U-Net과 앙상블

기초심화CV1팀

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Contents

핵심 아이디어

Overlap-tile strategy

부족한 데이터 수를 해결하기 위해 다양한 기법 사용

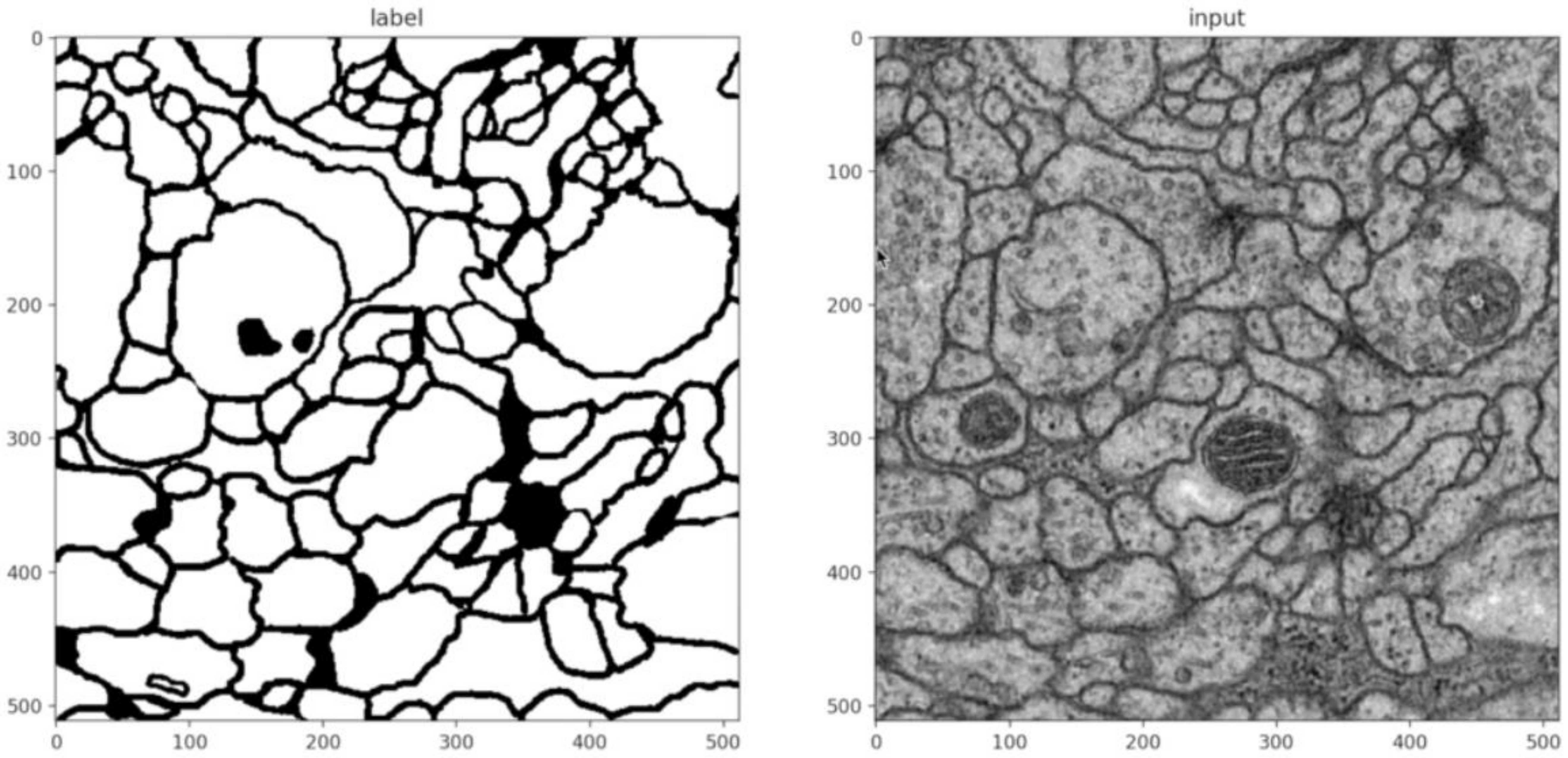
Skip Architecture

인코더의 피처맵을 디코더의 피처맵에 Concat 하여 위치정보 전달

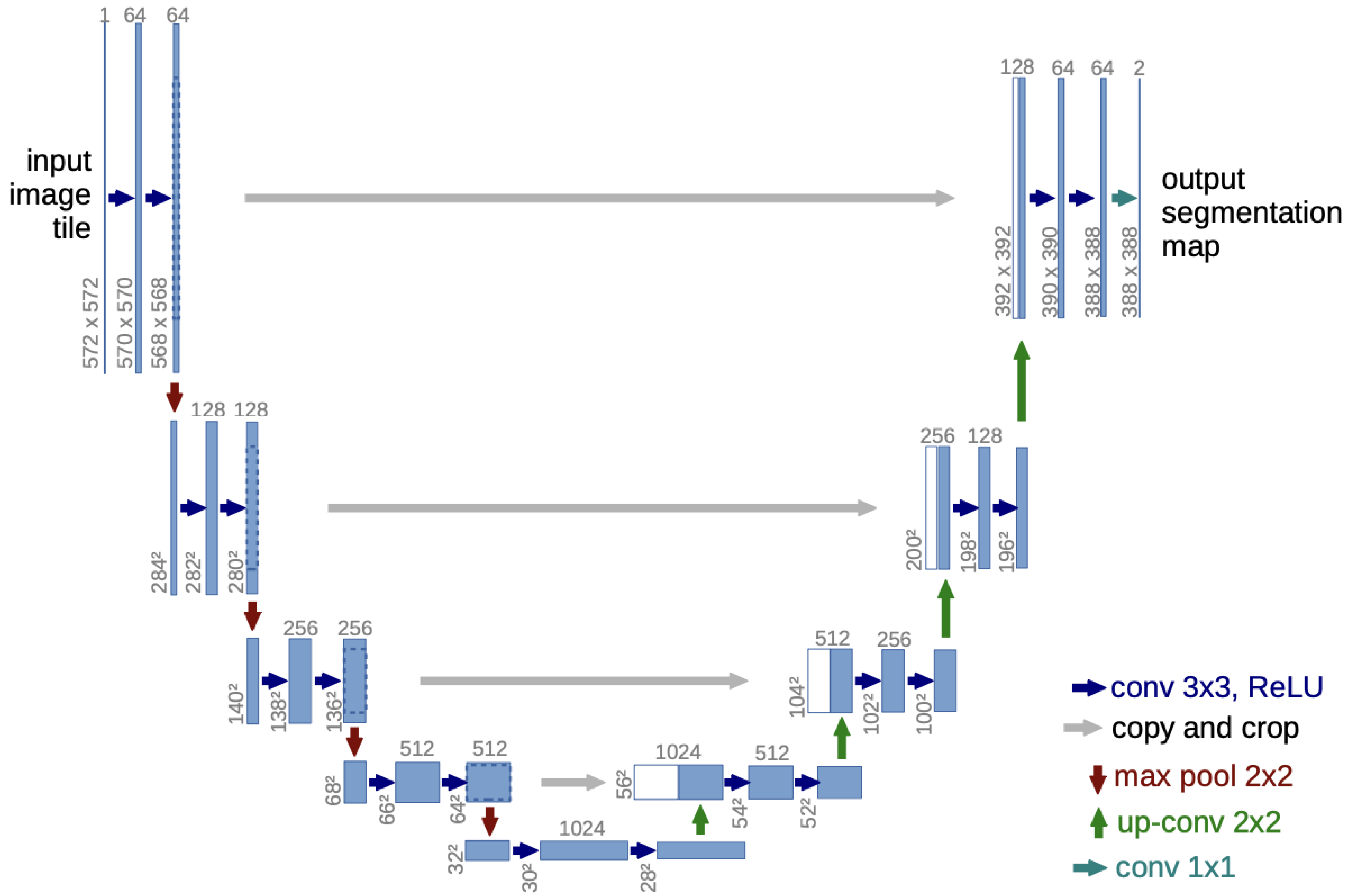
Loss function

세포의 경계선 라인에 대해 더 강한 학습을 시키기 위해 경계선 픽셀에는 더 큰 손실값을 줌

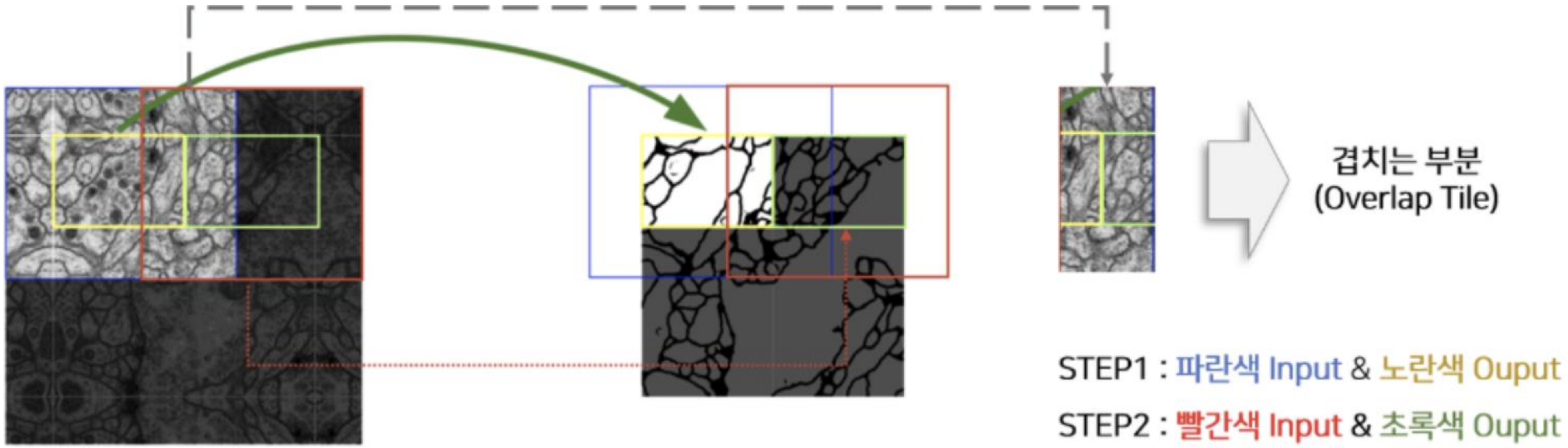
데이터셋



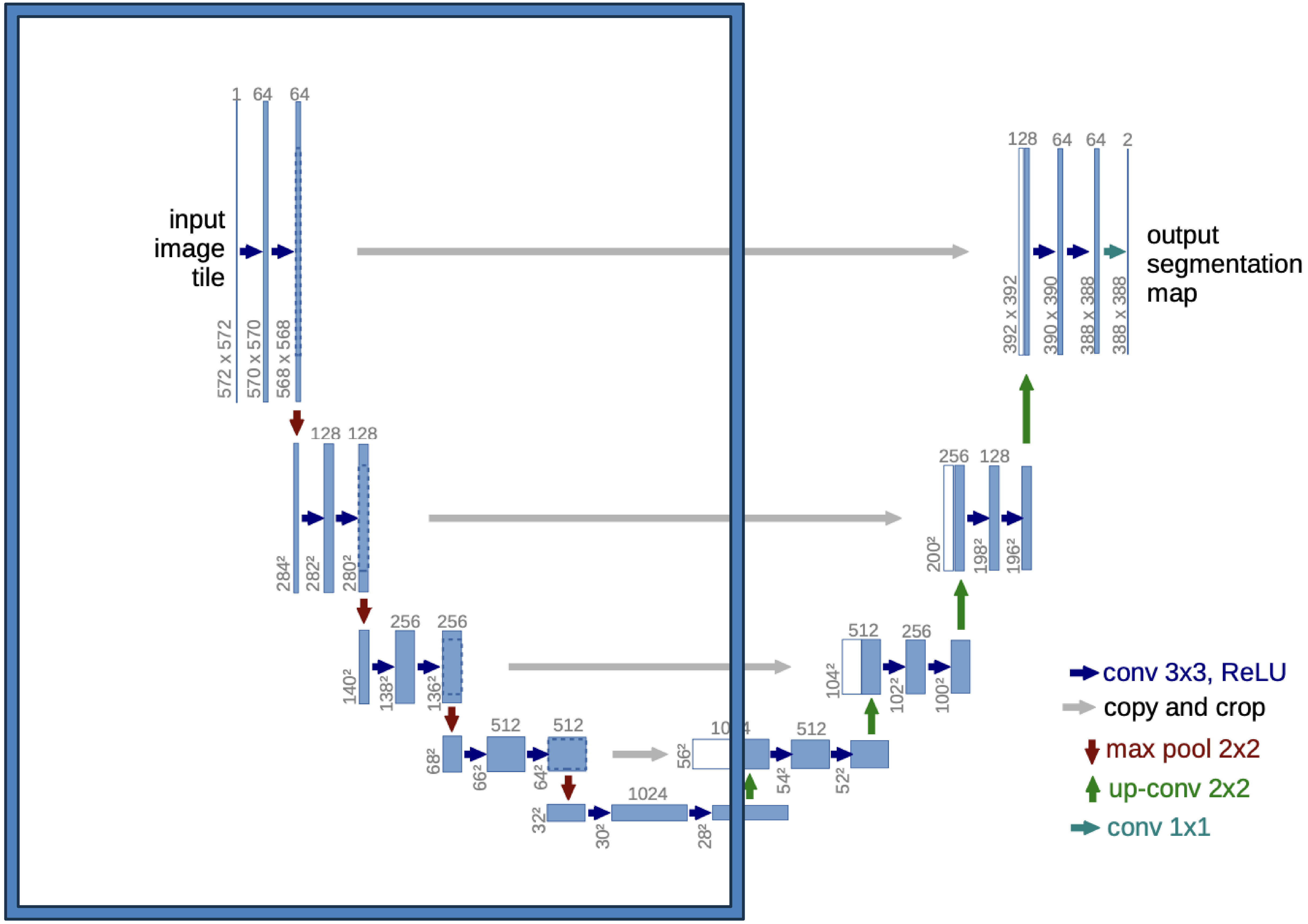
아키텍쳐


1 64 64
input
image
tile
572 x 572
570 x 570
568 x 568
128 128
256 256
512 512
1024
512
256
128
64 64 2
output
segmentation
map
392 x 392
390 x 390
388 x 388
388 x 388
conv 3x3, ReLU
copy and crop
max pool 2x2
up-conv 2x2
conv 1x1

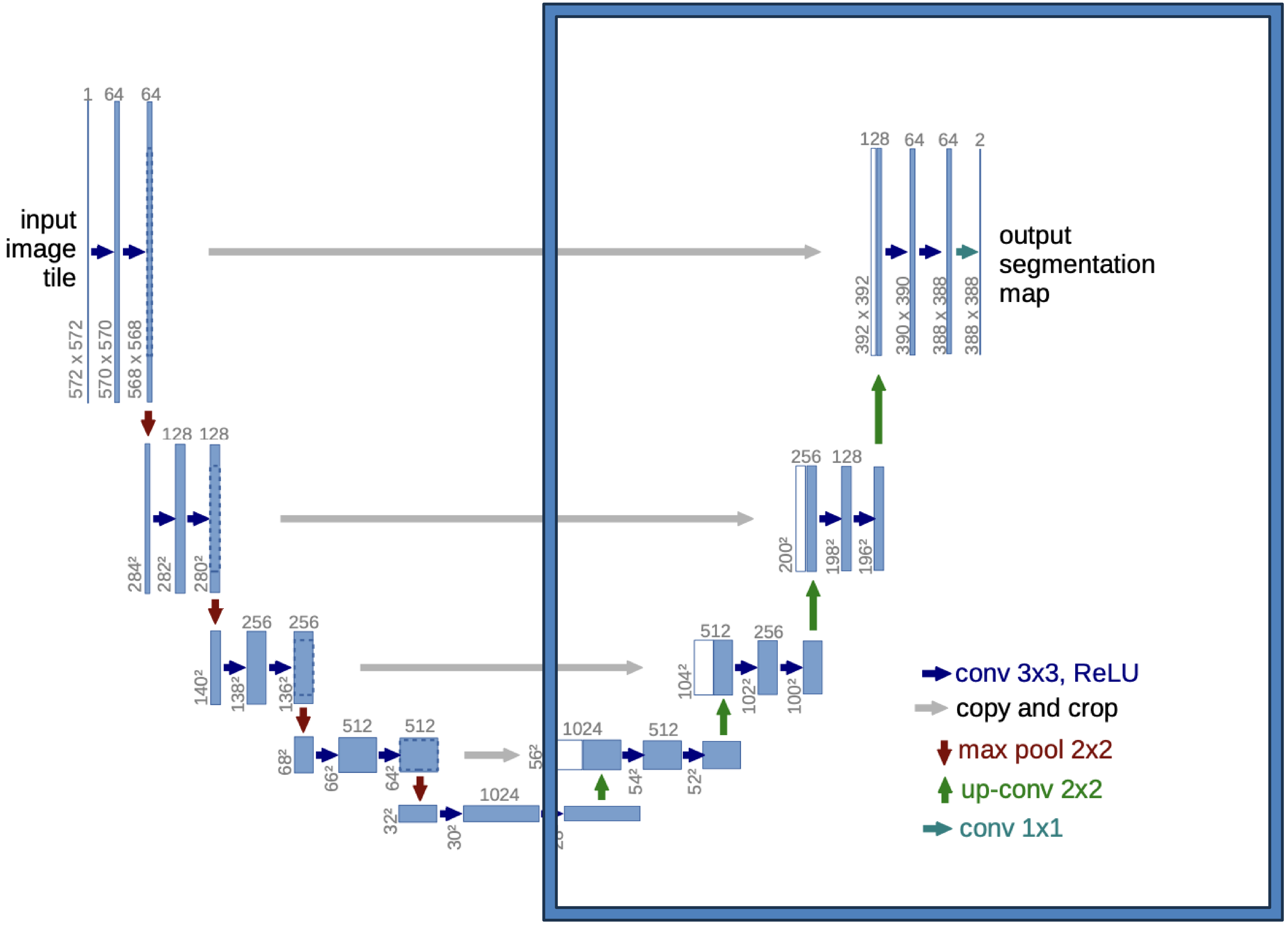
Overlap-tile strategy



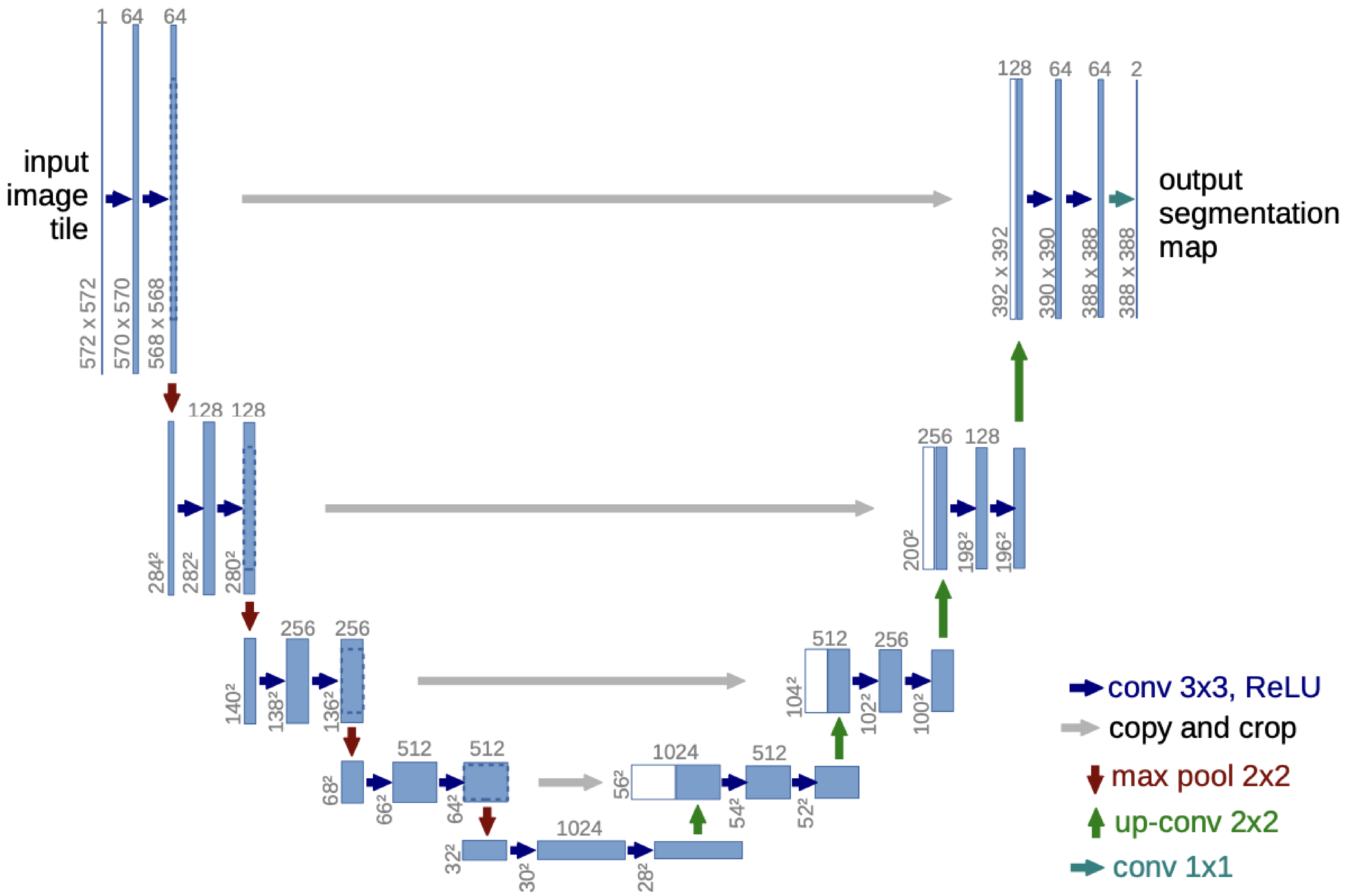
Contracting Path



Expanding Path



Skip Architecture



Loss function

pixel-wise cross-entropy loss

$$w(x) = w_c(x) + w_0 \cdot \exp\left(-\frac{(d_1(x) + d_2(x))^2}{2\sigma^2}\right)$$

d1: The distance to the border of the nearest cell
d2: The distance to the border of the second nearest cell

$$p_k(x) = \frac{\exp(a_k(x))}{\sum_{k'=1}^{K} \exp(a_{k'}(x))}$$

$$E = \sum_{x \in \Omega} w(x) \log(p_{\ell(x)}(x))$$

Loss function

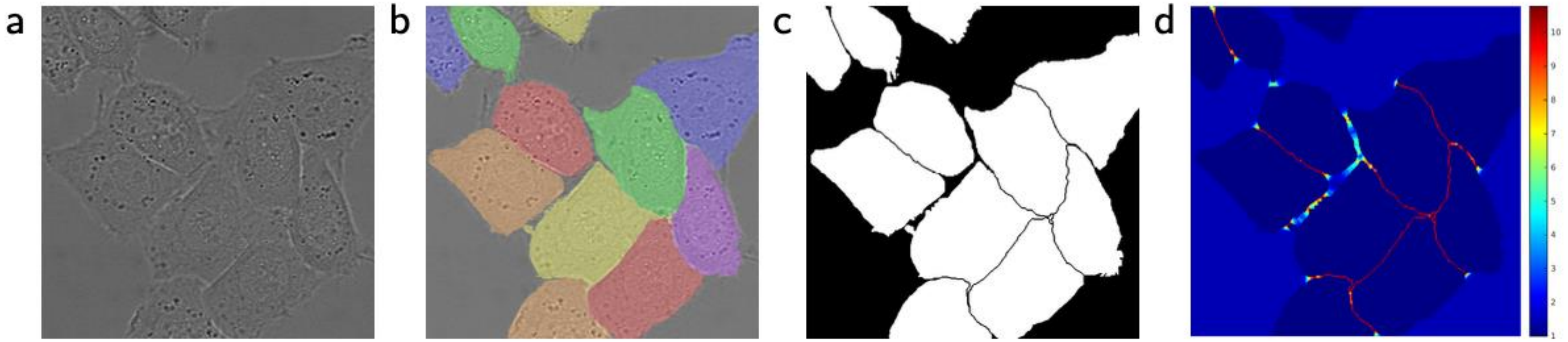
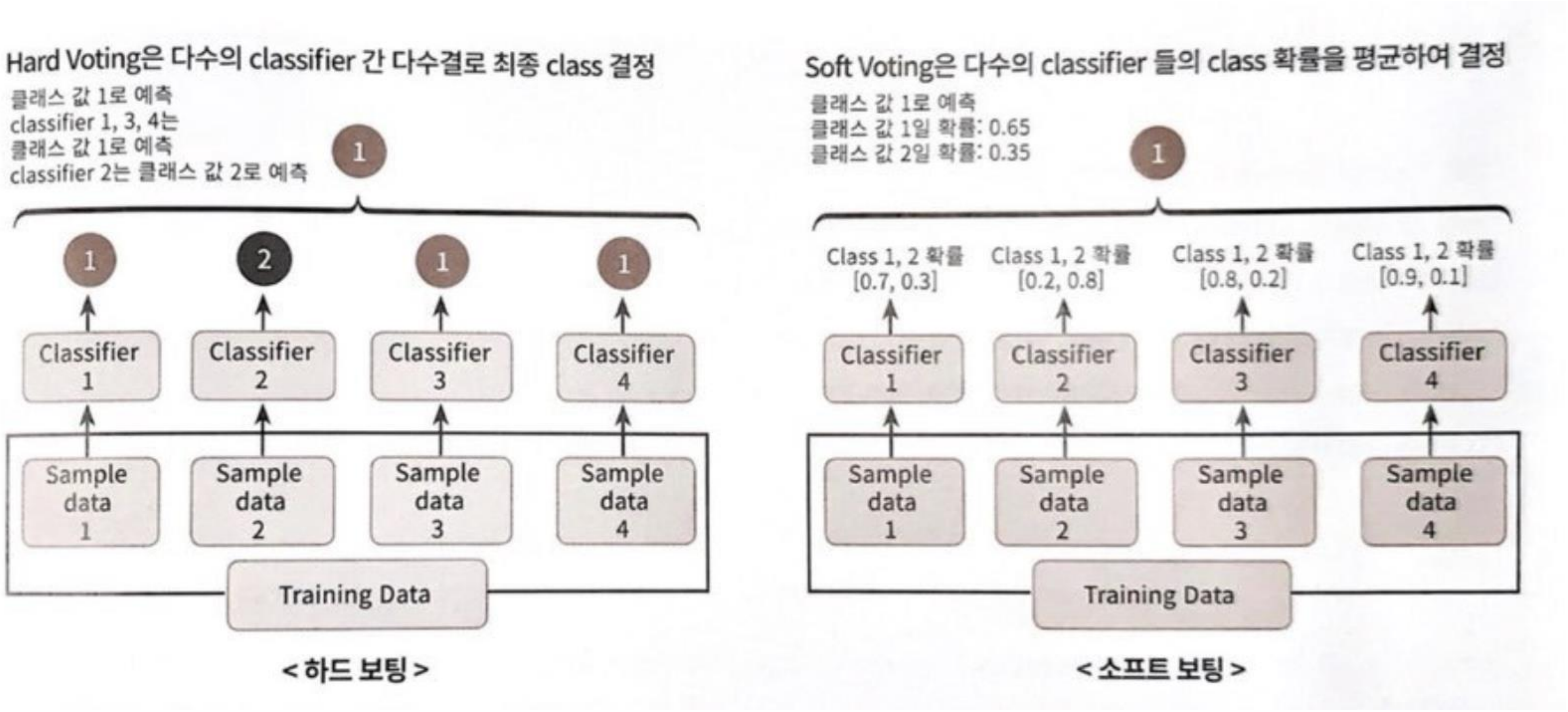


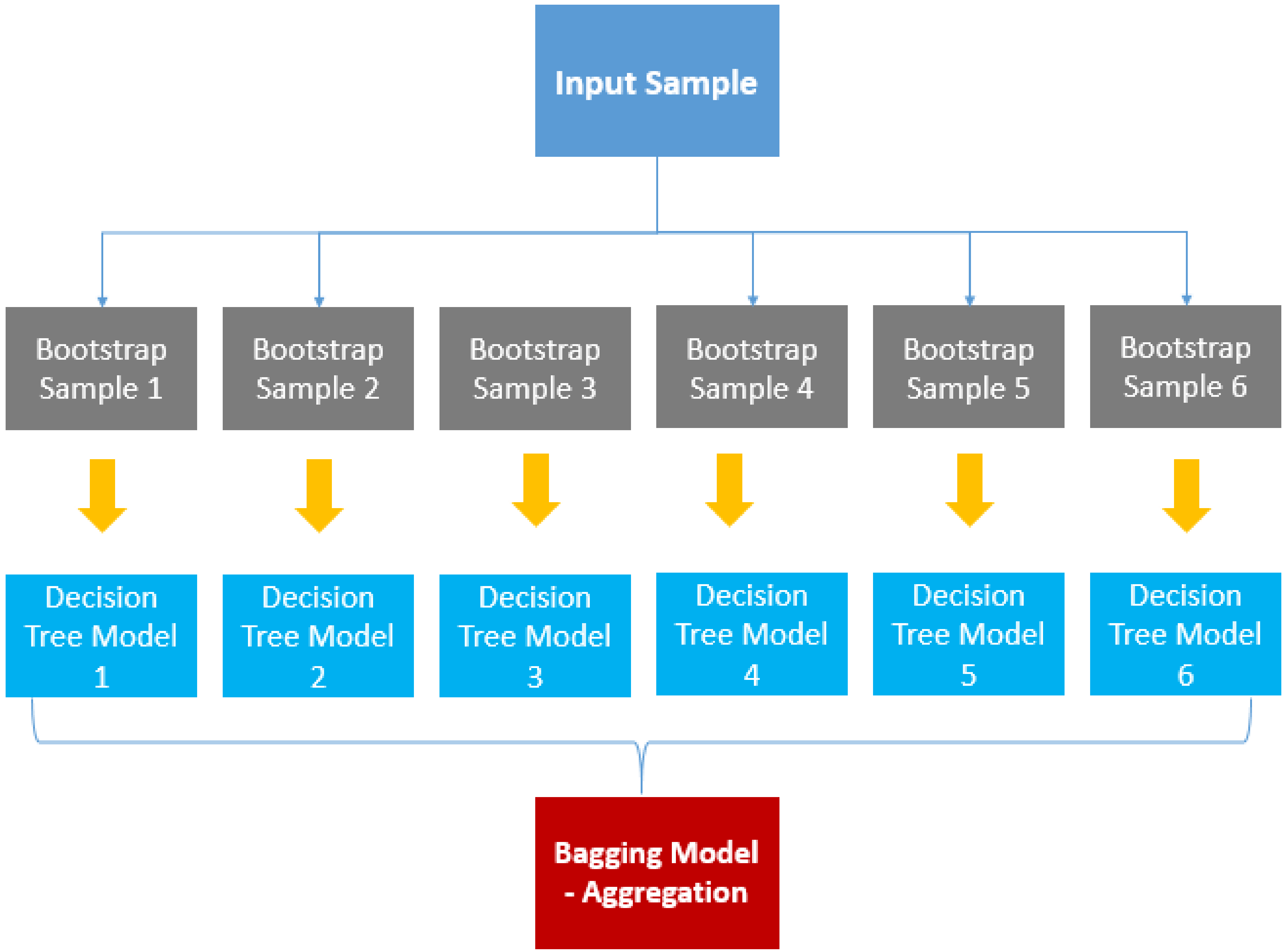
Fig. 3. HeLa cells on glass recorded with DIC (differential interference contrast) microscopy. (**a**) raw image. (**b**) overlay with ground truth segmentation. Different colors indicate different instances of the HeLa cells. (**c**) generated segmentation mask (white: foreground, black: background). (**d**) map with a pixel-wise loss weight to force the network to learn the border pixels.

앙상블 기법

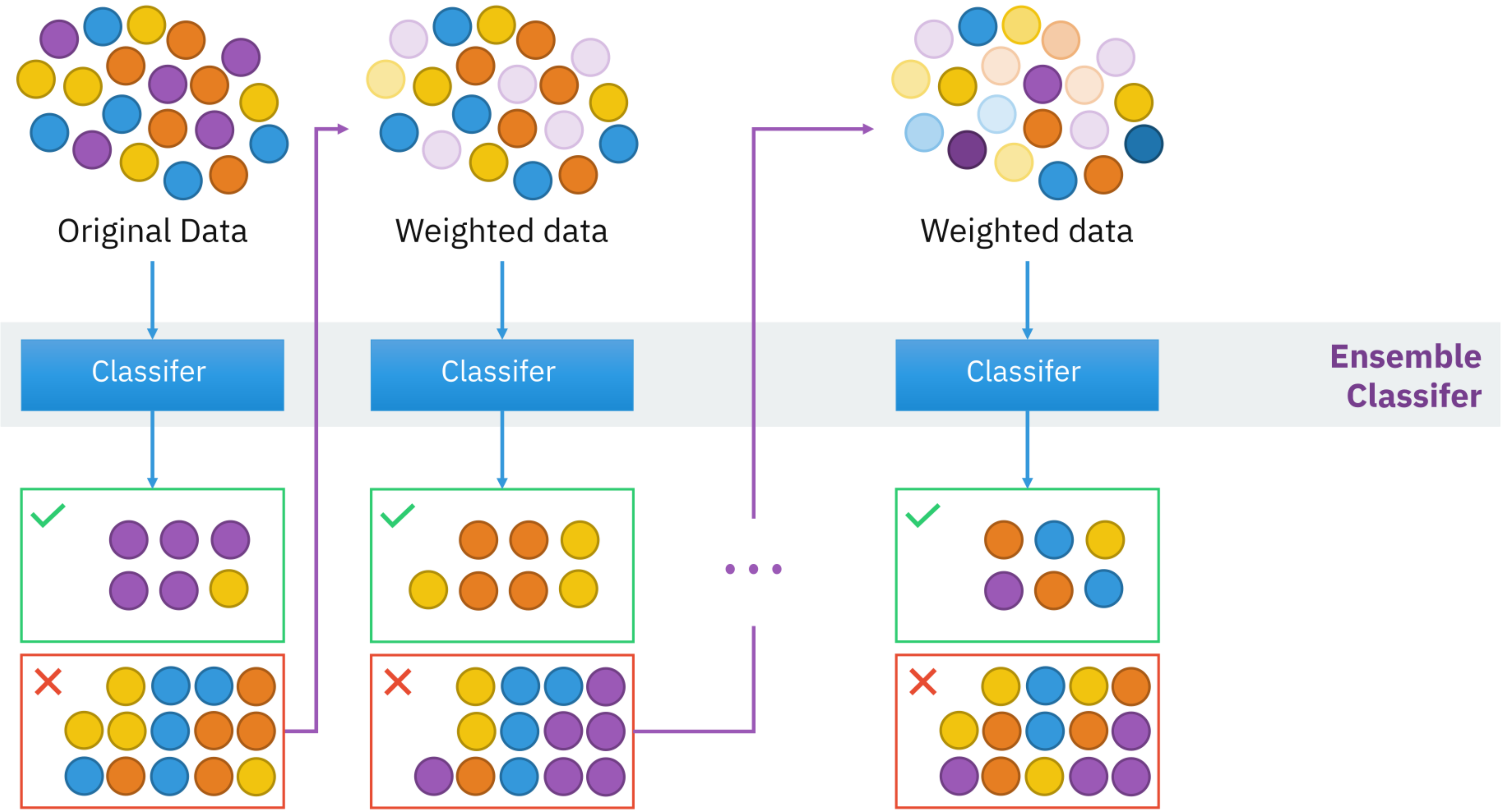


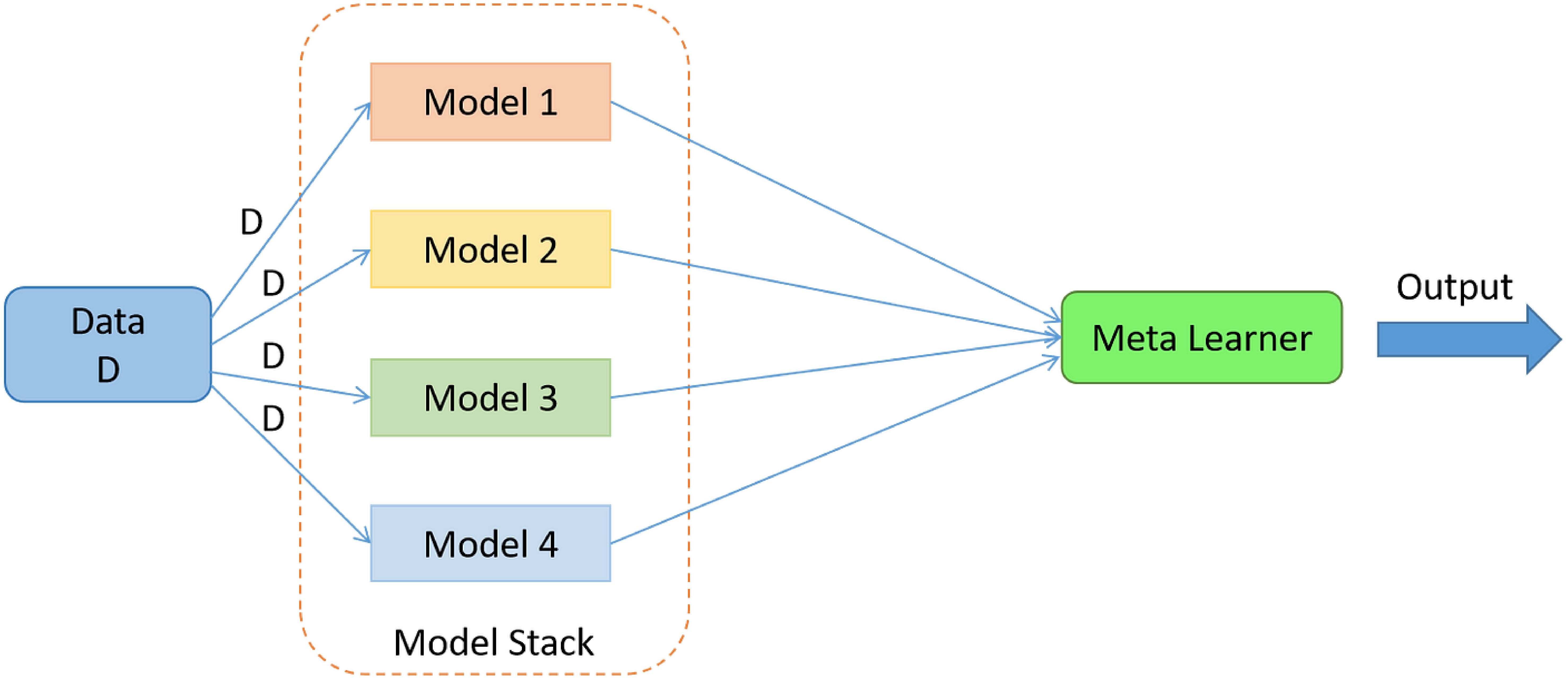
Hard Voting은 다수의 classifier 간 다수결로 최종 class 결정
클래스 값 1로 예측
classifier 1, 3, 4는
클래스 값 1로 예측
classifier 2는 클래스 값 2로 예측
1
1
2
1
1
Classifier 1
Classifier 2
Classifier 3
Classifier 4
Sample data 1
Sample data 2
Sample data 3
Sample data 4
Training Data
<하드 보팅>
Soft Voting은 다수의 classifier 들의 class 확률을 평균하여 결정
클래스 값 1로 예측
클래스 값 1일 확률: 0.65
클래스 값 2일 확률: 0.35
1
Class 1, 2 확률 [0.7, 0.3]
Class 1, 2 확률 [0.2, 0.8]
Class 1, 2 확률 [0.8, 0.2]
Class 1, 2 확률 [0.9, 0.1]
Classifier 1
Classifier 2
Classifier 3
Classifier 4
Sample data 1
Sample data 2
Sample data 3
Sample data 4
Training Data
<소프트 보팅>

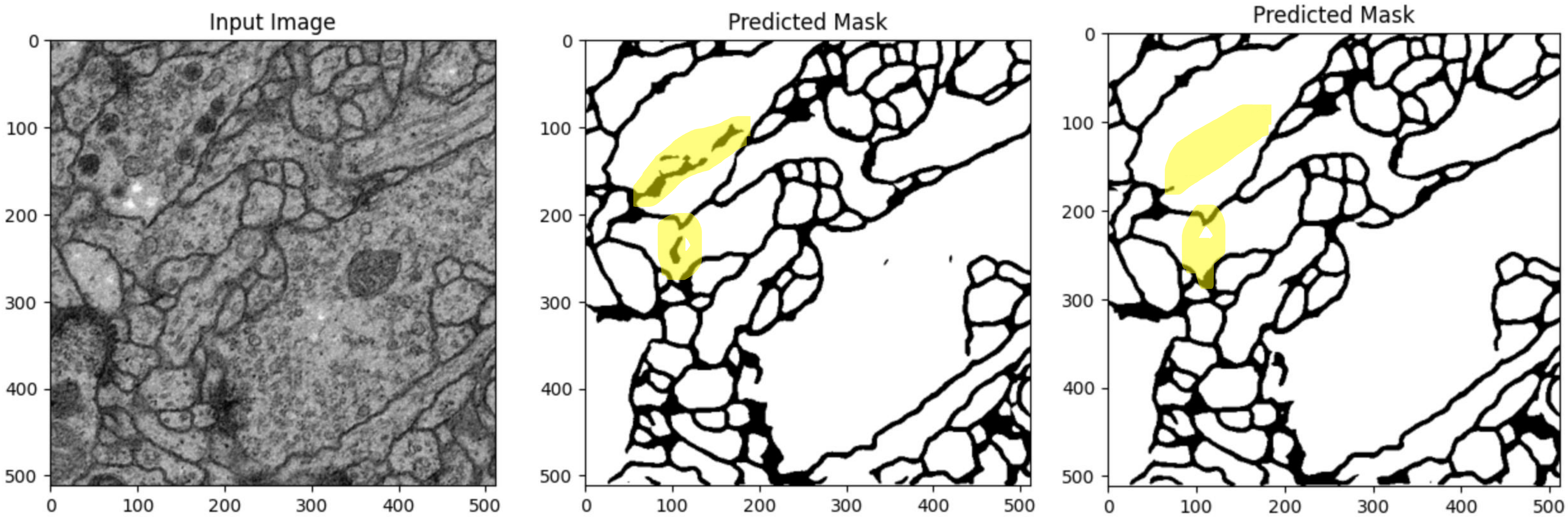
Bagging


Input Sample
Bootstrap Sample 1
Bootstrap Sample 2
Bootstrap Sample 3
Bootstrap Sample 4
Bootstrap Sample 5
Bootstrap Sample 6
Decision Tree Model 1
Decision Tree Model 2
Decision Tree Model 3
Decision Tree Model 4
Decision Tree Model 5
Decision Tree Model 6
Bagging Model - Aggregation

Boosting


Original Data
Weighted data
Weighted data
Classifer
Classifer
Classifer
Ensemble Classifer


Model 1
Model 2
Model 3
Model 4
Data
D
D
D
D
D
Model Stack
Meta Learner
Output


Input Image
Predicted Mask
Predicted Mask
0
100
200
300
400
500