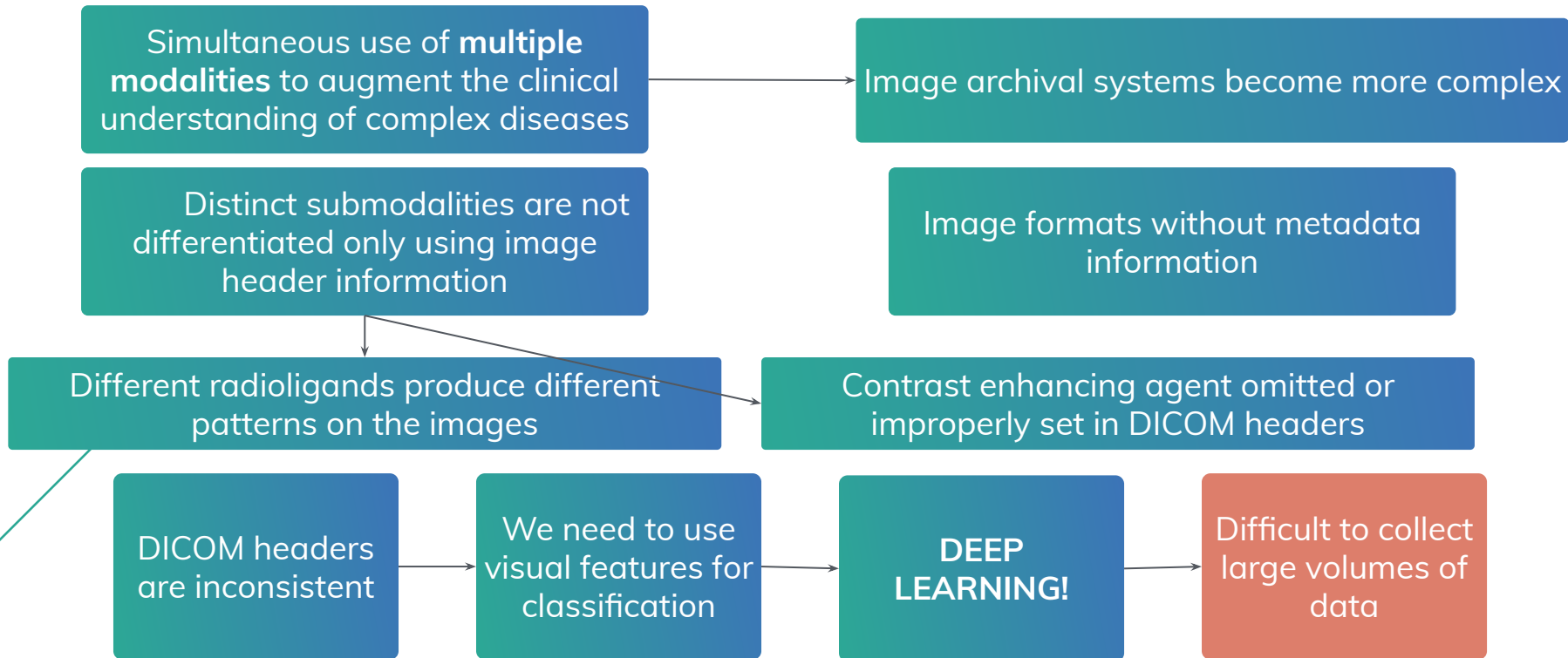


Few shot learning with Deep Triplet Networks for Brain Imaging modality classification

Santi Puch*, Irina Sánchez*, Matt Rowe

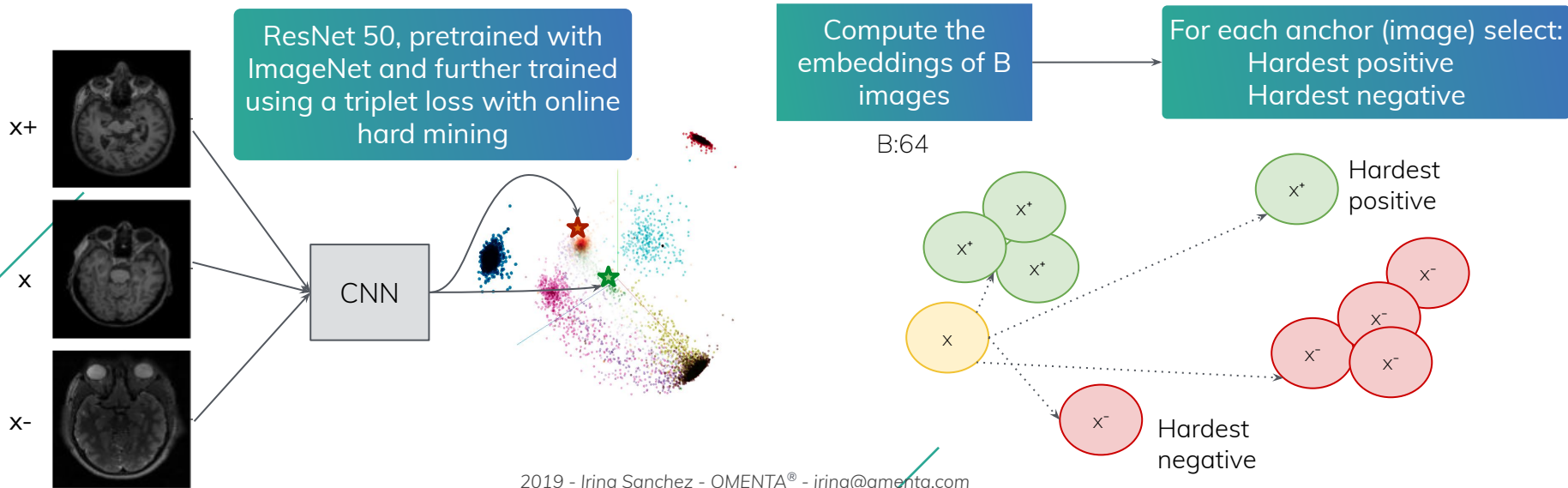
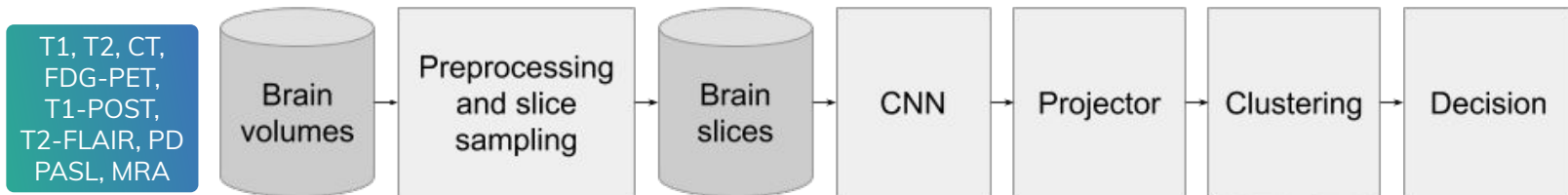
* Authors contributed equally to this work

Why?



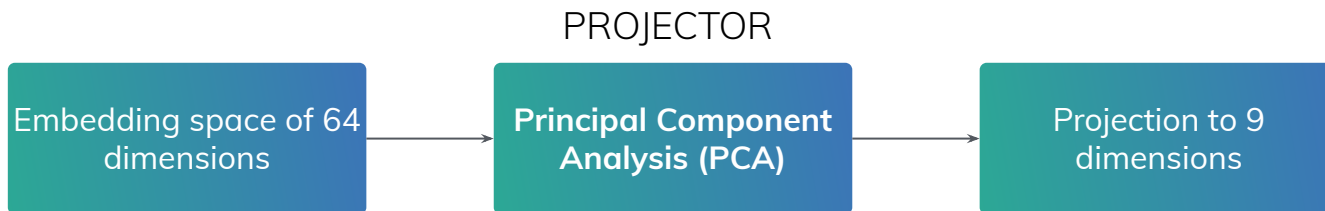
How?

Proposed pipeline

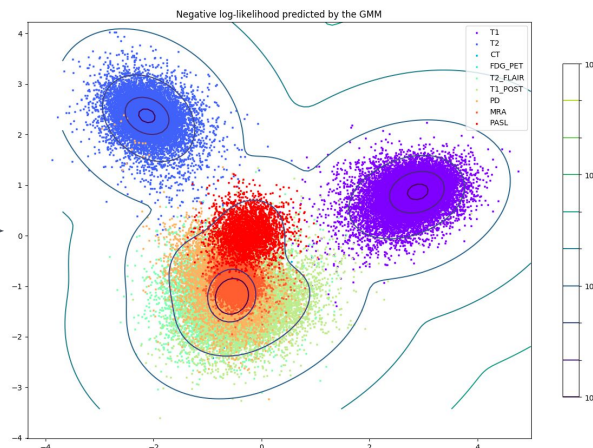
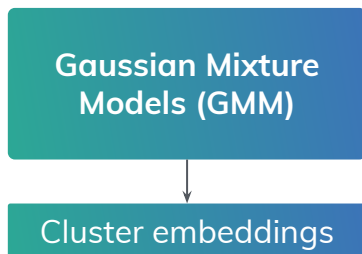


How?

Projector and clustering



CLUSTERING



What?

Triplet Network Classifier vs standard CNN classifier

MODALITY # SLICES

T1	30874
T2	231759
CT	185411
FDG-PET	15432
T1-POST	8071
T2-FLAIR	9828
PD	8370
PASL	5321
MRA	8462

Exp1: Train with all the available data
Exp2: Restrict the number of slices of the few-shot classes to 150 = 10 volumes

Table 1: Classification metrics of the Triplet Network classifier (TN) and the standard CNN classifier (CNN). B: base classes; F: few-shot classes.

Model	Precision(B)	Recall(B)	F1-score(B)	Precision(F)	Recall(F)	F1-score(F)	Accuracy
CNN classifier - exp 1	0.98	0.99	0.9875	0.966	0.924	0.944	0.953
TN classifier - exp 1	1	0.938	0.965	0.89	0.996	0.93	0.971
CNN classifier - exp 2	0.782	0.995	0.887	1	0.332	0.396	0.626
TN classifier - exp 2	0.92	0.967	0.942	0.816	0.702	0.746	0.819

BASE CLASSES

FEW-SHOT CLASSES

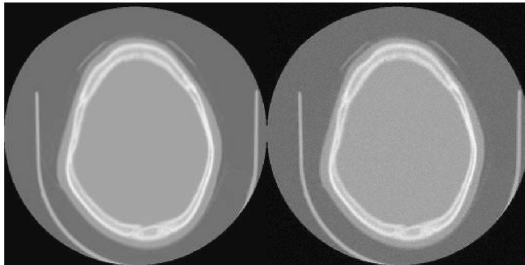
What?

Robustness against noise

Exp3: Model trained with data that has been randomly corrupted by noise

Exp4: Model trained with curated data

Gaussian Noise



Salt and Pepper Noise

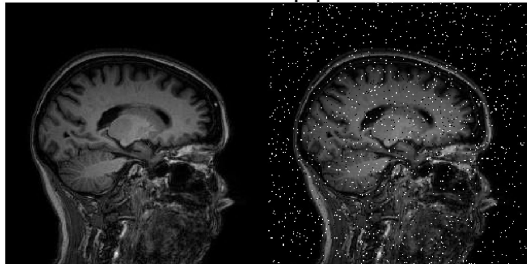


Table 2: Classification metrics of the few-shot classifier (Triplet) and the standard CNN classifier (Baseline) when trained with data corrupted noise (exp3) and trained with curated data but tested with corrupted volumes (exp4). B: base classes; F: few-shot classes.

Model	Precision(B)	Recall(B)	F1-score(B)	Precision(F)	Recall(F)	F1-score(F)	Accuracy
Noise							
Gaussian							
CNN classifier - exp 3	0.99	0.987	0.987	0.956	0.93	0.938	0.955
TN classifier - exp 3	0.992	0.947	0.97	0.888	0.942	0.902	0.97
CNN classifier limit - exp 3	0.815	0.997	0.887	1	0.328	0.4	0.625
TN classifier limit - exp 3	0.942	0.965	0.952	0.658	0.62	0.622	0.773
CNN classifier - exp 4	0.85	0.742	0.735	0.964	0.478	0.638	0.596
TN classifier - exp 4	0.992	0.687	0.787	0.754	0.774	0.682	0.737
CNN classifier limit - exp 4	0.725	10.817	0.732	0.742	0.194	0.29	0.47
TN classifier limit - exp 4	0.927	0.67	0.765	0.634	0.678	0.588	0.673
Noise							
Salt and pepper							
CNN classifier - exp 3	0.982	0.985	0.982	0.946	0.916	0.93	0.947
TN classifier - exp 3	0.96	0.9375	0.945	0.658	0.738	0.668	0.827
CNN classifier limit - exp 3	0.765	0.99	0.87	0.914	0.31	0.384	0.625
TN classifier limit - exp 3	0.932	0.952	0.94	0.782	0.75	0.756	0.839
CNN classifier - exp 4	0.832	0.612	0.647	0.822	0.522	0.576	0.561
TN classifier - exp 4	0.912	0.49	0.6325	0.798	0.562	0.538	0.53
CNN classifier limit - exp 4	0.785	0.505	0.602	0.616	0.26	0.25	0.47
TN classifier limit - exp 4	0.722	0.49	0.545	0.64	0.396	0.448	0.44

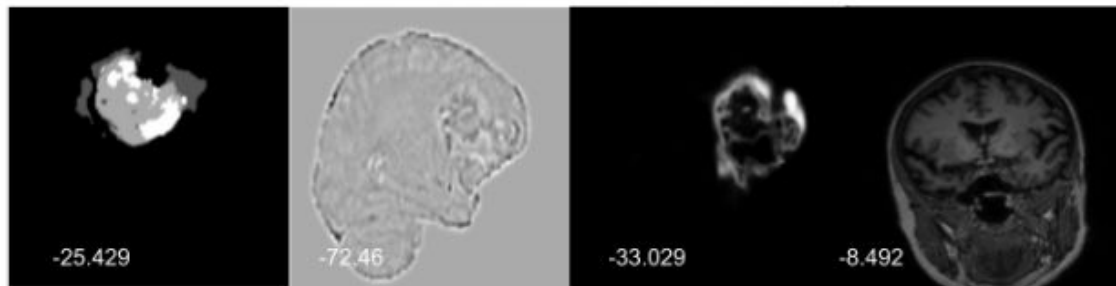
What?

Investigation of uncertainty measures

Estimated log-likelihood of a sample on the GMM model as a measure of uncertainty.

UNCERTAINTY MEASURE: minimum log-likelihood threshold taking the 1st percentile over the training data : **-12.44**

Fig. 4: Three samples of classes not represented in our dataset and a T1 slice, with their corresponding log-likelihood.



Thank you for your
attention

Contact

Irina Sánchez

irina@qmenta.com