

ABSTRACT

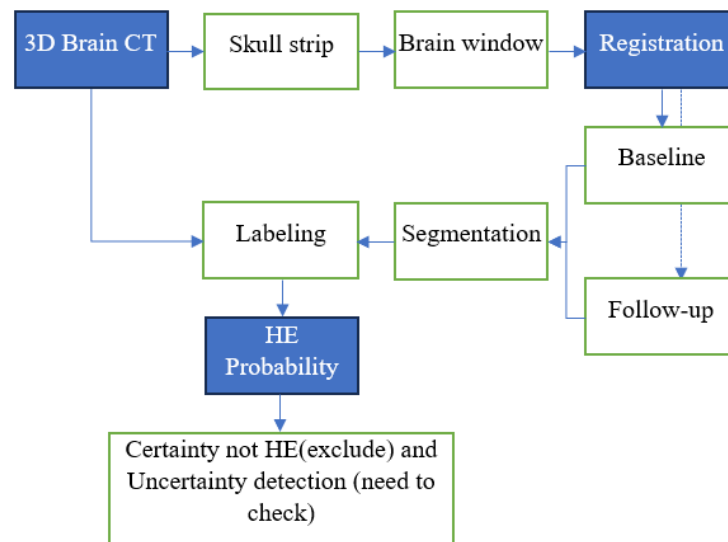
Background and Purpose:

- When running a model for HE prediction, the input is only the baseline CT. When training the model, training data is needed including input data (CT baseline) as well as the desired output data (label computing from baseline+follow-up segmentation)
- We aim to reduce the number of patients (baseline + follow-up) that doctors need to check to label the data when setting up a dataset for training HE prediction model from admission non-contrast head CT.

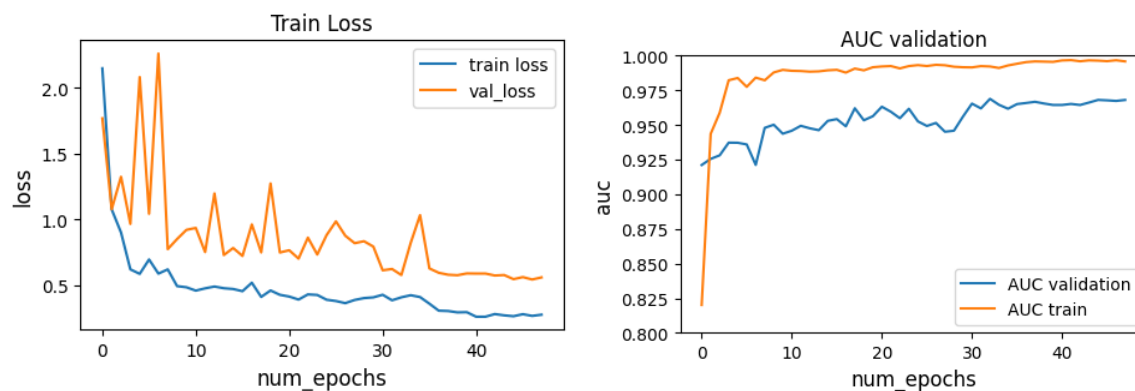
Methods: Using medical imaging from a multicentric clinical trial, a single-center longitudinal study, and external validation data, we proposed a model for HE labeling with multiple inputs, outputs, and loss function to detect the patients with no HE expansion in high certainty. We then compared the model with state of art methods.

Conclusion: We trained, and independently validated a deep learning model for the label of HE in supratentorial ICH, with improved labeling compared to other methods. Such a model can reduce the number of patients that doctors need to check to nearly 40% of the dataset.

Method 1: nnUNET for segmentation + VIT for labeling



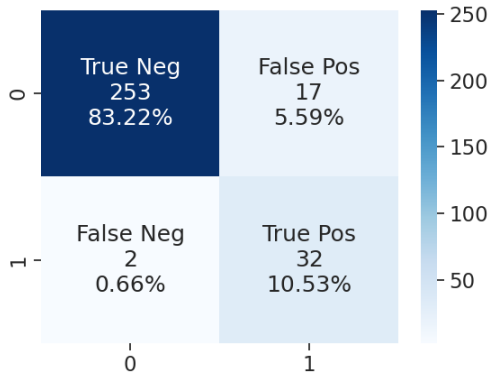
Loss diagram and AUC diagram for VIT



Results

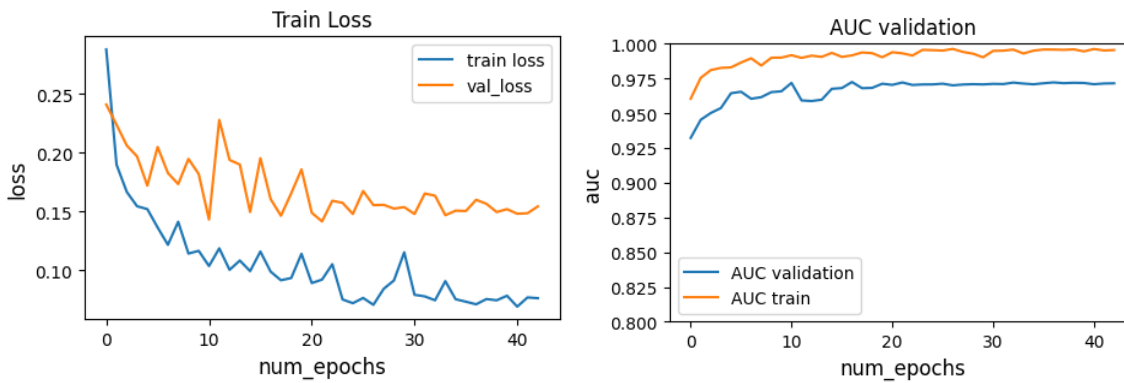
nnUNET + VIT		Metrics			
Total patients Tr=712 Total patients Validation=178		HE			
		>3000 HE_Tr=181 HE_Val=45	>6000 HE_Tr=121 HE_Val=27	>9000 HE_Tr=87 HE_Val=23	>12000 HE_Tr=55 HE_Val=17
4 inputs= Baseline(CT+seg) + followup(CT+seg)	AUC	0.91	0.97	0.99	0.995
	Specificity, Sensitivity	0.21, 0.98	0.66, 0.96	0.96, 1	0.95, 1
	no. patients exclude, %	28, 16%	100, 56%	149, 84%	153, 86%
Yale Test Total patients = 304		>3000 HE=76	>6000 HE=55	>9000 HE=42	>12000 HE=34
4 inputs= Baseline(CT+seg) + followup(CT+seg)	AUC	0.92	0.96	0.98	0.98
	Specificity, Sensitivity	0.20, 0.98	0.64, 1	0.90, 0.92	0.94, 0.94
	no. patients exclude, %	47, 16%	160, 53%	235, 77%	253, 83%

Example confusion matrix using VIT on Yale >12000



Method 2: nnUNET for segmentation + DenseNet121 for labeling

Loss diagram and AUC diagram



Results

nnUNET + DenseNet121	Metrics	HE			
Total patients Tr=712 Total patients Validation=178		>3000 HE_Tr=181 HE_Val=45	>6000 HE_Tr=121 HE_Val=27	>9000 HE_Tr=87 HE_Val=23	>12000 HE_Tr=55 HE_Val=17
4 inputs= Baseline(CT+seg) + followup(CT+seg)	AUC	0.92	0.97	0.99	0.99
	Specificity, Sensitivity	0.43, 1	0.77, 1	0.81, 1	0.97, 0.94
	no. patients exclude, %	57, 32%	117, 66%	125, 70%	156, 88%
Yale Test Total patients = 304		>3000 HE=76	>6000 HE=55	>9000 HE=42	>12000 HE=34
	AUC	0.96	0.98	0.99	0.99

4 inputs= Baseline(CT+seg) + followup(CT+seg)	Specificity, Sensitivity	0.54, 1	0.87, 0.92	0.84, 0.97	0.99,0.76
	no. patients exclude, %	124, 41%	217, 71%	220, 72%	268, 88%

Example confusion matrix using DenseNet121 on Yale >3000

