

# *NAML Project*

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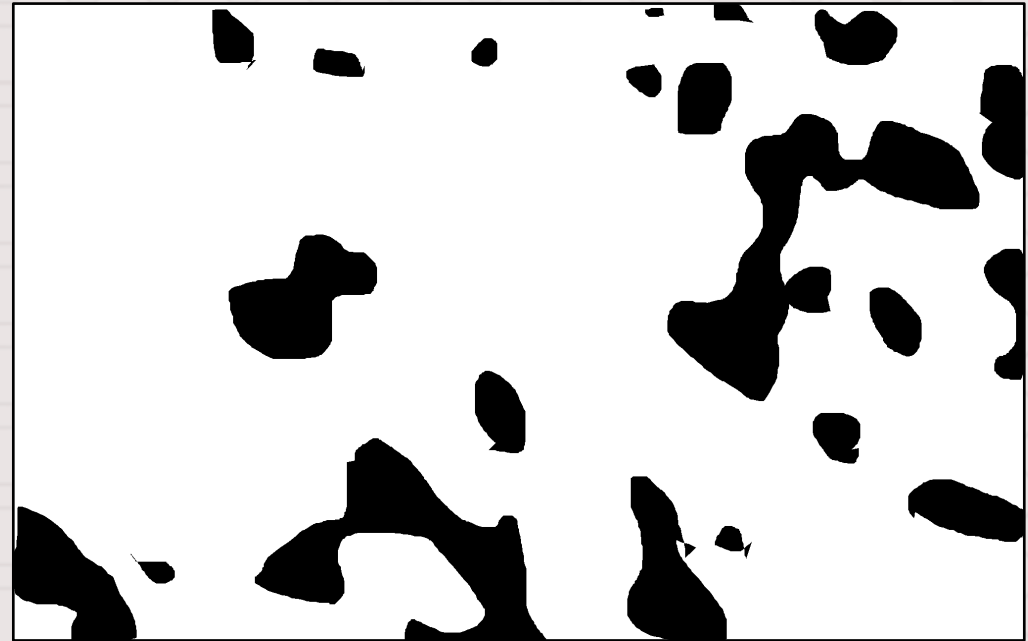
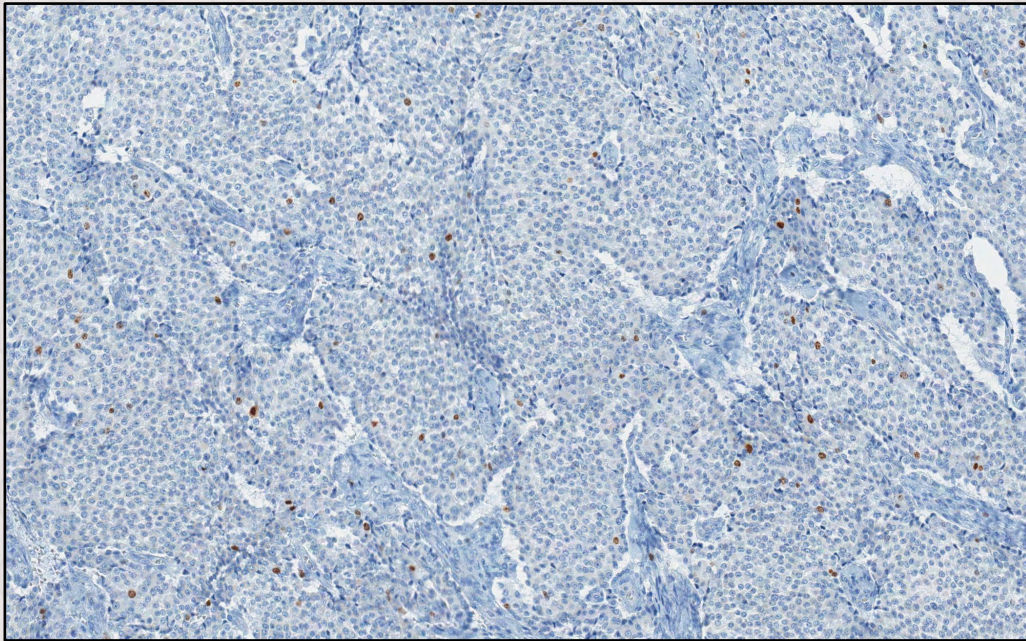
Luca Olivieri

Tommaso Giordano

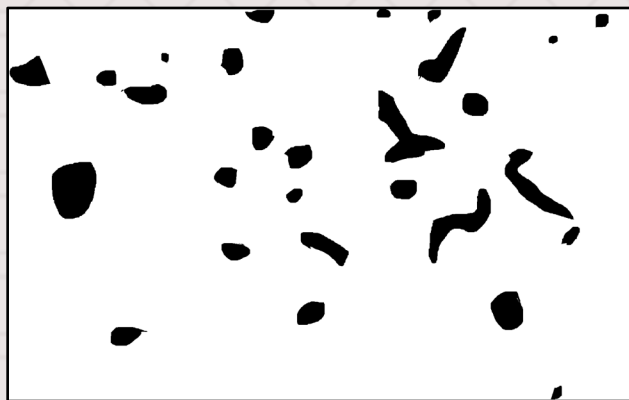
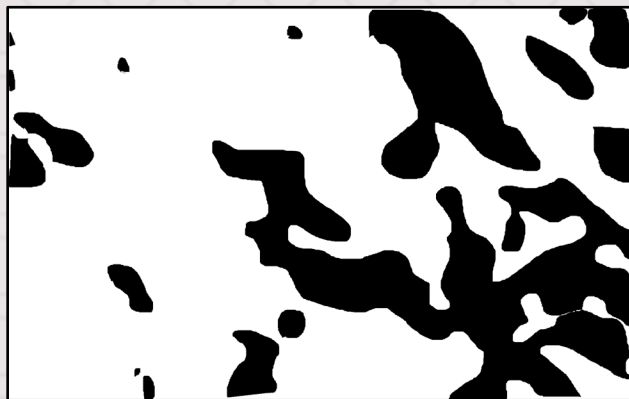


*dataset model inference results*

*Dataset*  
*Input-output*



*dataset   model   inference   results*



## *Dataset challenges*

- *Very unbalanced (1 to 10)*
- *Only testing data present*





# Models

## *AlexNet*

*Fine-tuning*

Layer Type	Input Dimension	Output Dimension
Linear	4096	1000
Linear	1000	512
Linear	512	128
Linear	128	32
Linear	32	2

## *Inception V3*

*Transfer-learning*

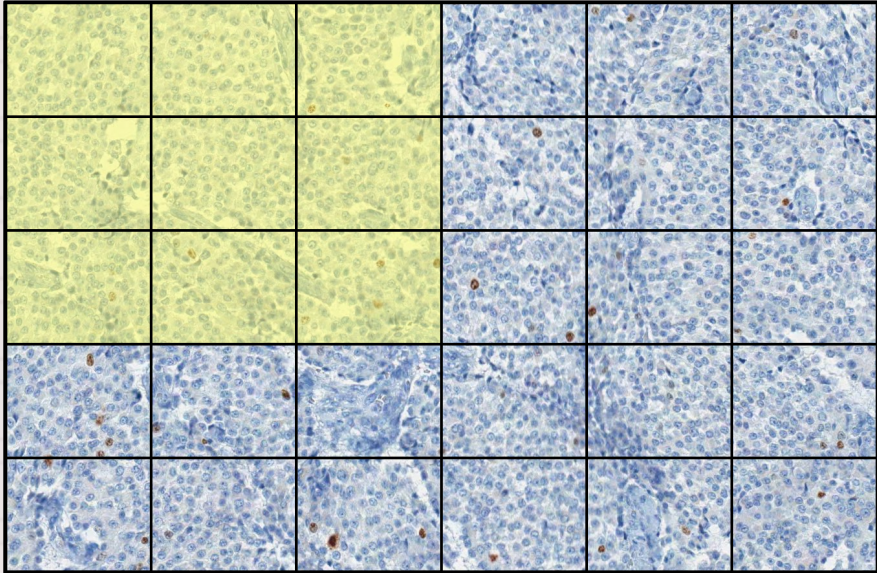
Layer Type	Input Dimension	Output Dimension
Linear	2048	512
Linear	512	128
Linear	128	32
Linear	32	2

ID	Model	Optimiser	Loss function	Batch size	Epochs
A1	AlexNet	Adam(lr = $10^{-4}$ )	XEn	100	5
A2	AlexNet	AdamW(lr = $10^{-4}$ , $\lambda = 0.1$ )	XEn	100	5
I1	Inc.-V3	Adam(lr = $5 \cdot 10^{-4}$ )	FL( $\alpha = 1, \gamma = 2$ )	100	5
I2	Inc.-V3	AdamW(lr = $5 \cdot 10^{-4}$ )	XEn	100	5



*dataset   model   inference   results*

*Inference*

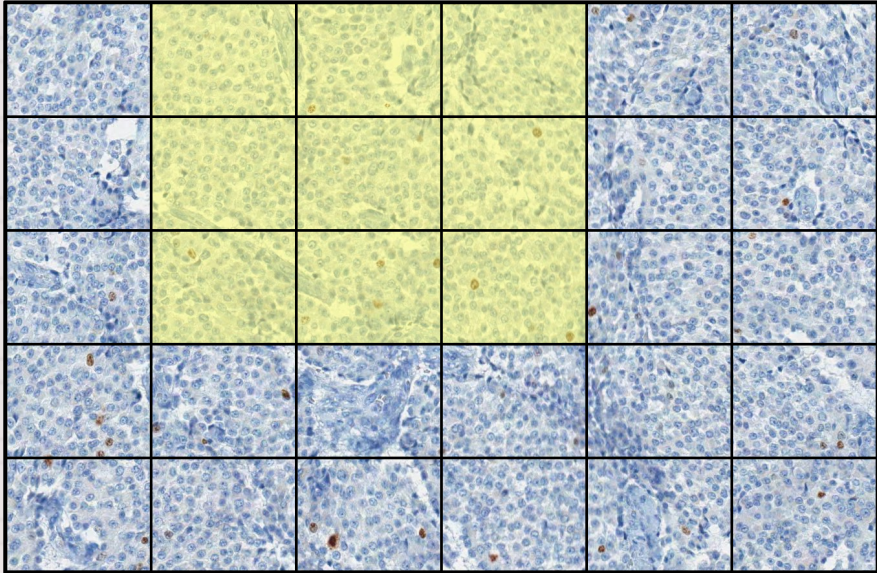


*Prediction: 1*

1	1	1			
1	1	1			
1	1	1			

*dataset   model   inference   results*

*Inference*



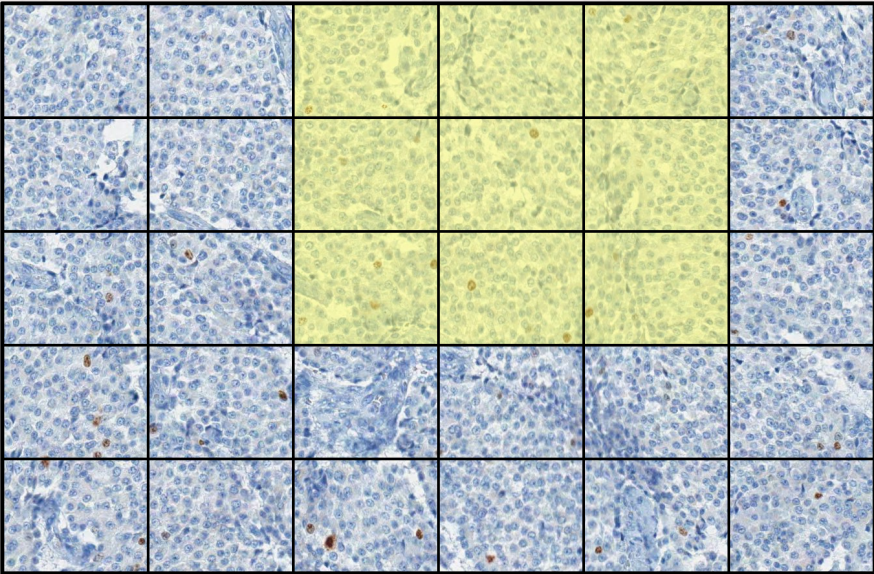
*Prediction: 1*

1	2	2	1		
1	2	2	1		
1	2	2	1		



*dataset   model   inference   results*

*Inference*



*Prediction: 0*

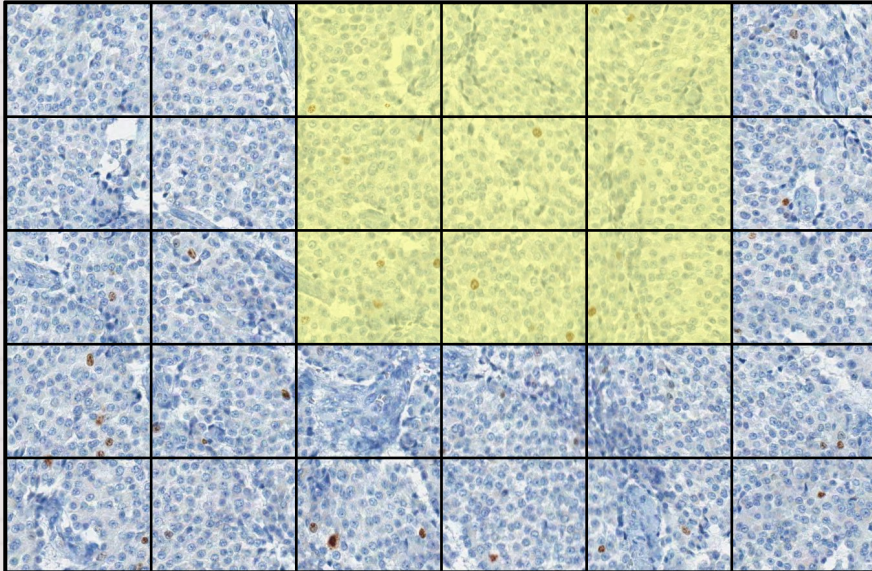
1	2	2	1	0	
1	2	2	1	0	
1	2	2	1	0	

*dataset model inference results*

*30 images*

- *10-fold cross validation*
- *1 image reserved for testing*

*Inference*



1	2	2	1	0	
1	2	2	1	0	
1	2	2	1	0	

*Prediction: 0*





*dataset   model   inference   results*

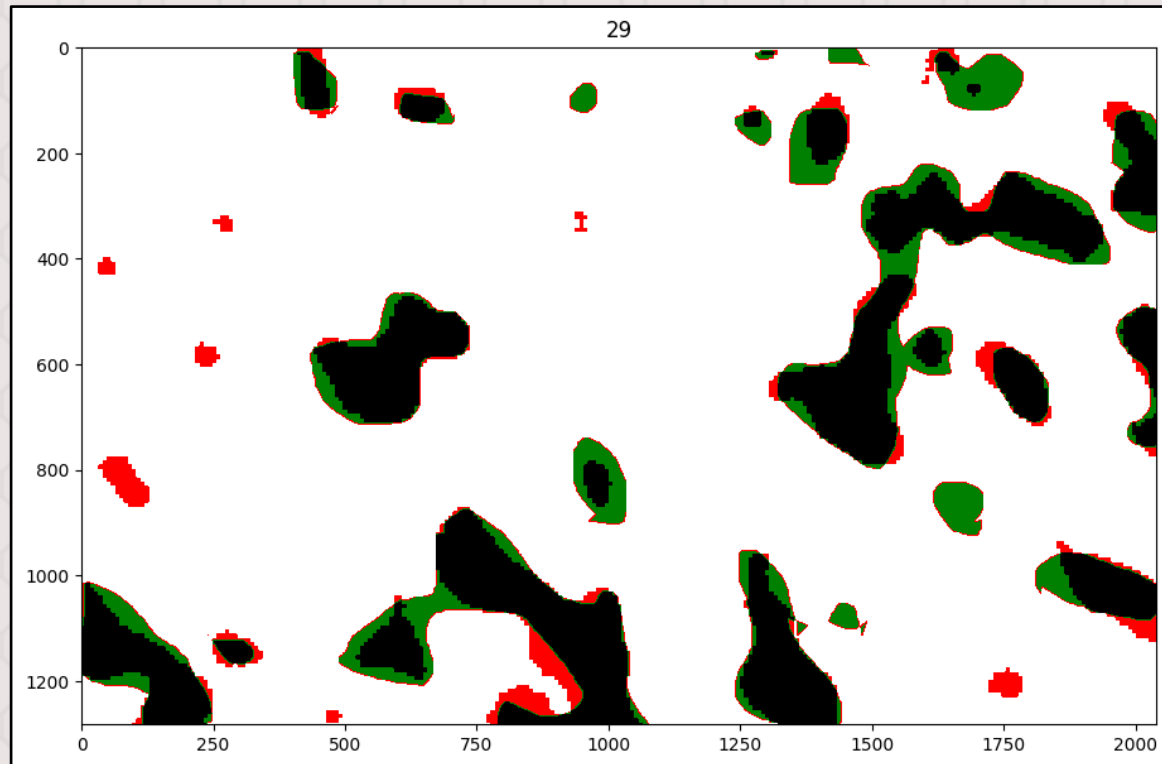
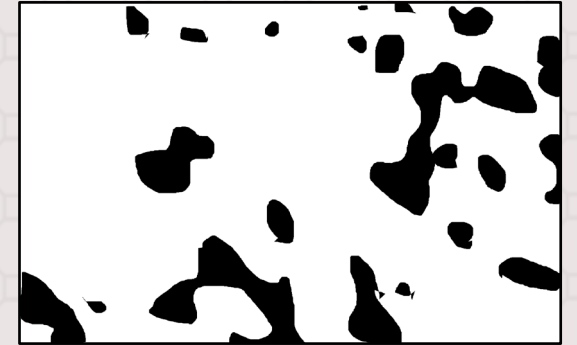
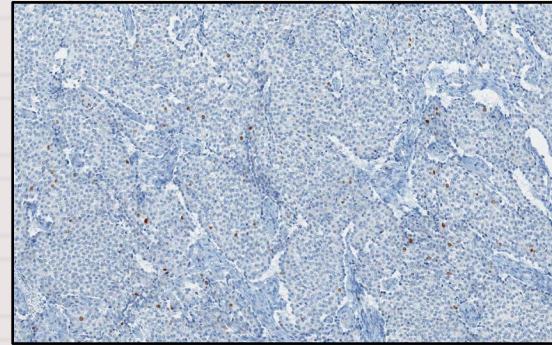
	A1	A2	I1	I2
Acc.	0.9125 ± 0.0044	0.9172 ± 0.0031	0.8966 ± 0.0058	0.9041 ± 0.0048
Prec.	0.9100 ± 0.0071	0.8948 ± 0.0064	0.9138 ± 0.0066	0.9122 ± 0.0069
Spec.	0.6084 ± 0.0163	0.5458 ± 0.0102	0.6549 ± 0.0156	0.6590 ± 0.0106
Sens.	0.9552 ± 0.0069	0.9822 ± 0.0015	0.9338 ± 0.0068	0.9449 ± 0.0042
IoU	0.8929 ± 0.0063	0.9019 ± 0.0043	0.8762 ± 0.0075	0.8854 ± 0.0062
Dice	0.9414 ± 0.0037	0.9471 ± 0.0025	0.9320 ± 0.0044	0.9377 ± 0.0036

ID	Model	Optimiser	Loss function	Batch size	Epochs
A1	AlexNet	Adam(lr = 10 <sup>-4</sup> )	XEn	100	5
A2	AlexNet	AdamW(lr = 10 <sup>-4</sup> , λ = 0.1)	XEn	100	5
I1	Inc.-V3	Adam(lr = 5 · 10 <sup>-4</sup> )	FL(α = 1, γ = 2)	100	5
I2	Inc.-V3	AdamW(lr = 5 · 10 <sup>-4</sup> )	XEn	100	5

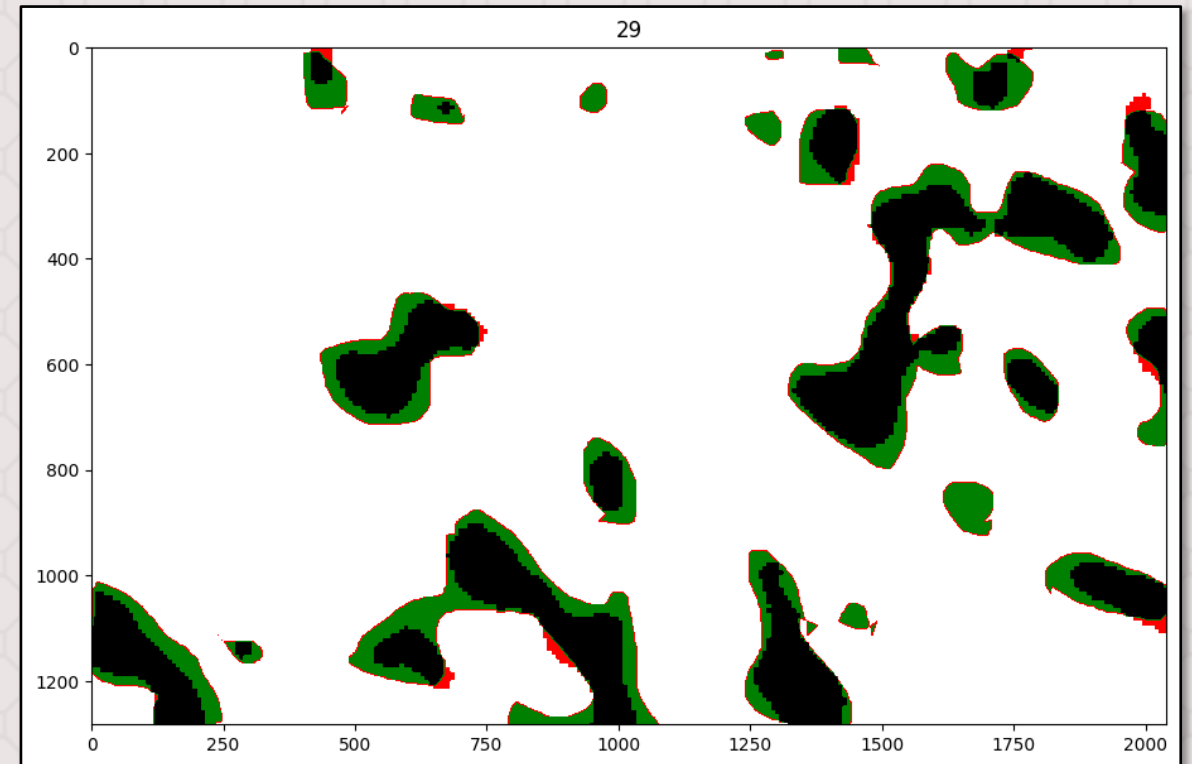
*dataset model inference results*

## Results testing

- Correct tumor
- Correct non tumor
- False positive
- False negative



*A1 model (AlexNet)*

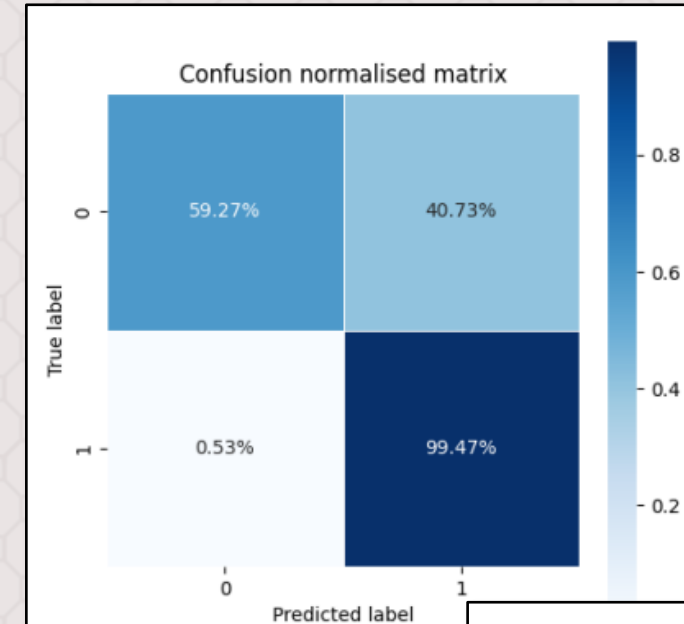


*I1 model (Inception v3)*



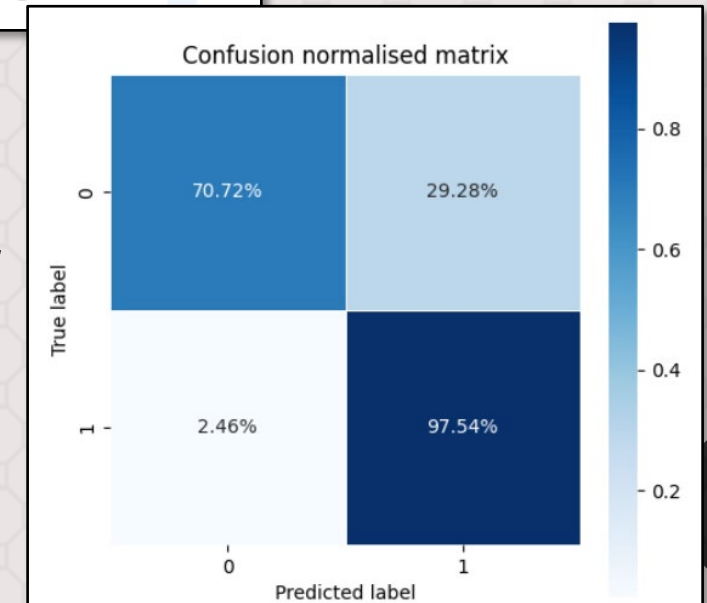
## Results testing

	AlexNet not regularized (A1)	Inception-v3 cross entropy (I1)
Acc.	92,54%	92,92%
Prec.	92,15%	94,12%
Spec.	59.27%	70,72%
Rec.	99,47%	97,54%
IoU	91,70%	91,94%
Dice	95,67%	95,80%
F1	95,67%	95,17%



*A1 model  
(AlexNet)*

*I1 model  
(Inception v3)*







*dataset   model   inference   results*

*Also tried:*

- *Dataset oversampling*
- *Data augmentation*
- *Image equalization*
- *Custom class weighting*

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*Thank you!*

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