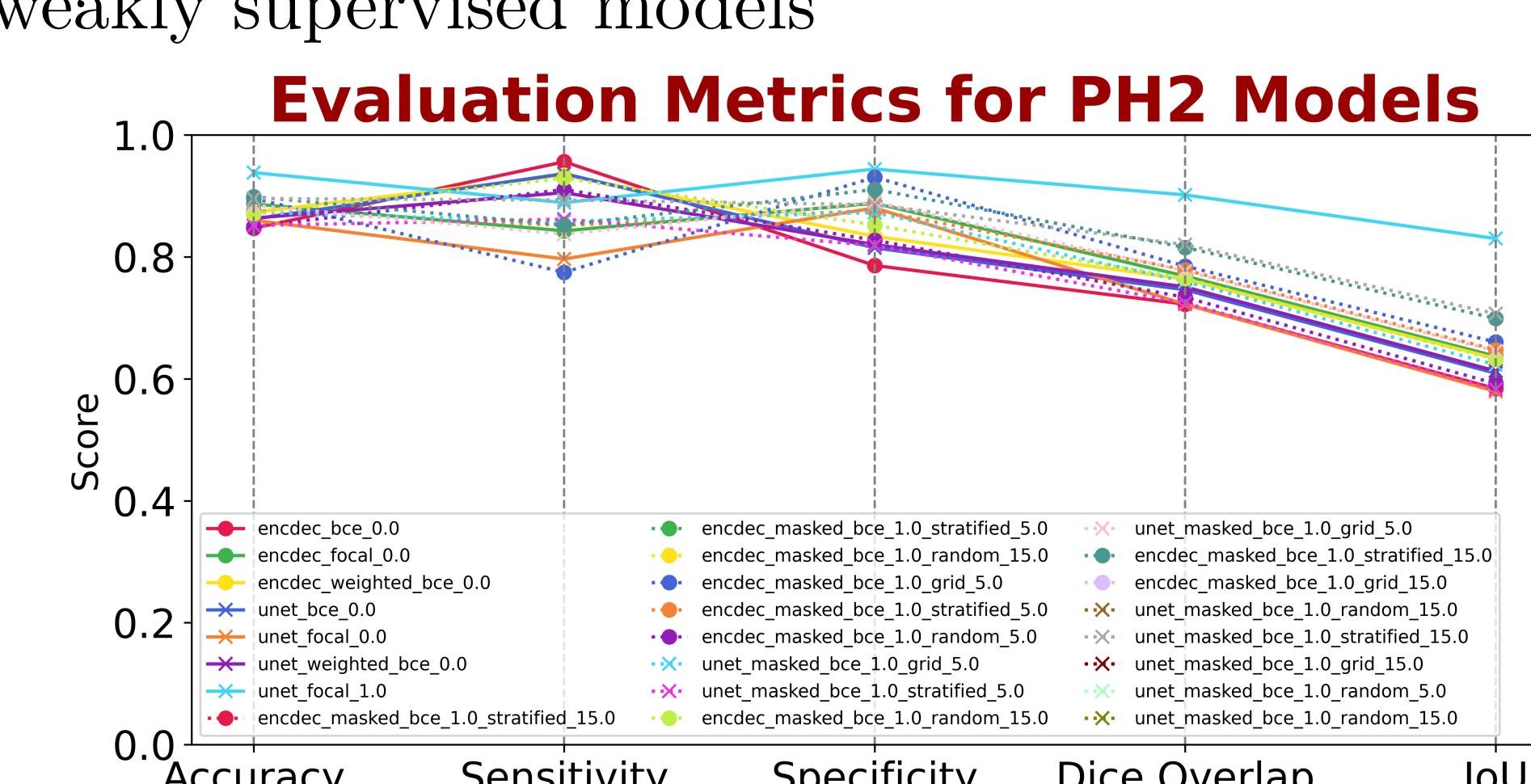
Used random cropping and no padding to prevent positional bias, ensuring the model doesn't assume lesions are always centered or surrounded by zero-padding at edges.



Left: Model predictions examples for fully and weakly supervised models



Results



Right: Evaluation results for all the different experiments