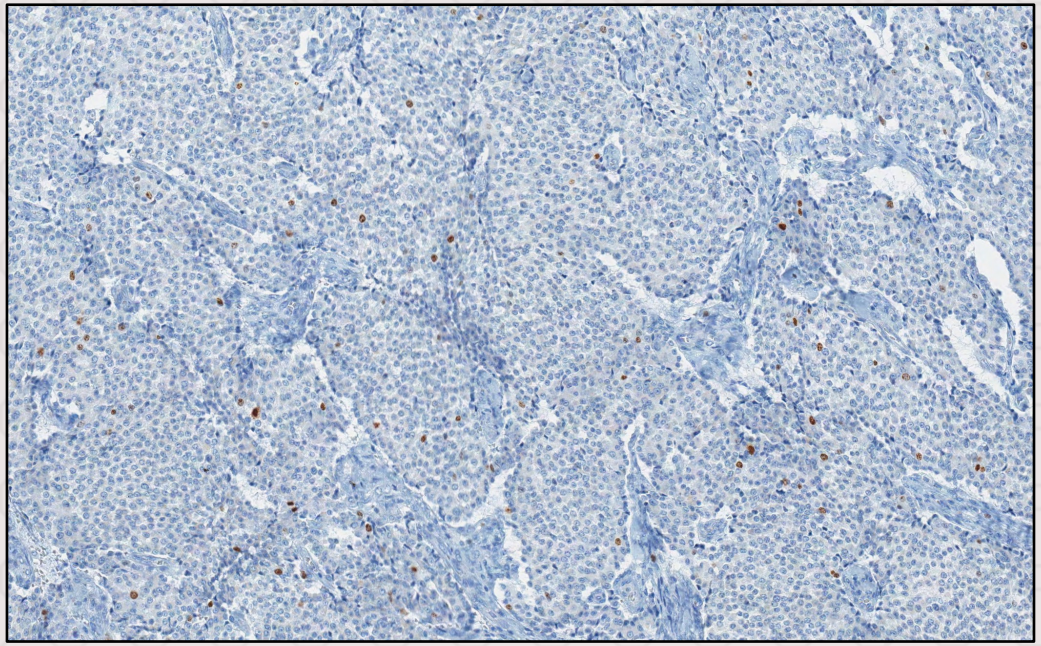
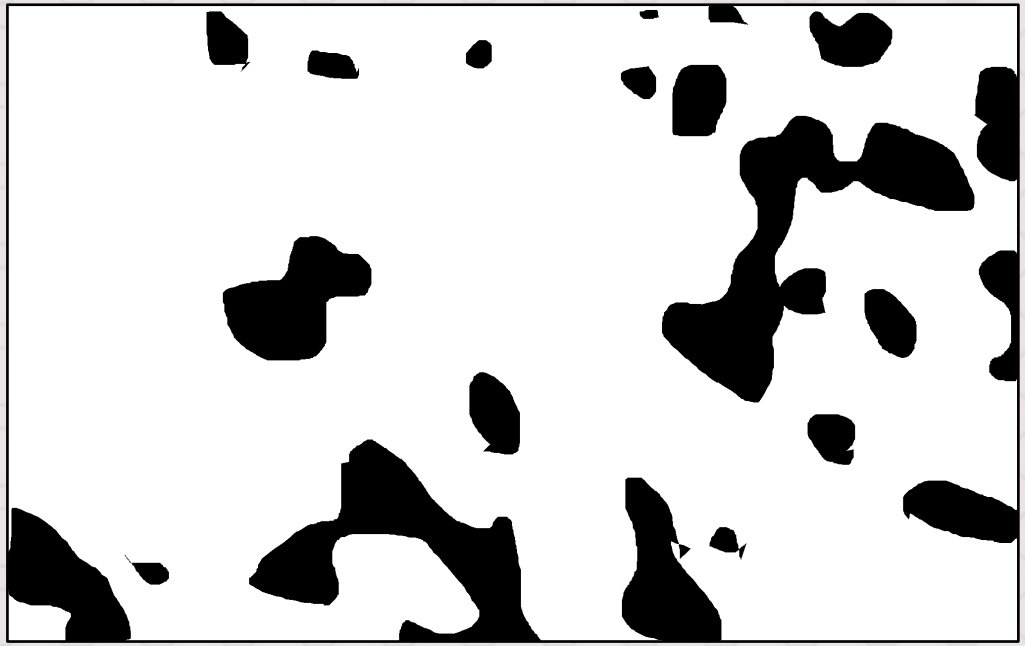
NAML Project

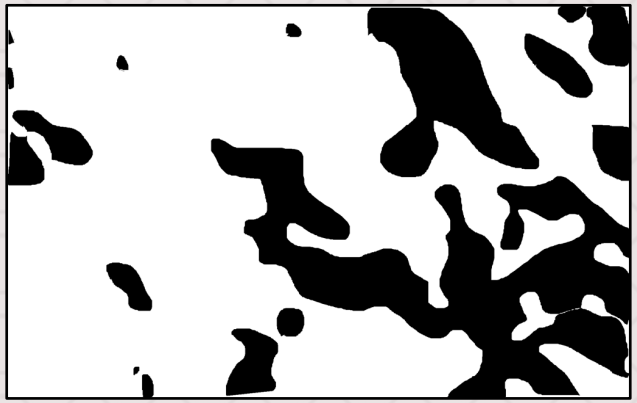
Luca Olivieri
Tommaso Giordano

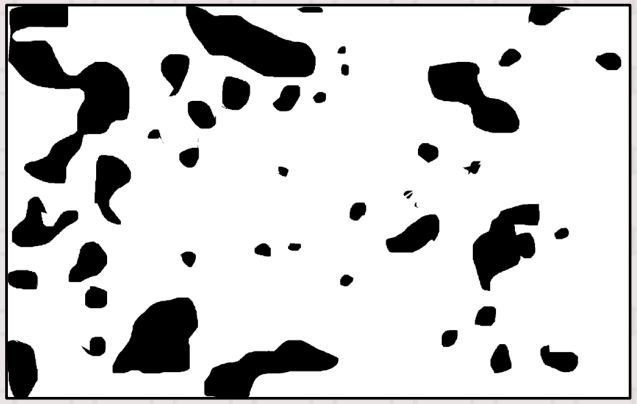
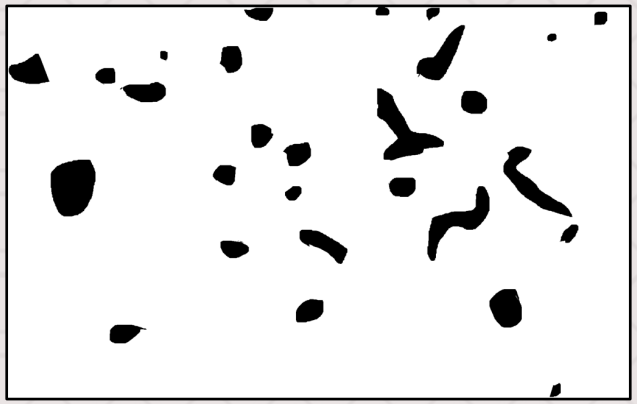
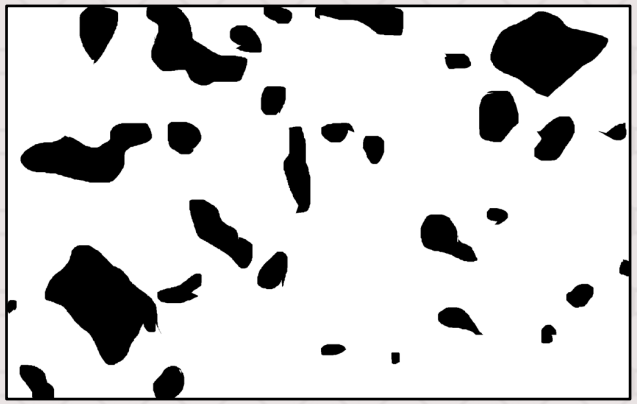
Dataset

Input-output







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

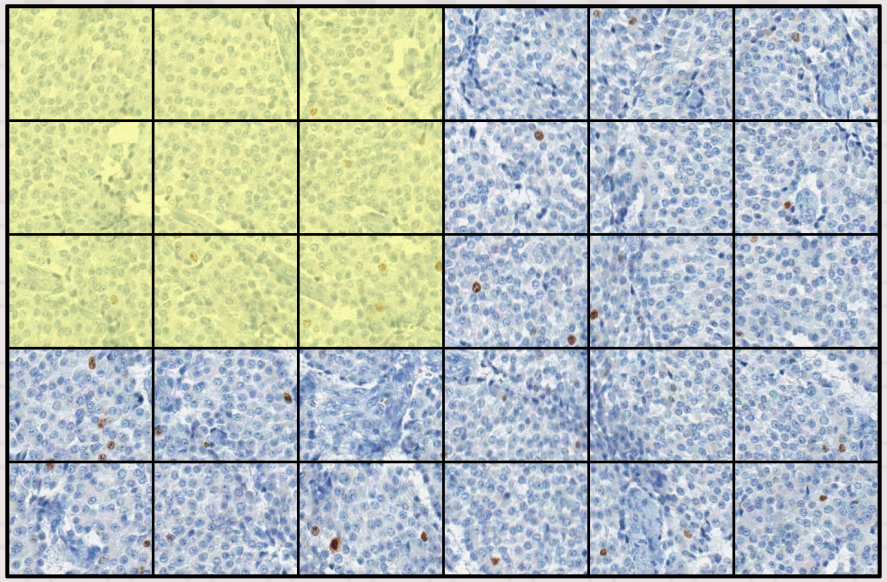
Inception V3

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

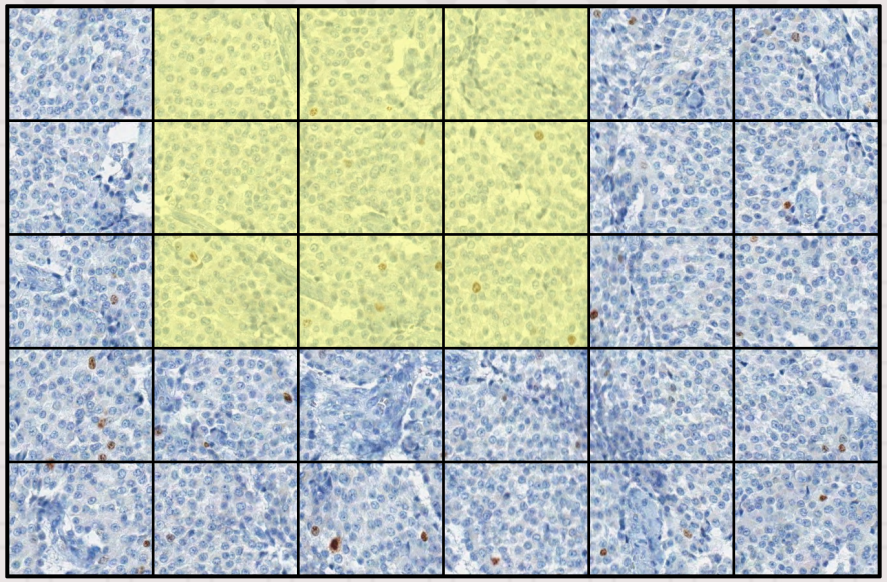
Inference



1	1	1			
1	1	1			
1	1	1			

Prediction: 1

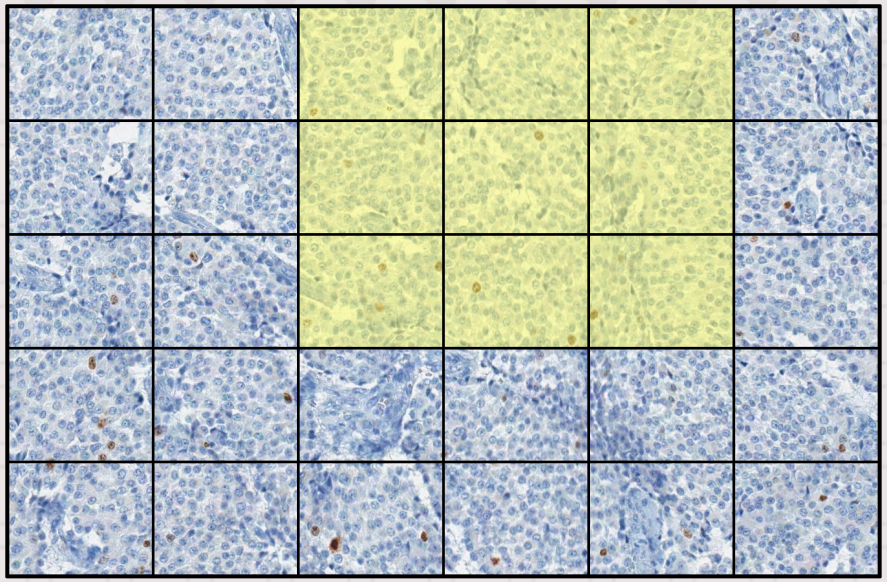
Inference



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

Prediction: 1

Inference

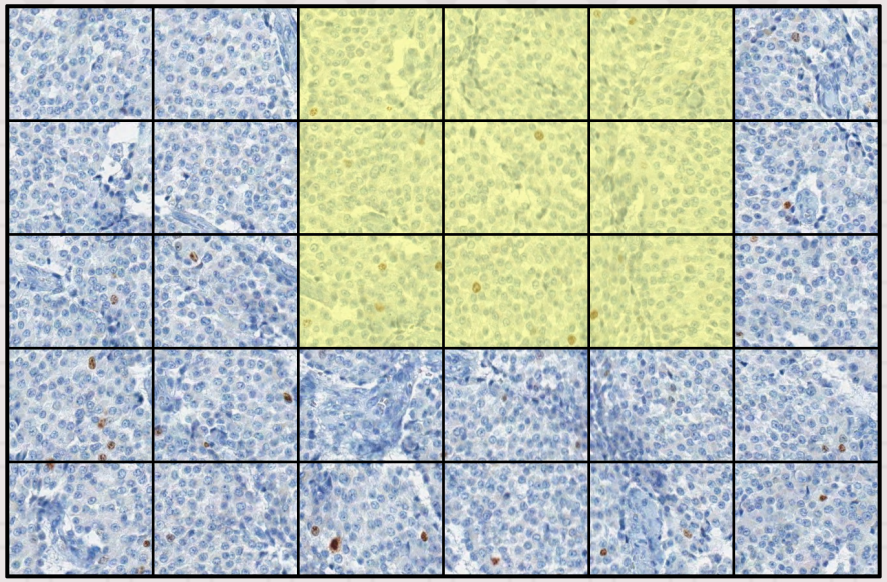


1	2	2	1	0	
1	2	2	1	0	
1	2	2	1	0	

Prediction: o

Inference

30 images
- 10-fold cross validation
- 1 image reserved for testing



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

Prediction: 0

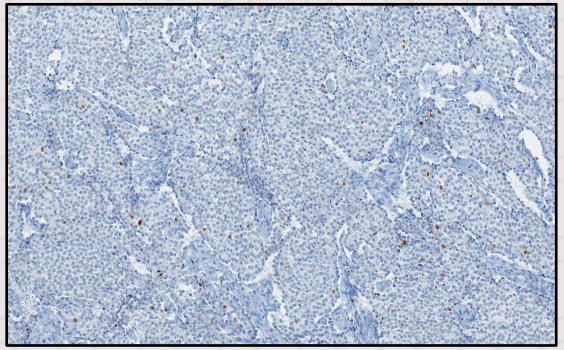
Results
validation

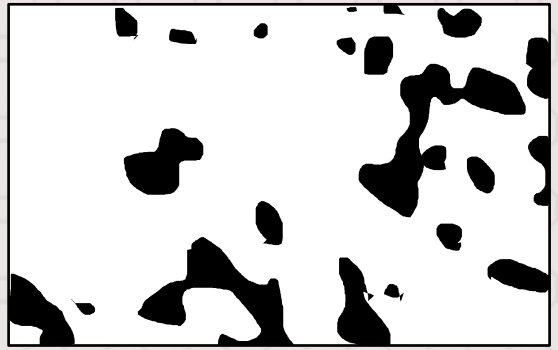
	A1	A2	I1	I2
Acc.	0.9125 ± 0.0044	0.9172 ± 0.0031	0.8966 ± 0.0058	0.9041 ± 0.0048
Prec.	0.9100 ± 0.0071	0.8948 ± 0.0064	0.9138 ± 0.0066	0.9122 ± 0.0069
Spec.	0.6084 ± 0.0163	0.5458 ± 0.0102	0.6549 ± 0.0156	0.6590 ± 0.0106
Sens.	0.9552 ± 0.0069	0.9822 ± 0.0015	0.9338 ± 0.0068	0.9449 ± 0.0042
IoU	0.8929 ± 0.0063	0.9019 ± 0.0043	0.8762 ± 0.0075	0.8854 ± 0.0062
F1	0.9414 ± 0.0037	0.9471 ± 0.0025	0.9320 ± 0.0044	0.9377 ± 0.0036

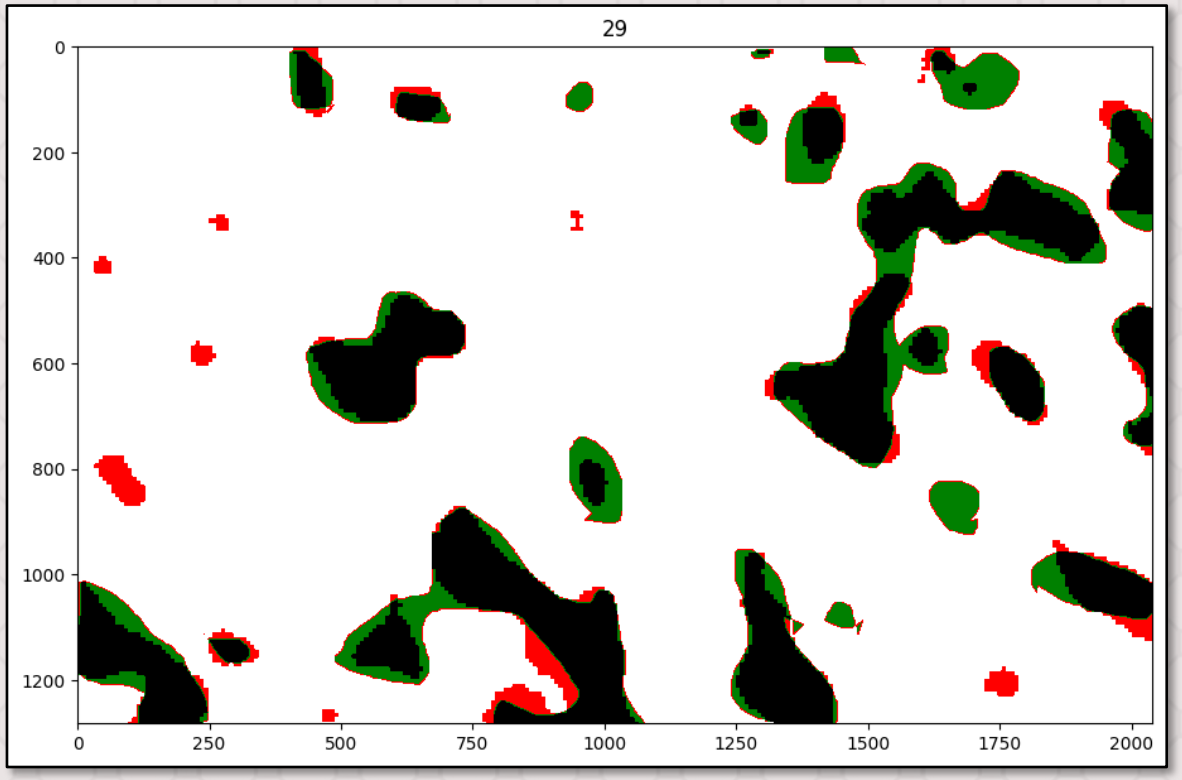
ID	Model	Optimiser	Loss function	Batch size	Epochs
A1	AlexNet	Adam($\mathrm{lr} = 10^{-4}$)	XEn	100	5
A2	AlexNet	AdamW($\mathrm{lr} = 10^{-4}$, $\lambda = 0.1$)	XEn	100	5
I1	Inc.-V3	Adam($\mathrm{lr} = 5 \cdot 10^{-4}$)	FL($\alpha = 1, \gamma = 2$)	100	5
I2	Inc.-V3	AdamW($\mathrm{lr} = 5 \cdot 10^{-4}$)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

Results
testing

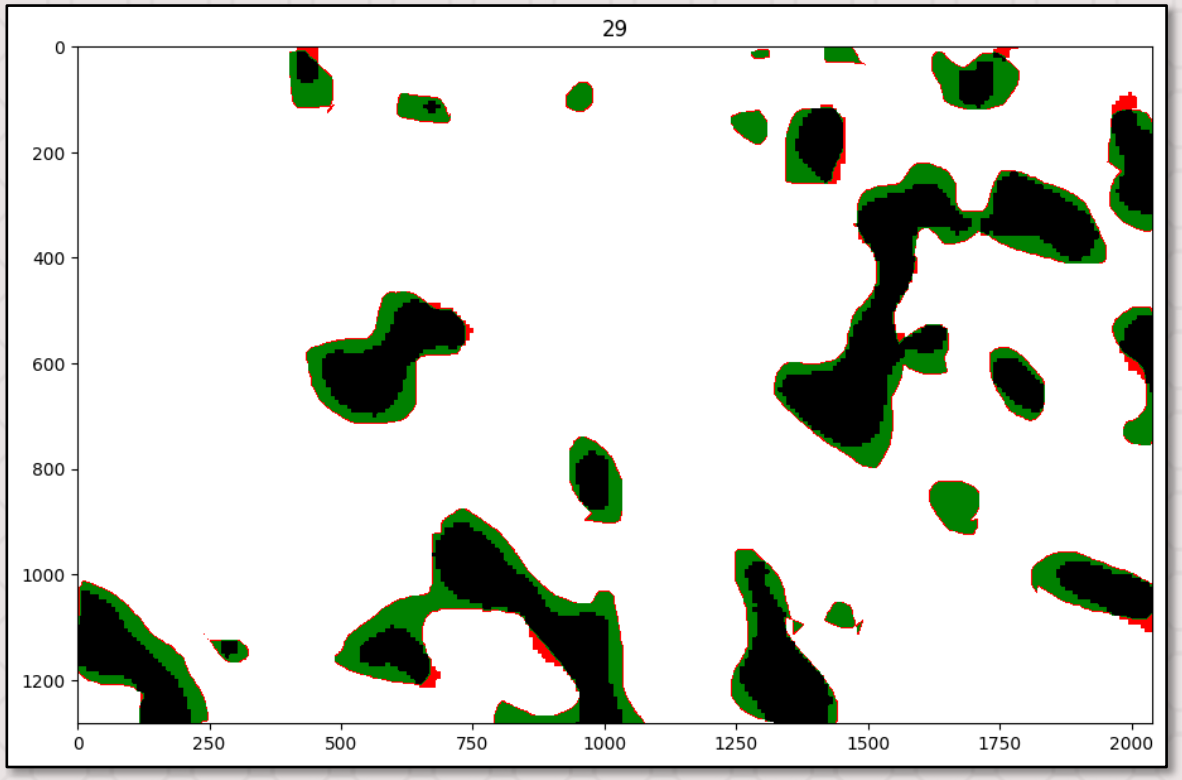
- Correct tumor
- Correct non tumor
- False positive
- False negative







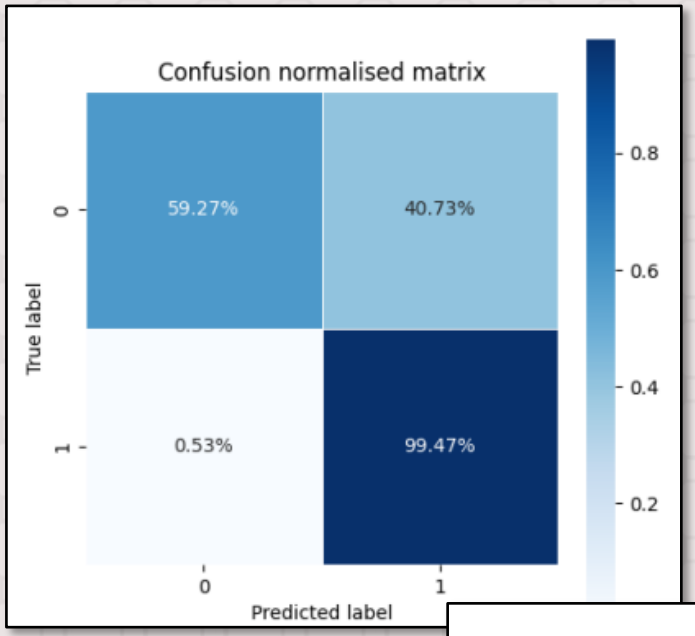
A1 model (AlexNet)



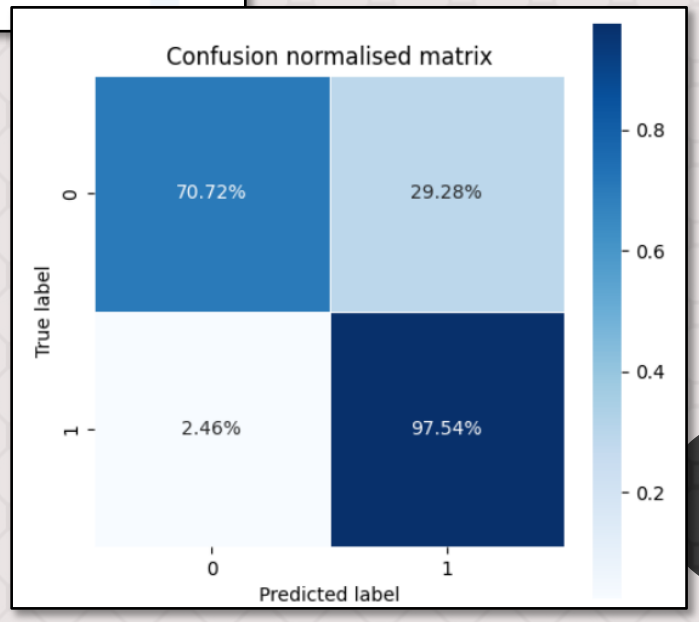
I2 model (Inception v3)

Results
testing

	AlexNet not regularized (A1)	Inception-v3 cross-entropy (I2)
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%
F1	95,67%	95,80%



A1 model (AlexNet)



I2 model (Inception v3)

Results
testing

Also tried:

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

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

Thank you!

Luca Olivieri
Tommaso Giordano