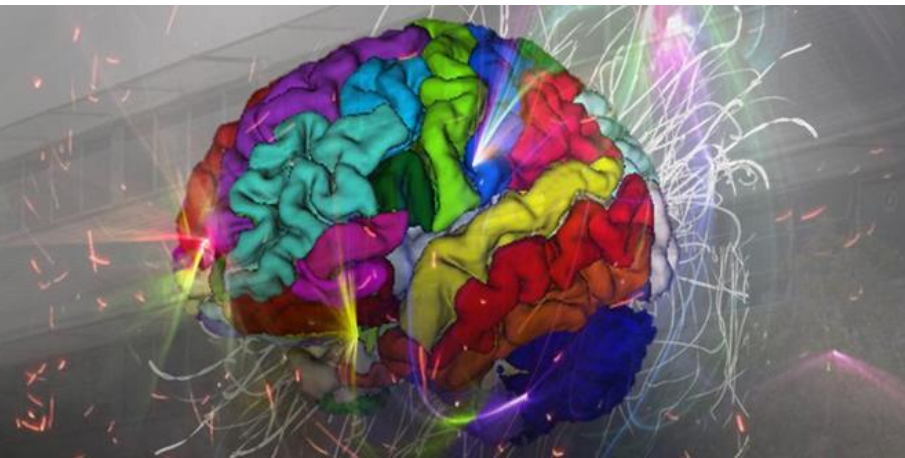




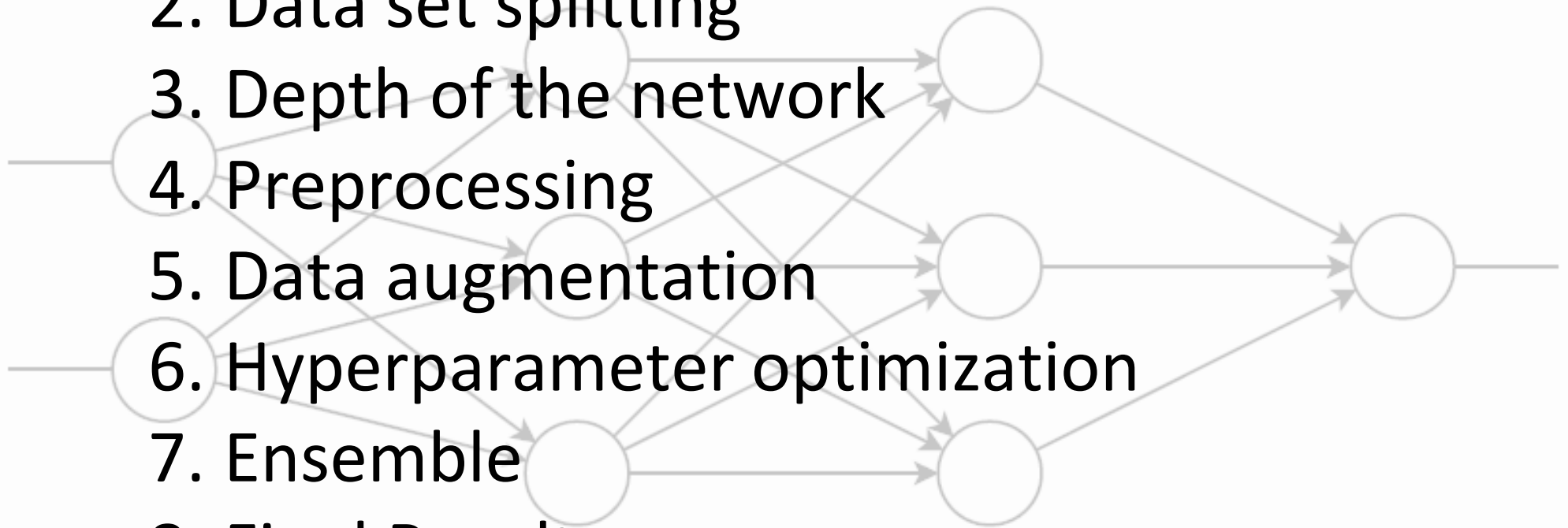
# CAD Project: Deep Learning Approach

Jaime Simarro & Ahmed Gouda

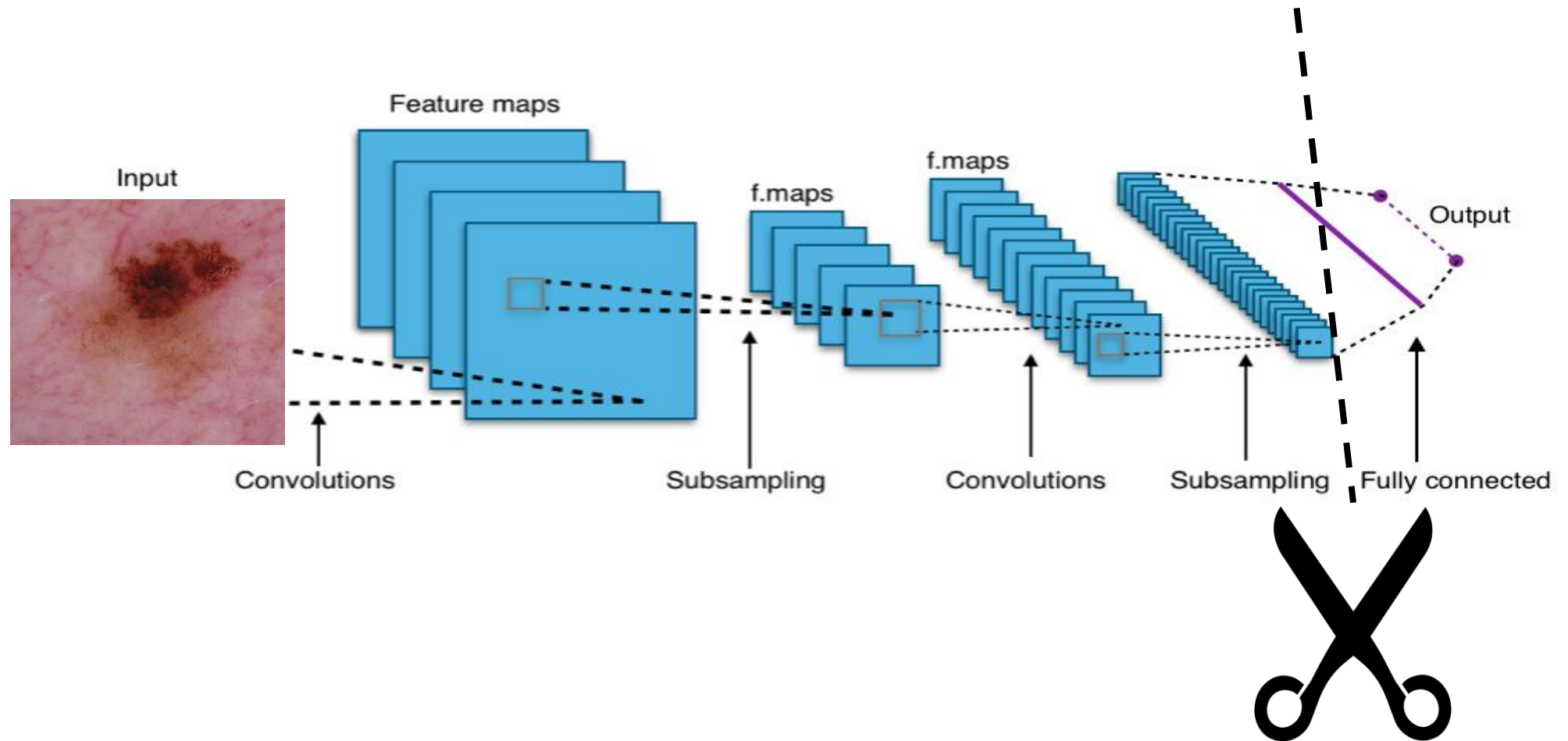


# Index

1. Model creation
2. Data set splitting
3. Depth of the network
4. Preprocessing
5. Data augmentation
6. Hyperparameter optimization
7. Ensemble
8. Final Results
9. Discursion

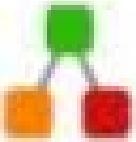


# Model Creation



# Normalization

	R	G	B
Mean	0.485	0.456	0.406
Std	0.229	0.224	0.225

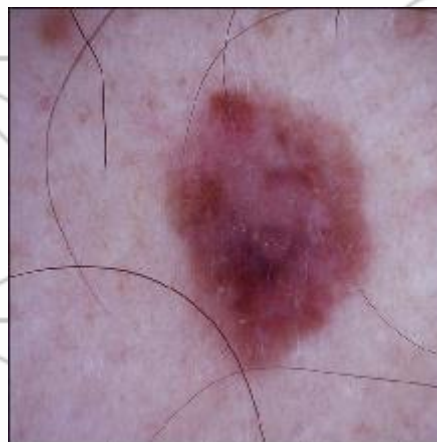
IMGENET

# Preprocessing

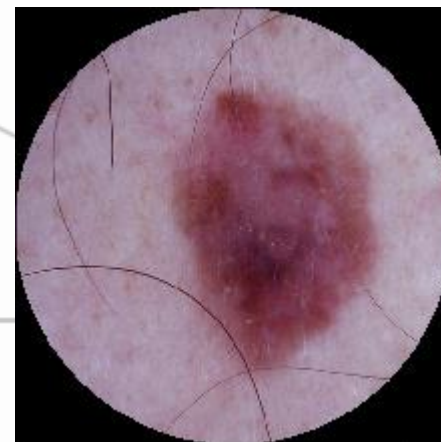
**Original Image**



**Square cropping**

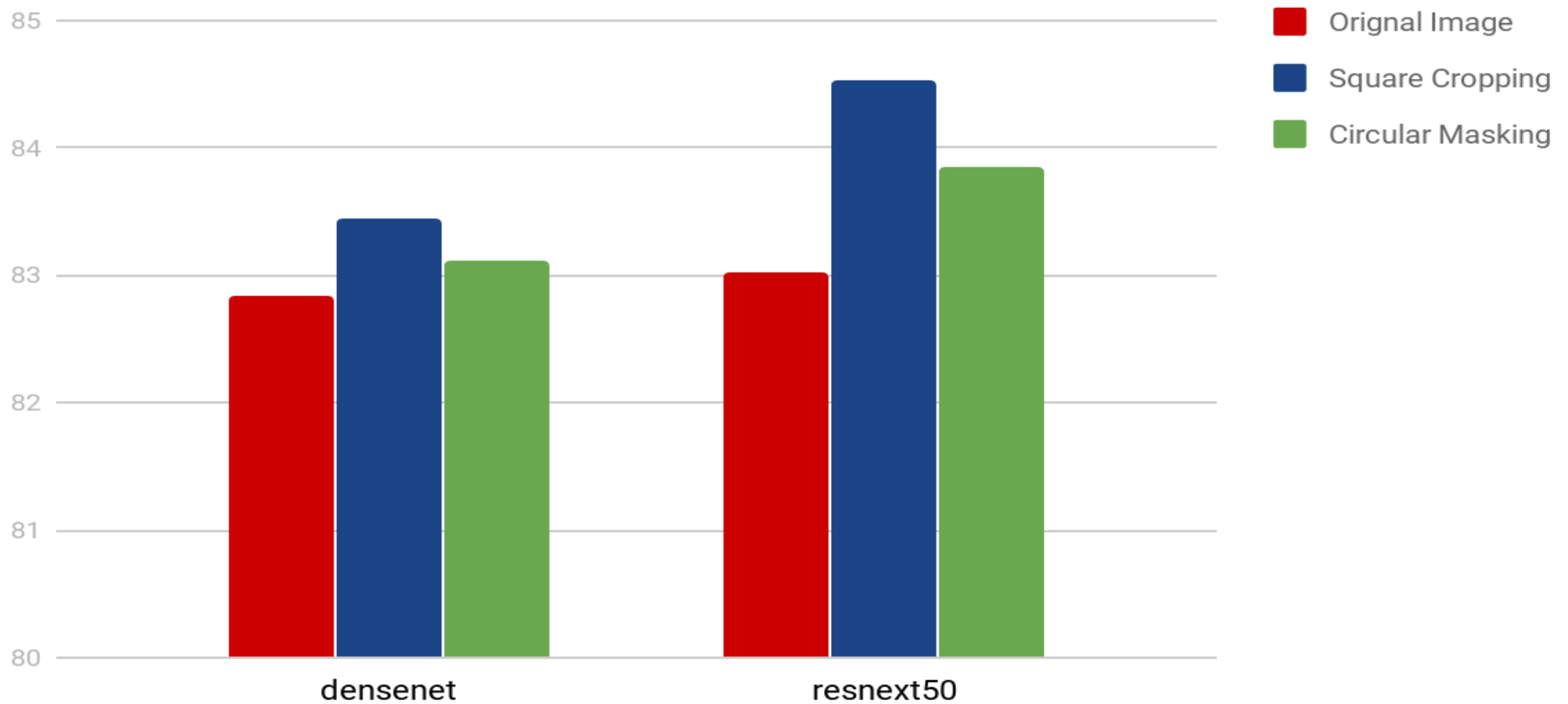


**Circular Masking**

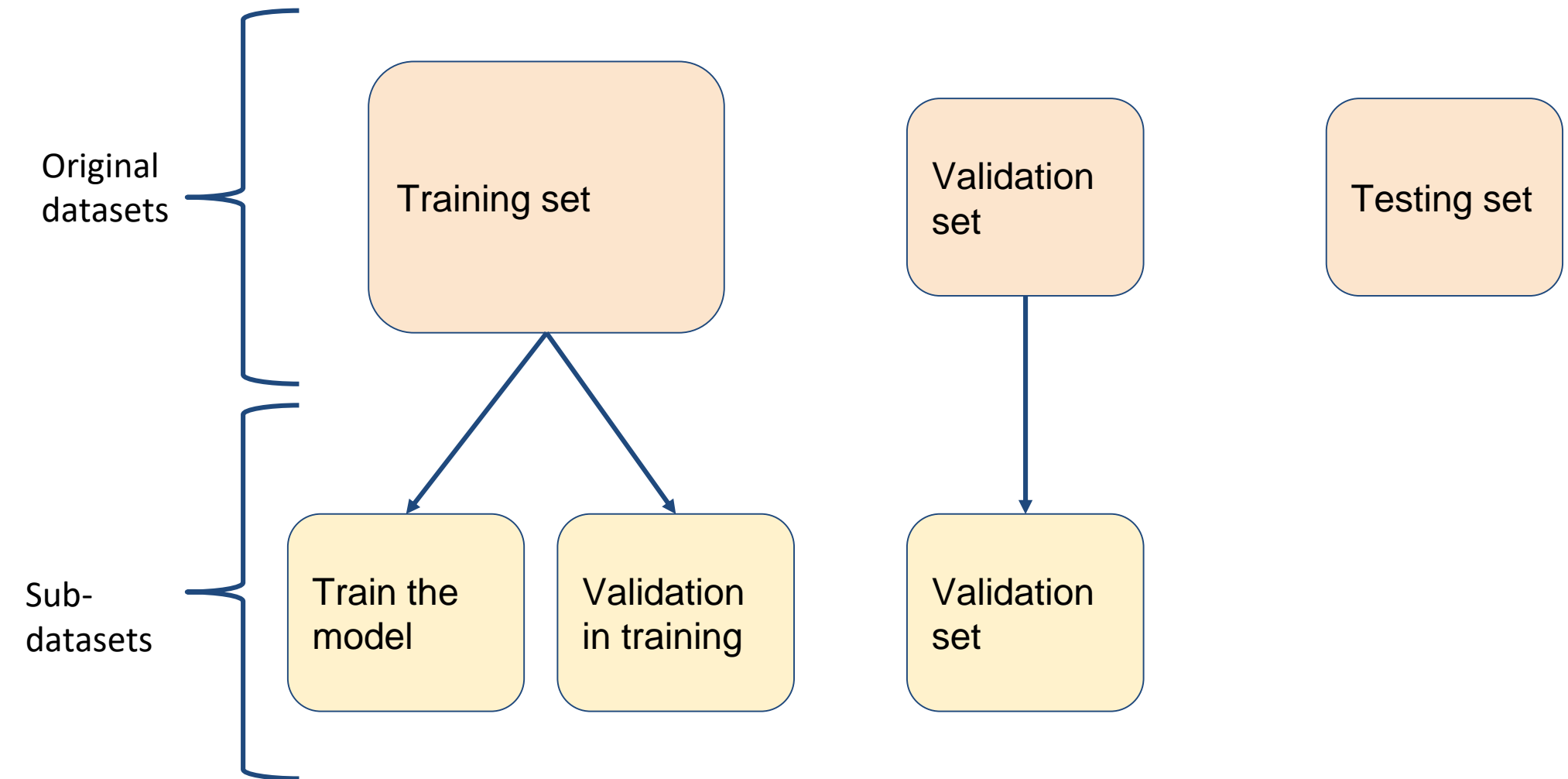


# Preprocessing

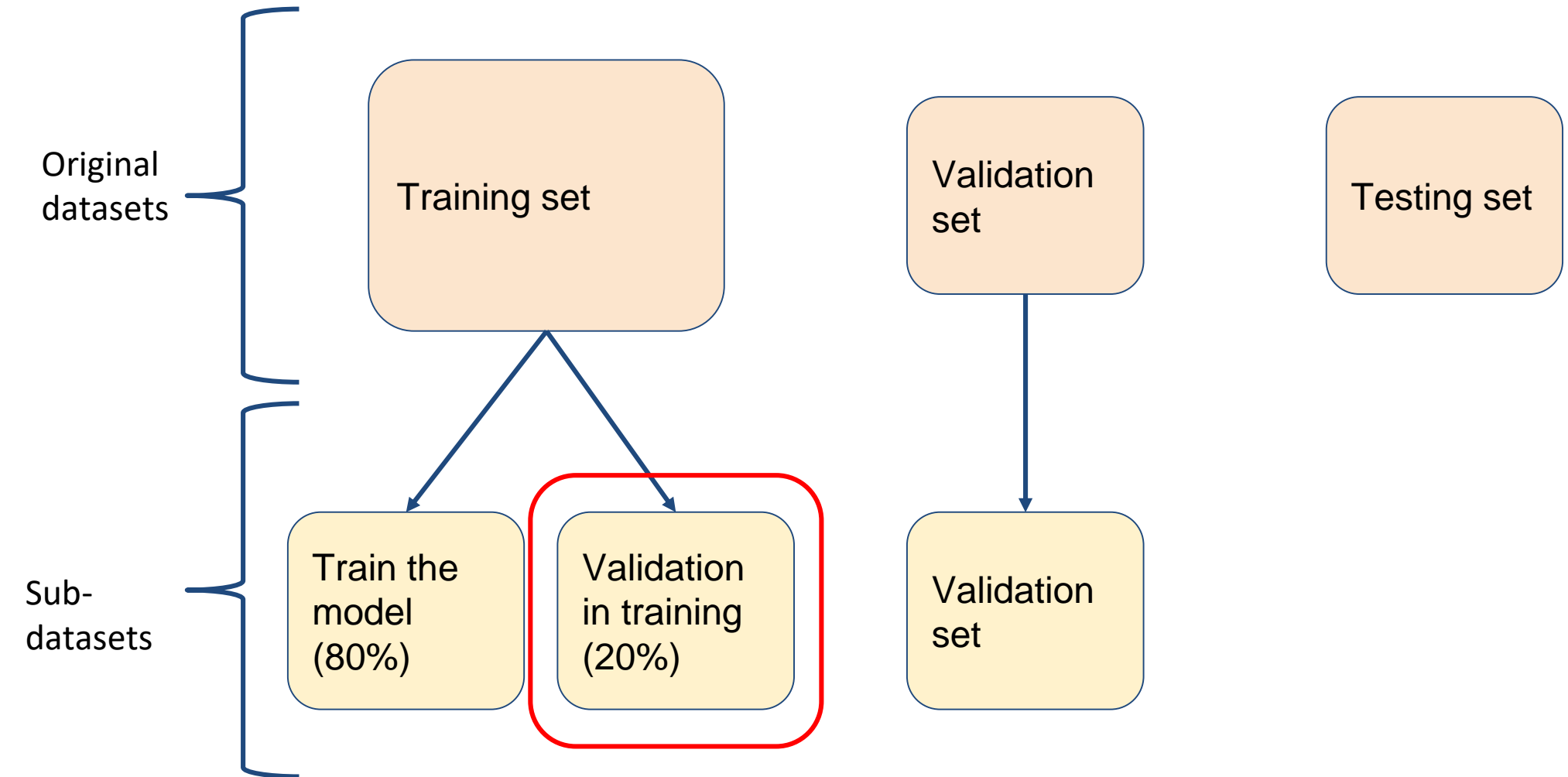
## Different Preprocessing Influence



# Database splitting



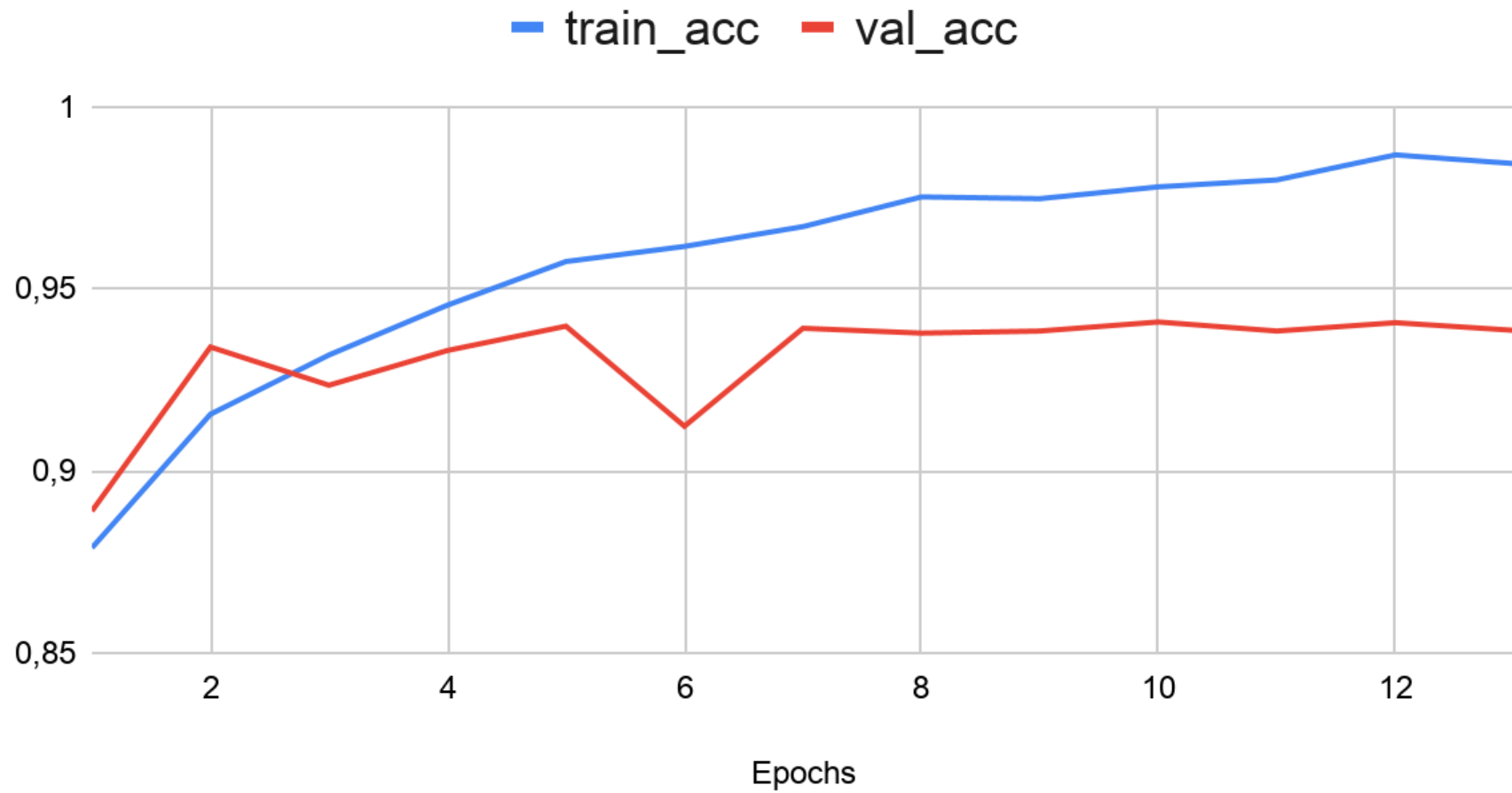
# Database splitting



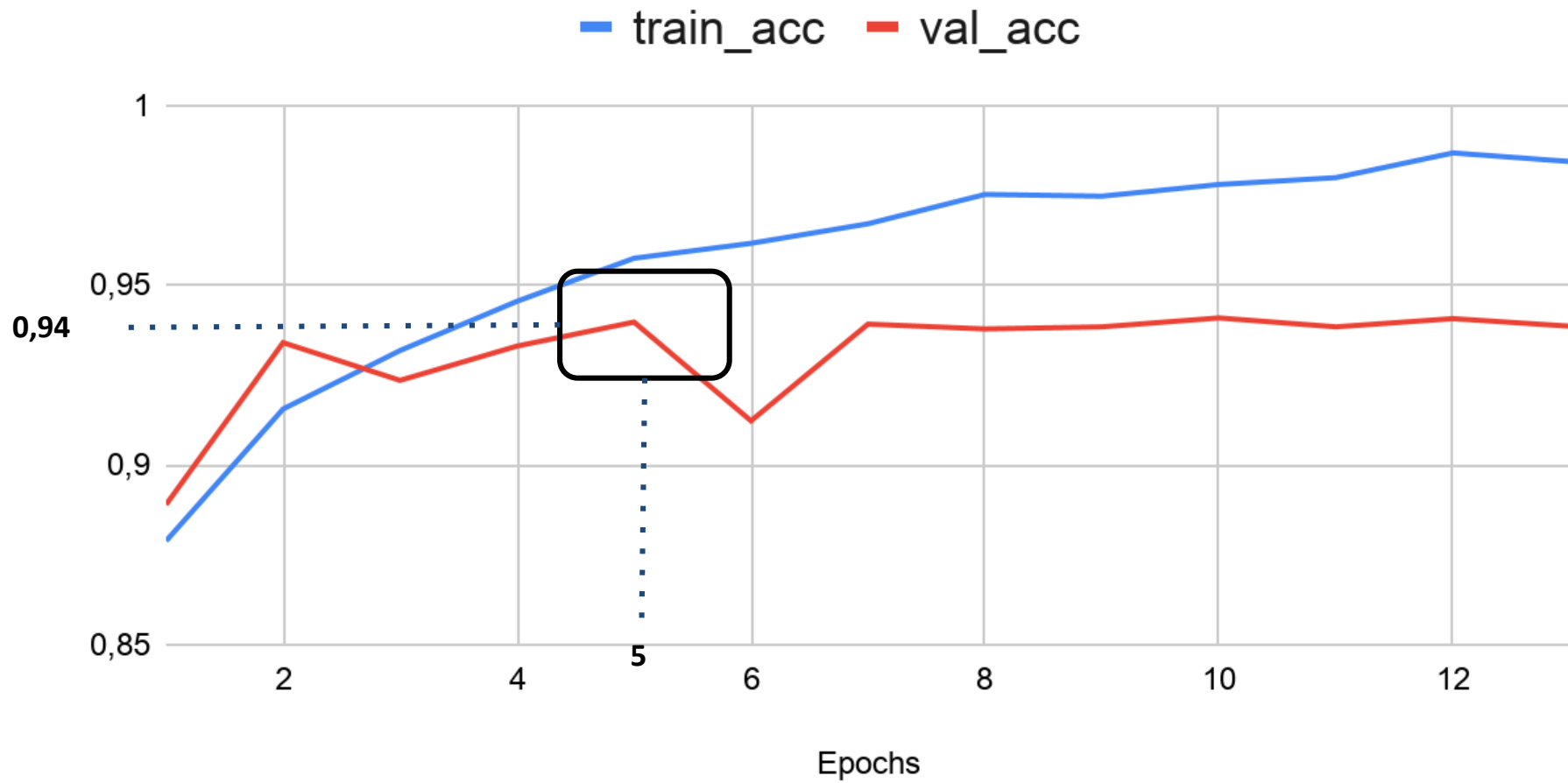
**SELECT THE BEST EPOCH:  
EARLY STOPPING**



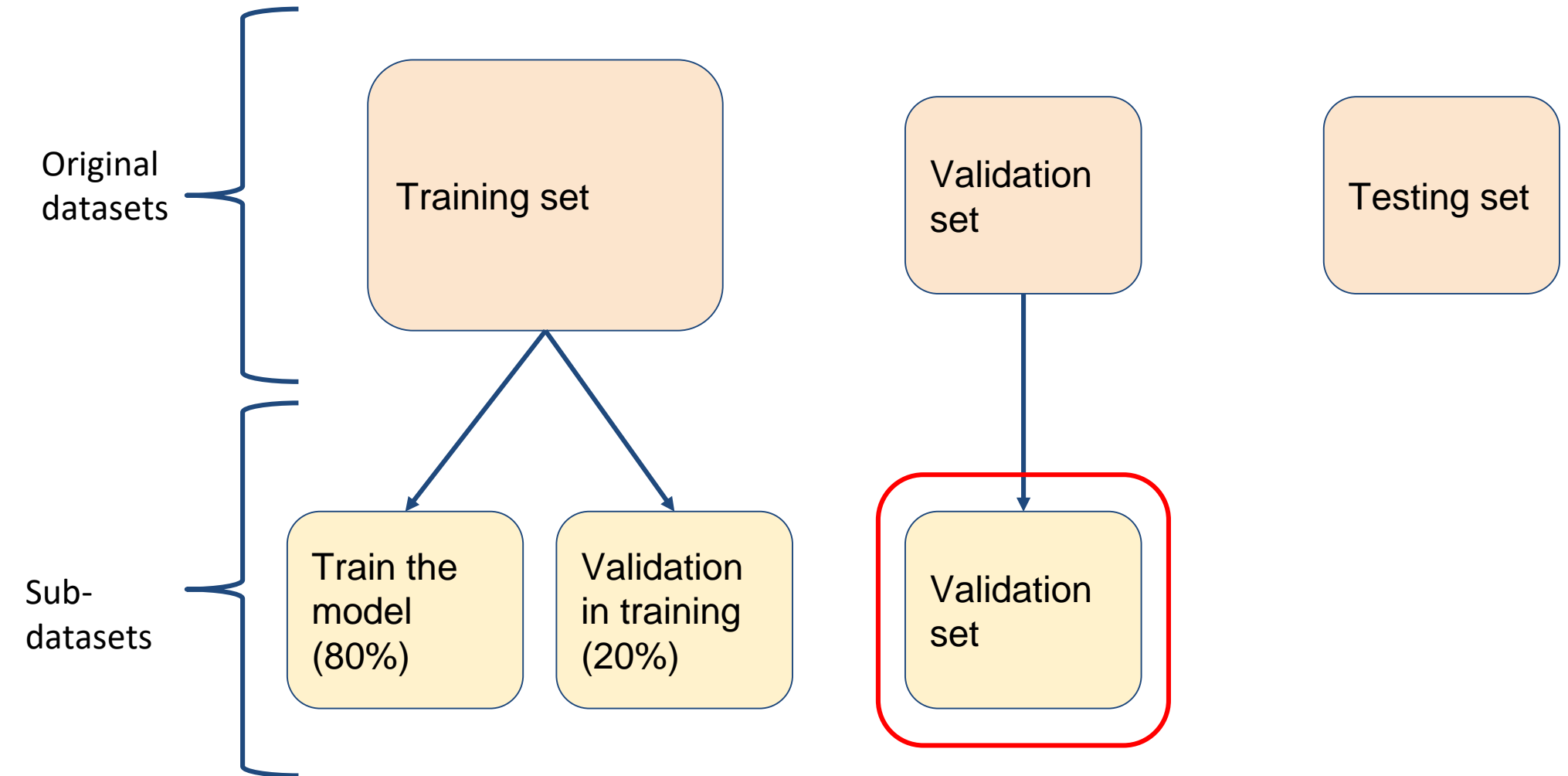
## Accuracy



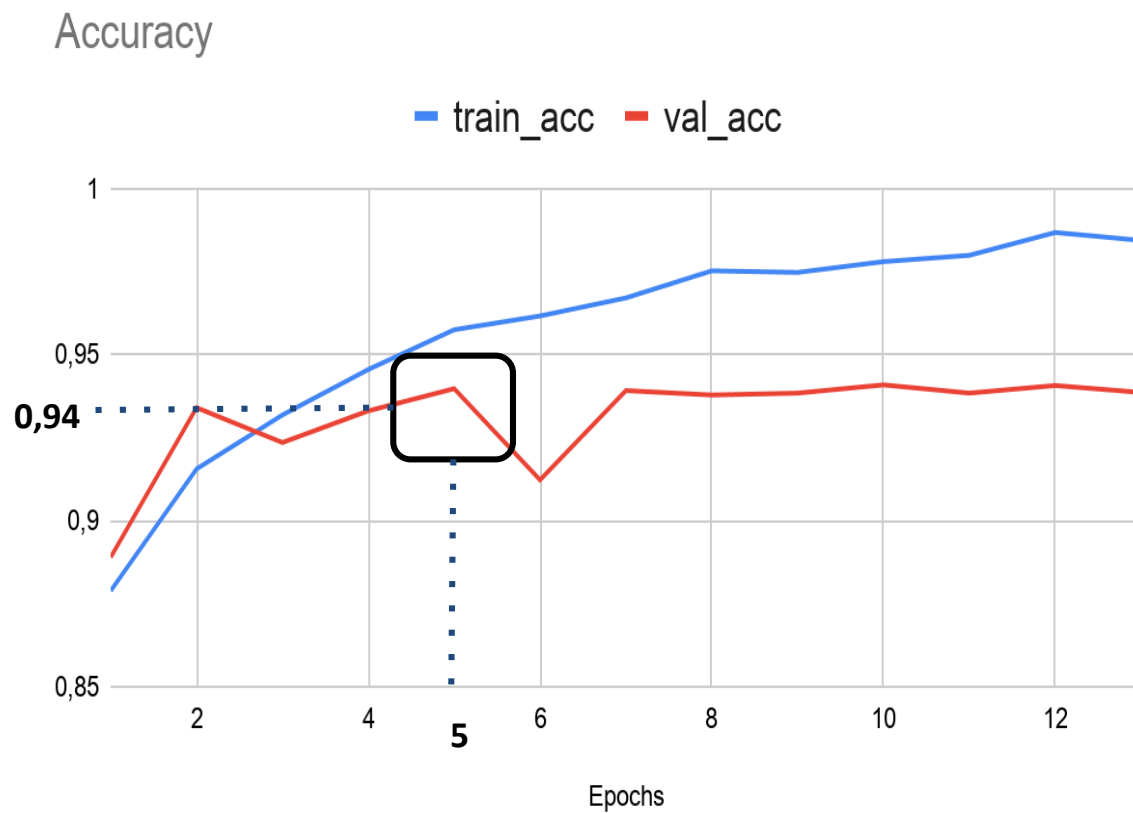
## Accuracy



# Database splitting



COMPARE BETWEEN MODELS

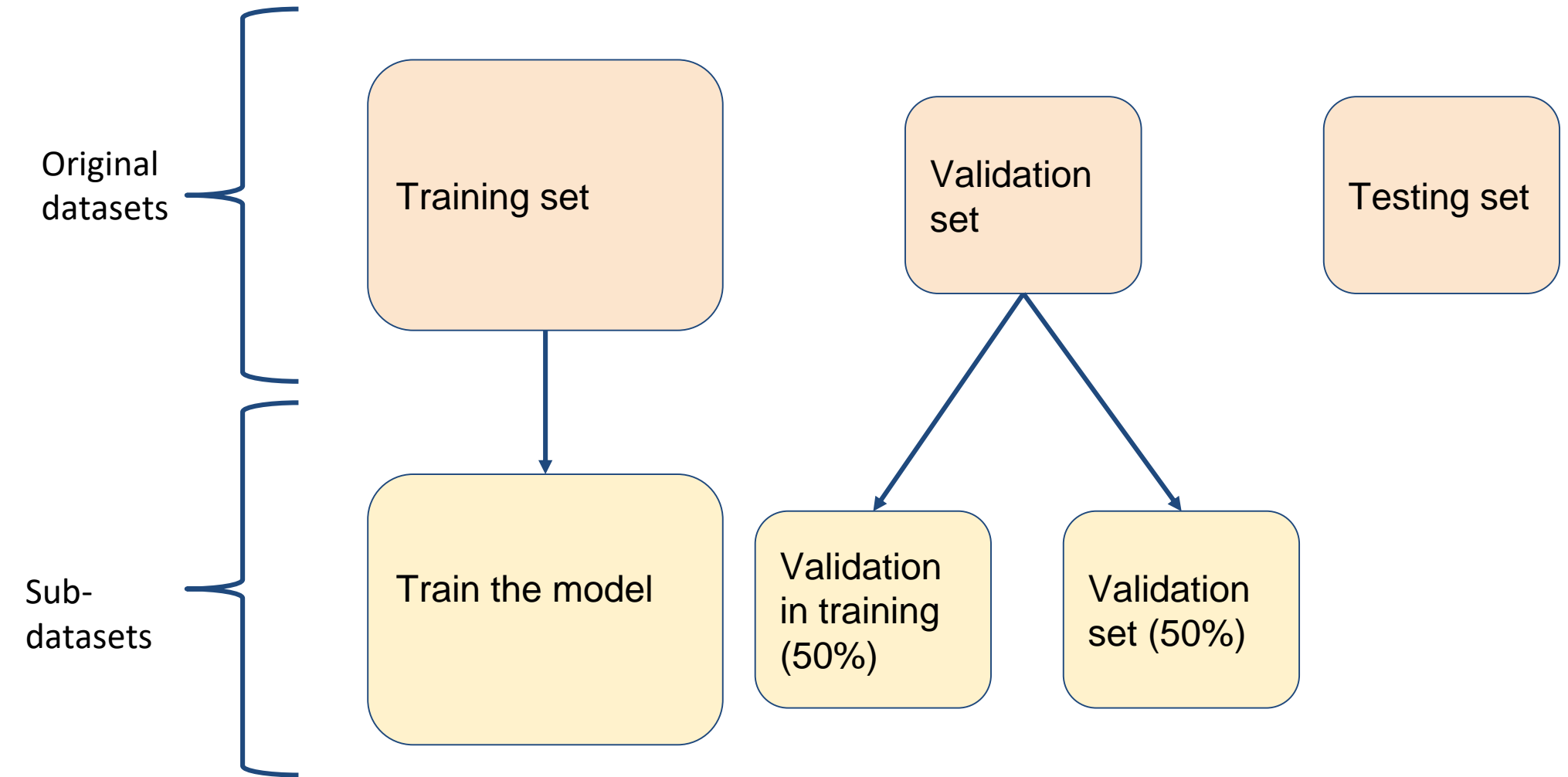


But **86,6%** in validation



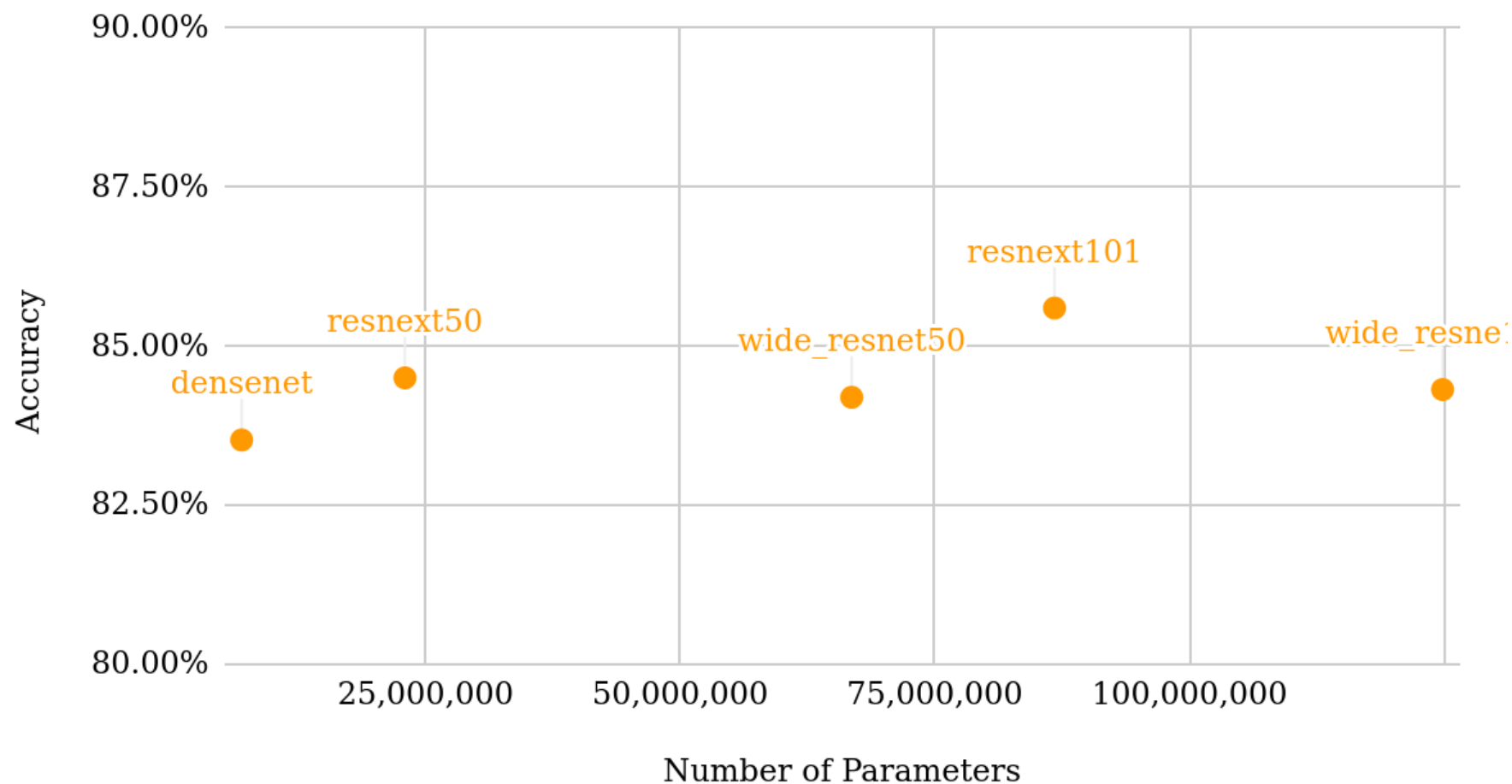
- Definitely, the validation in training it is **not representative**.
- They may come from differences distributions.

# Database splitting- Histopathology

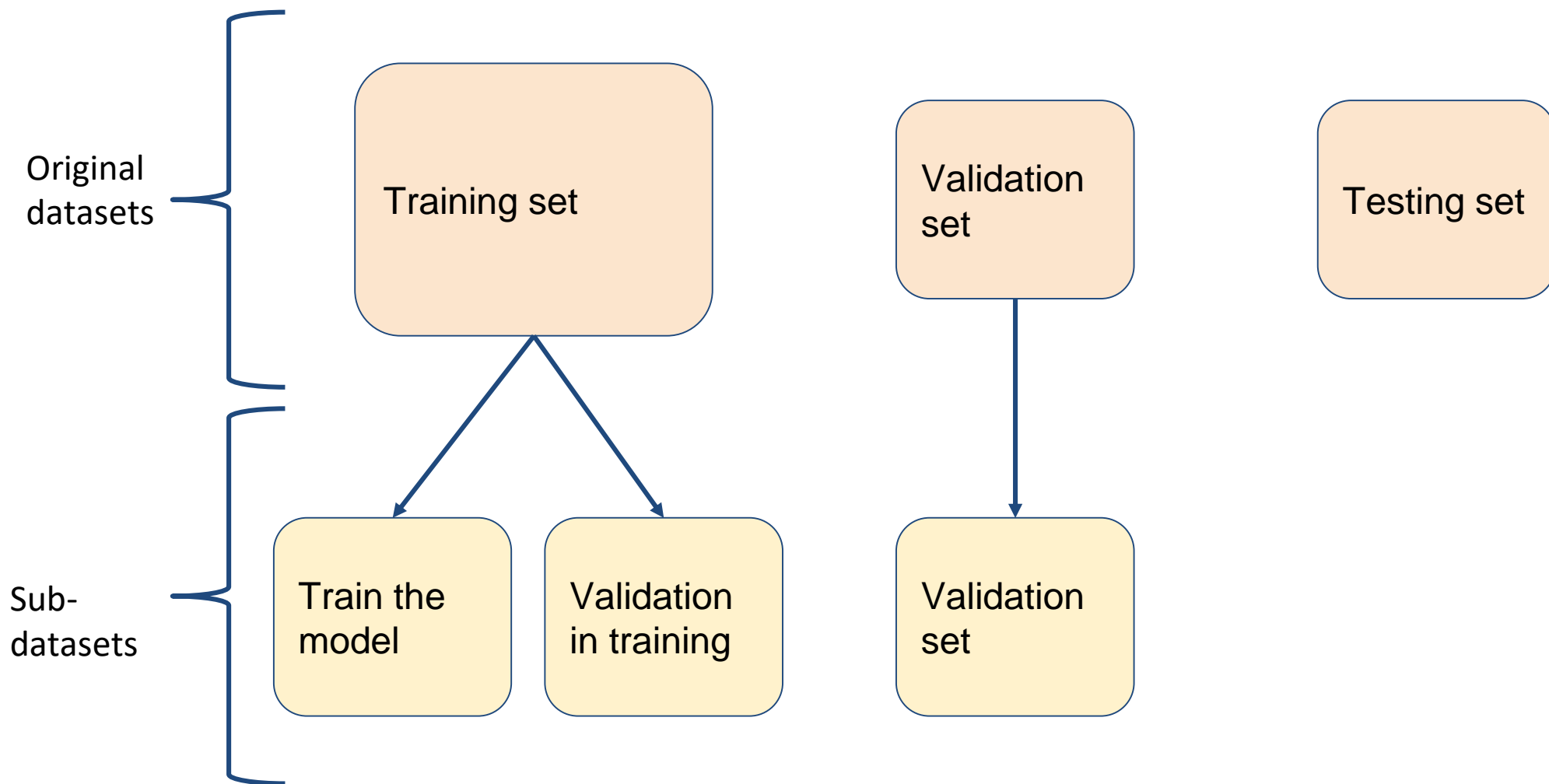


# Depth- Histopathology

Accuracy vs Parameters



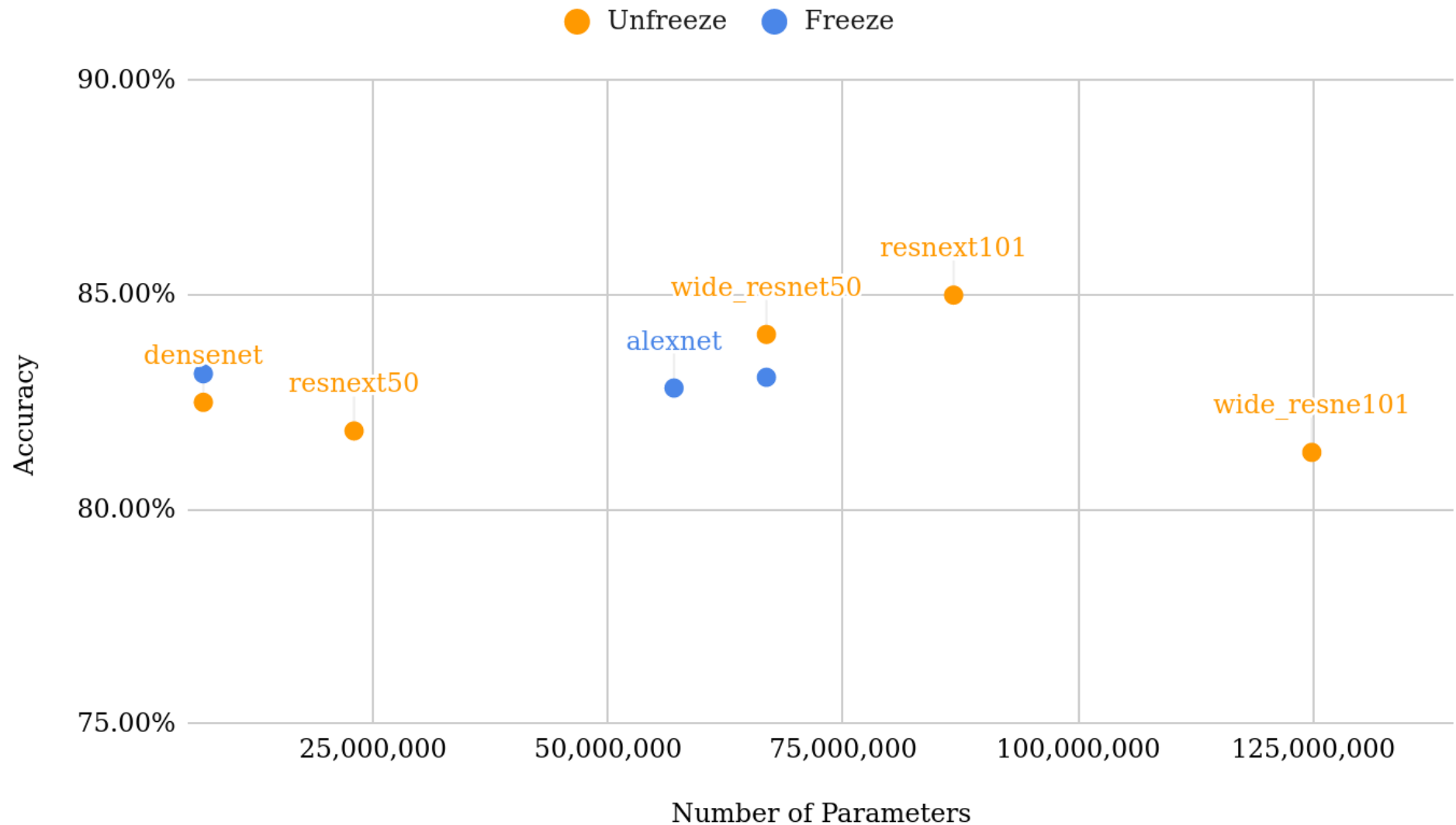
# Database splitting- Dermo





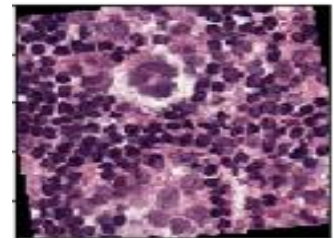
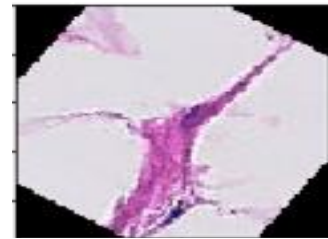
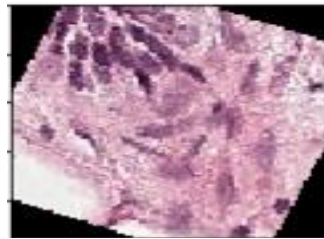
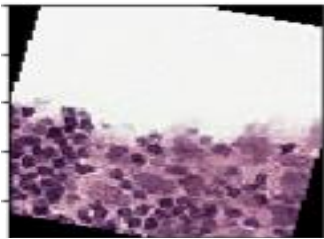
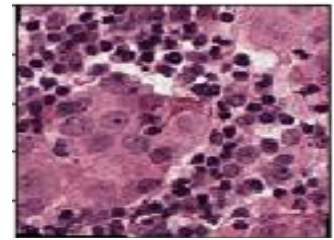
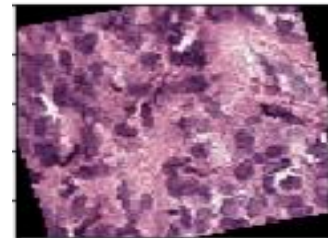
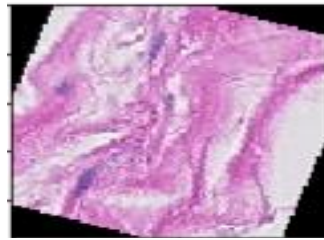
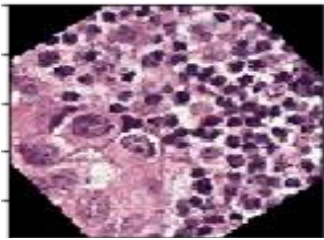
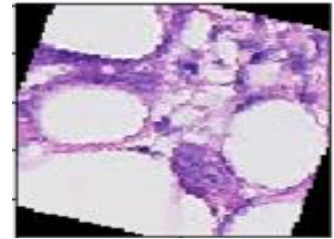
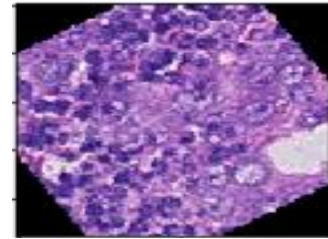
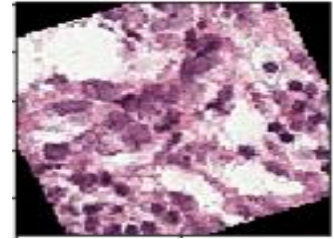
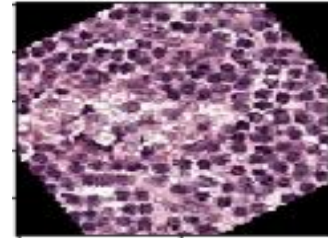
# Depth- Dermoscopy

## Accuracy vs Parameters



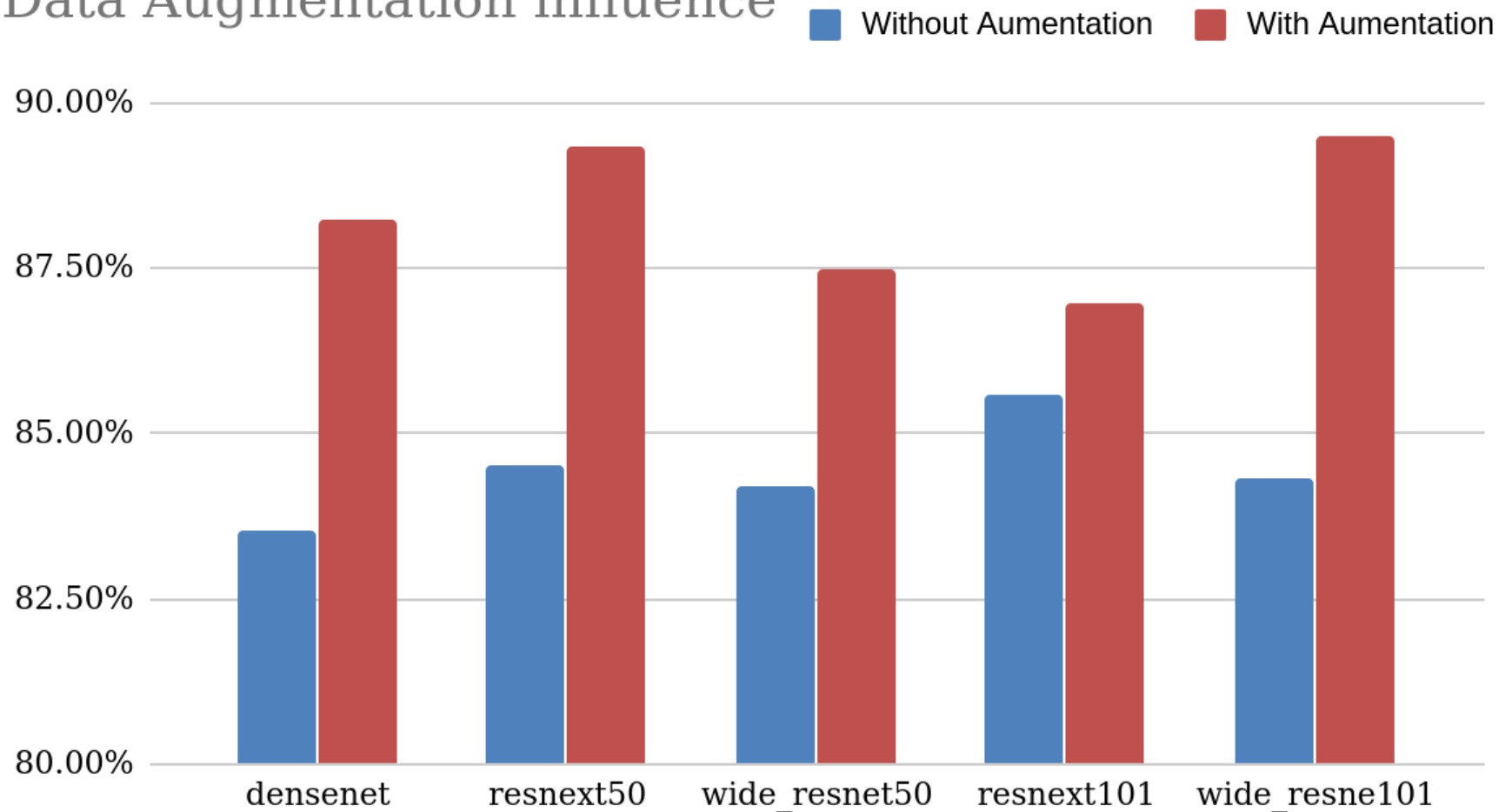
# Augmentation- Histopathology

- Random Horizontal Flip
- Random Vertical Flip
- Random Rotation (90 Degree)



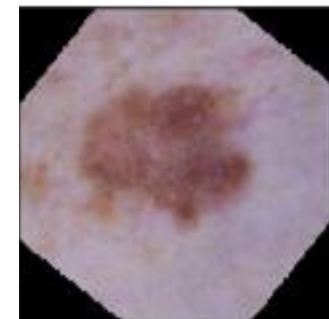
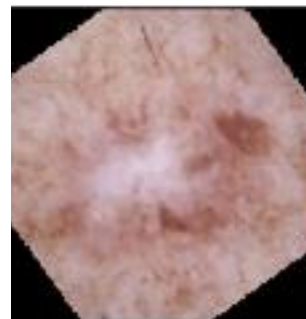
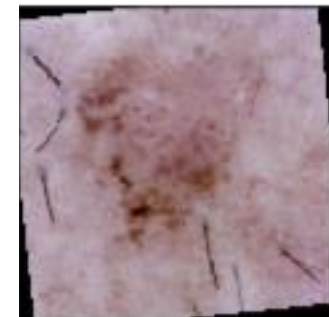
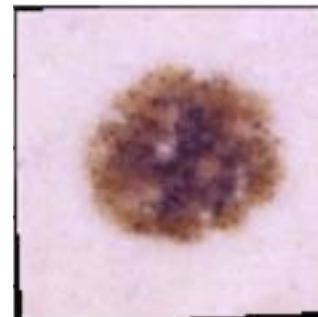
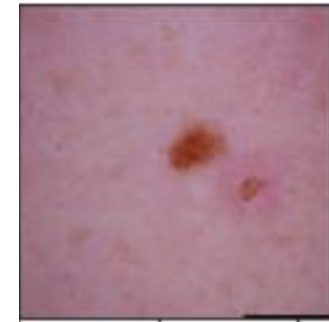
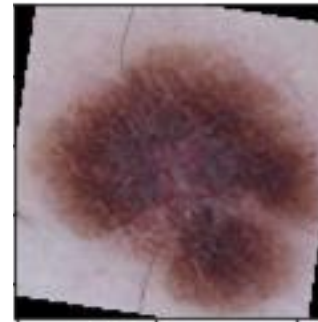
# Augmentation- Histopathology

Data Augmentation influence



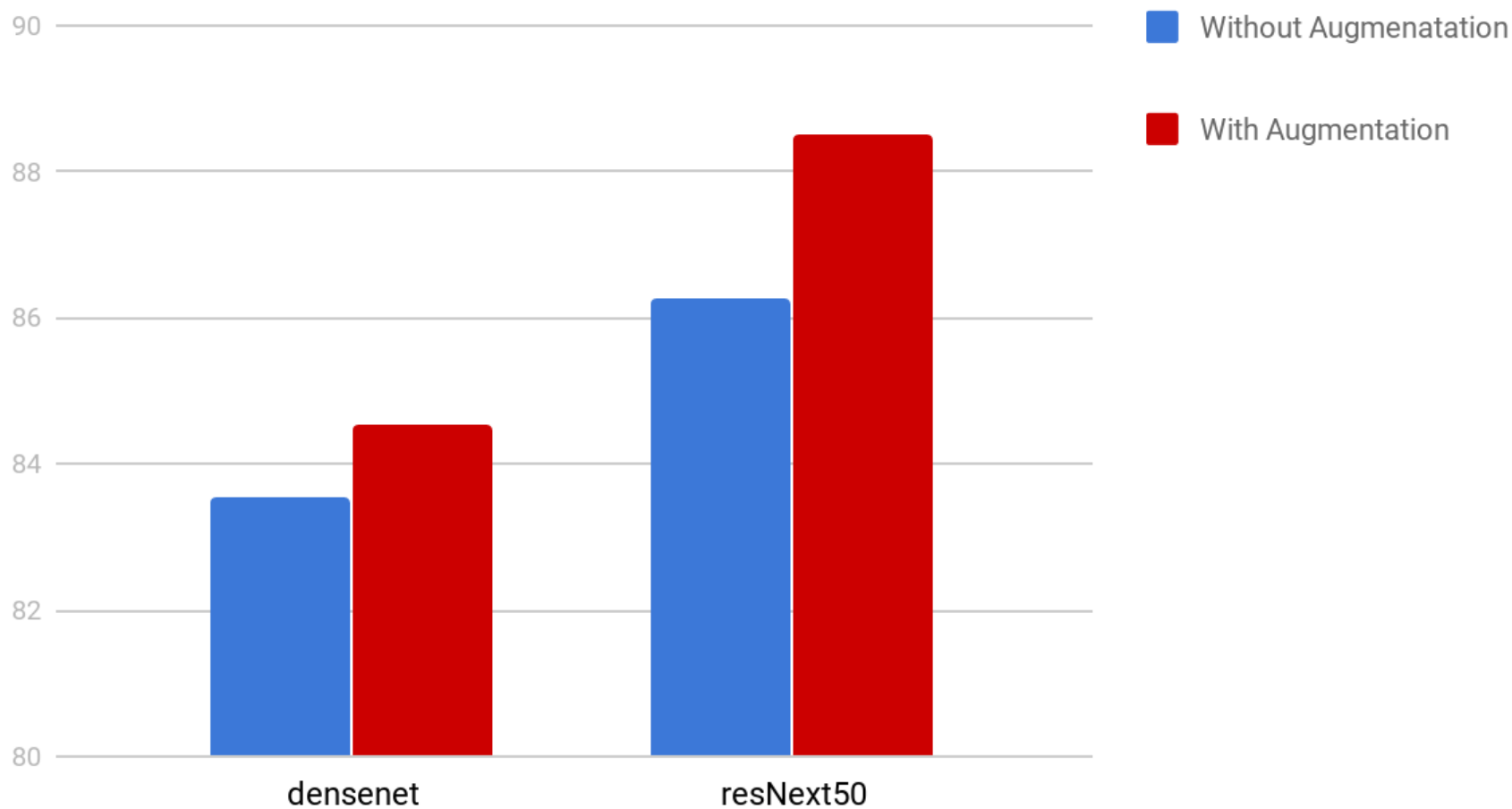
# Augmentation- Dermoscopy

- Random Resized Crop
- Random Horizontal Flip
- Random Vertical Flip
- Random Rotation (90 Degree)

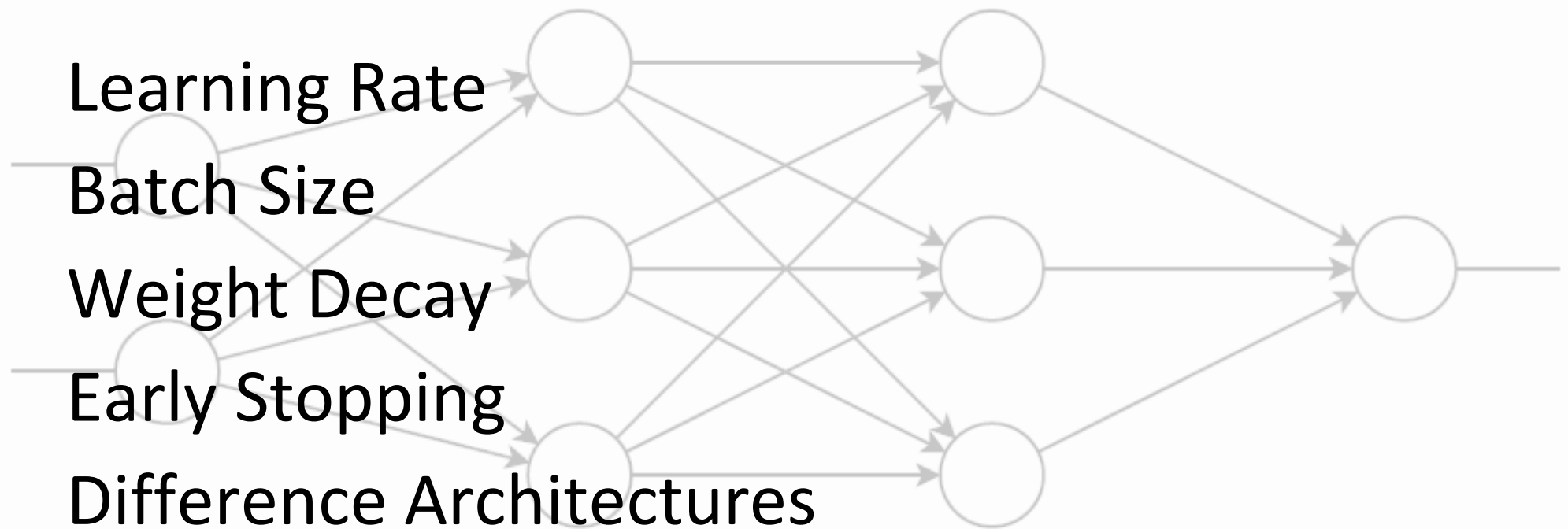


# Dermo Model Hyperparameters

Data Augmentation Influence



# Hyperparameter tuning



# Final Models- Histopathology

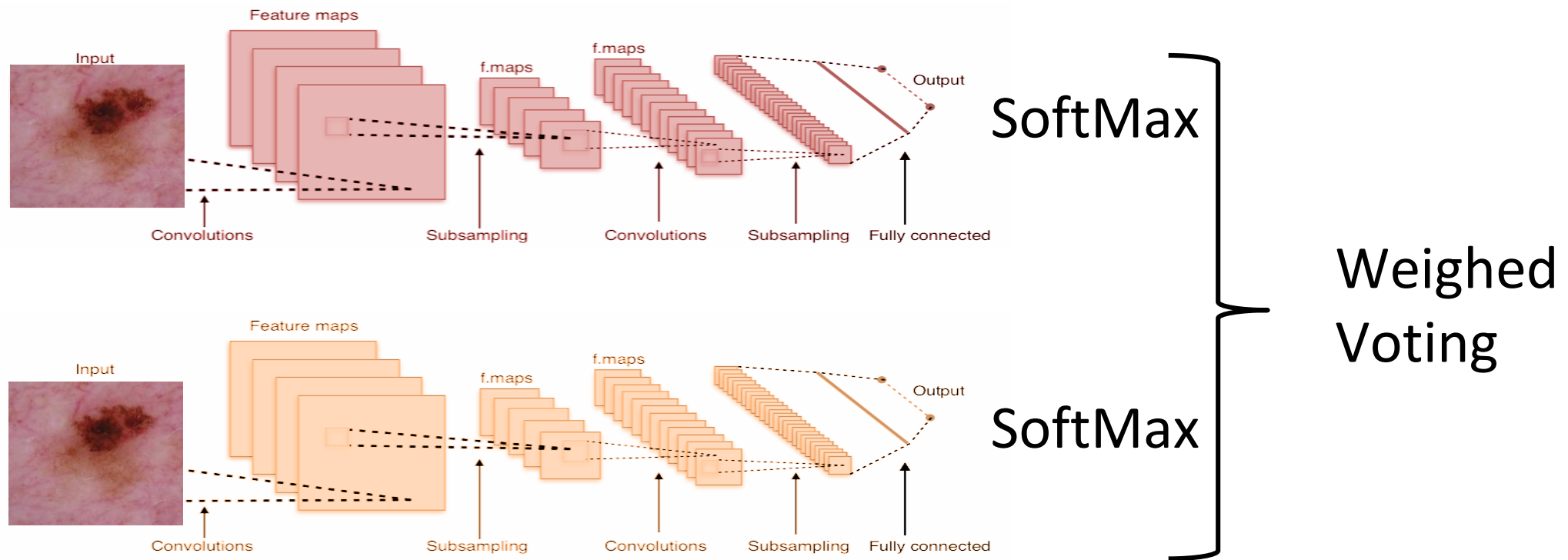
<b>Accuracy</b>	<b>Architecture</b>	<b>LR</b>	<b>Batch size</b>	<b>Weight decay</b>	<b>Epoch</b>
90.67%	densenet	0.0003	32	No	18
89.33%	resnext50	1.00E-04	32	No	13
90.37%	wide_resnet101	3.00E-05	32	No	18

# Final Models- Dermoscopy

<b>Accuracy</b>	<b>Architecture</b>	<b>LR</b>	<b>Batch size</b>	<b>Weight decay</b>	<b>Epoch</b>
84.53%	densenet	0.0005	16	No	19
88.50%	resnext50	0.001	16	No	16



# Ensemble



# Results- Histopathology

	Truth Positive	Truth Negative
Prediction Positive	TP: 736	FP: 56
Prediction Negative	FN: 84	TN: 764

**Ensemble:**

DensetNet121

ResNext50

**Acc: 91.46%**

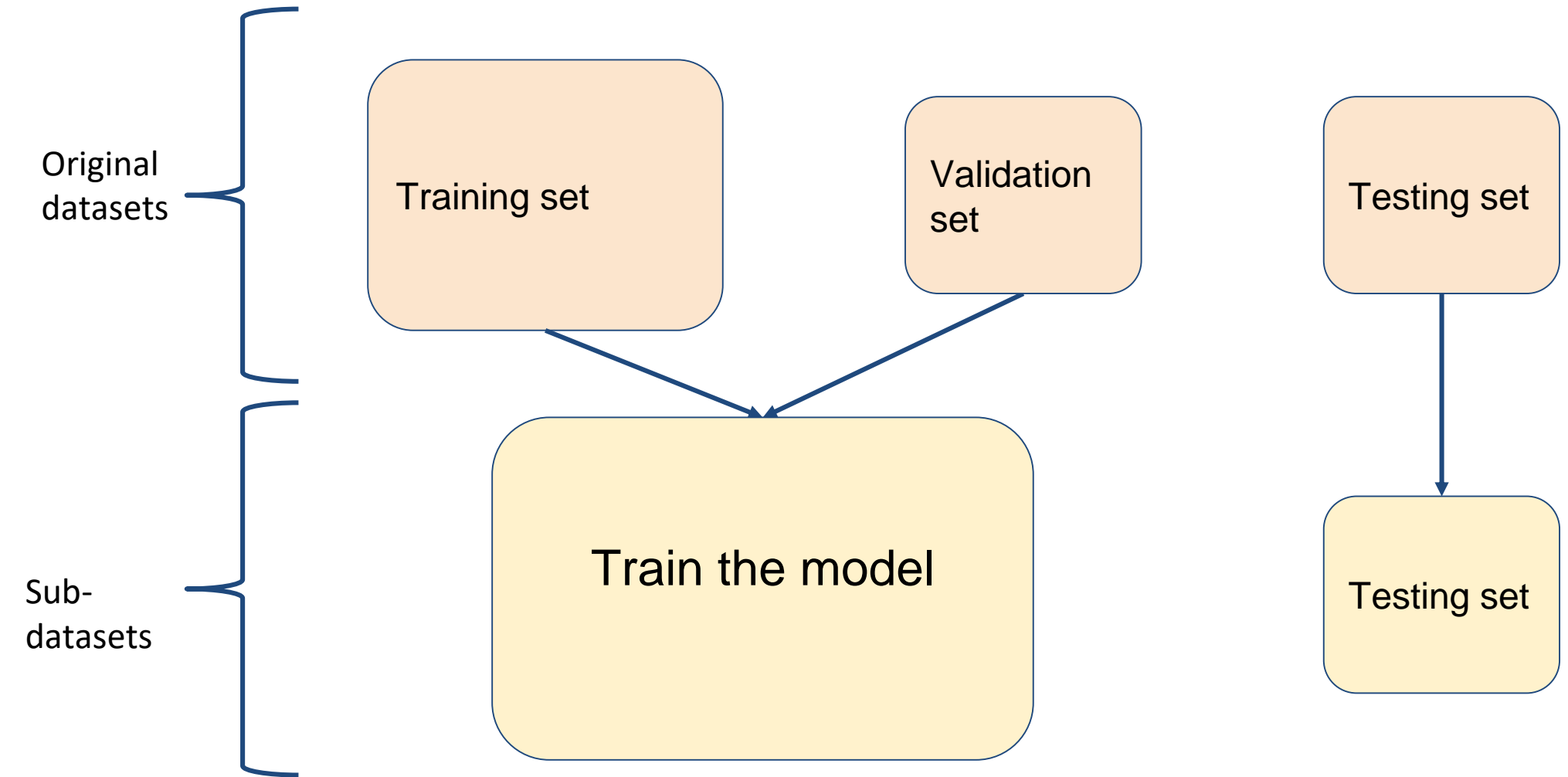
# Results- Dermoscopy

	Truth Positive	Truth Negative
Prediction Positive	TP: 503	FP: 89
Prediction Negative	FN: 97	TN: 511

**Without Ensemble:**  
ResNext50

**Acc: 88.50%**

# Final Model creation



# Discussion

New era: Deep learning

Shallow networks

Ensemble improve the results

Complexity of hyperparameter optimization

Importance of data augmentation

