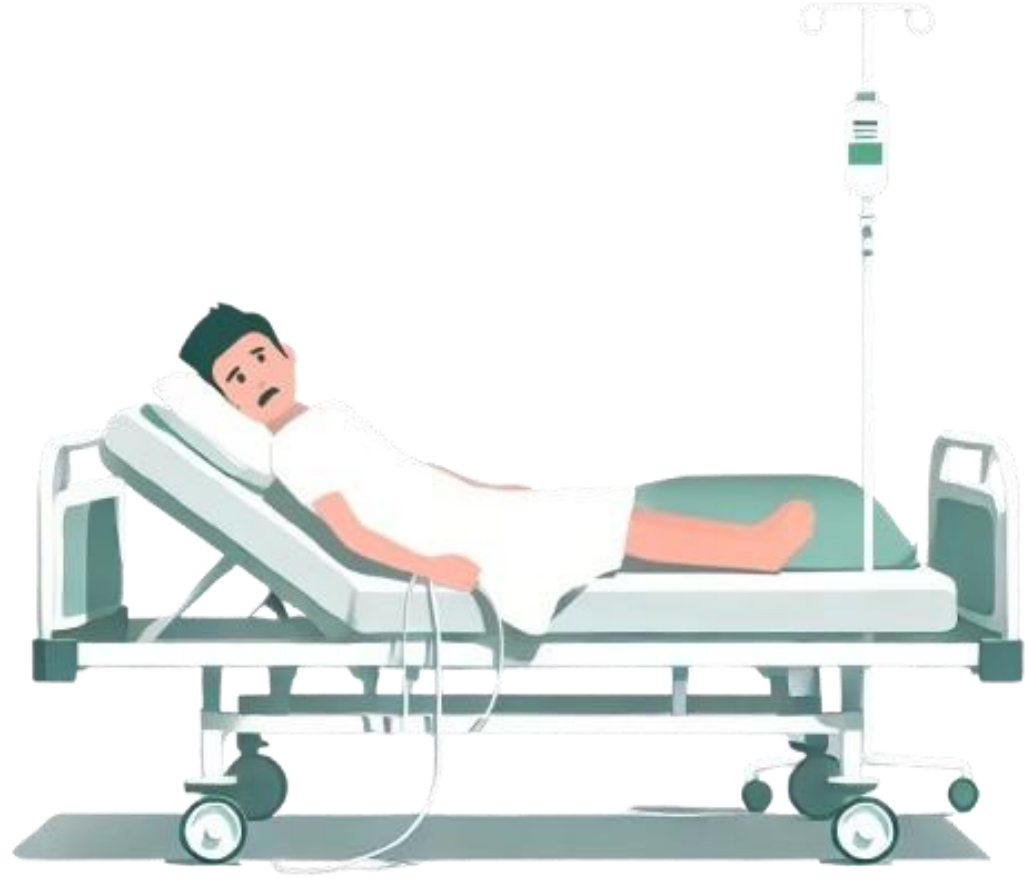
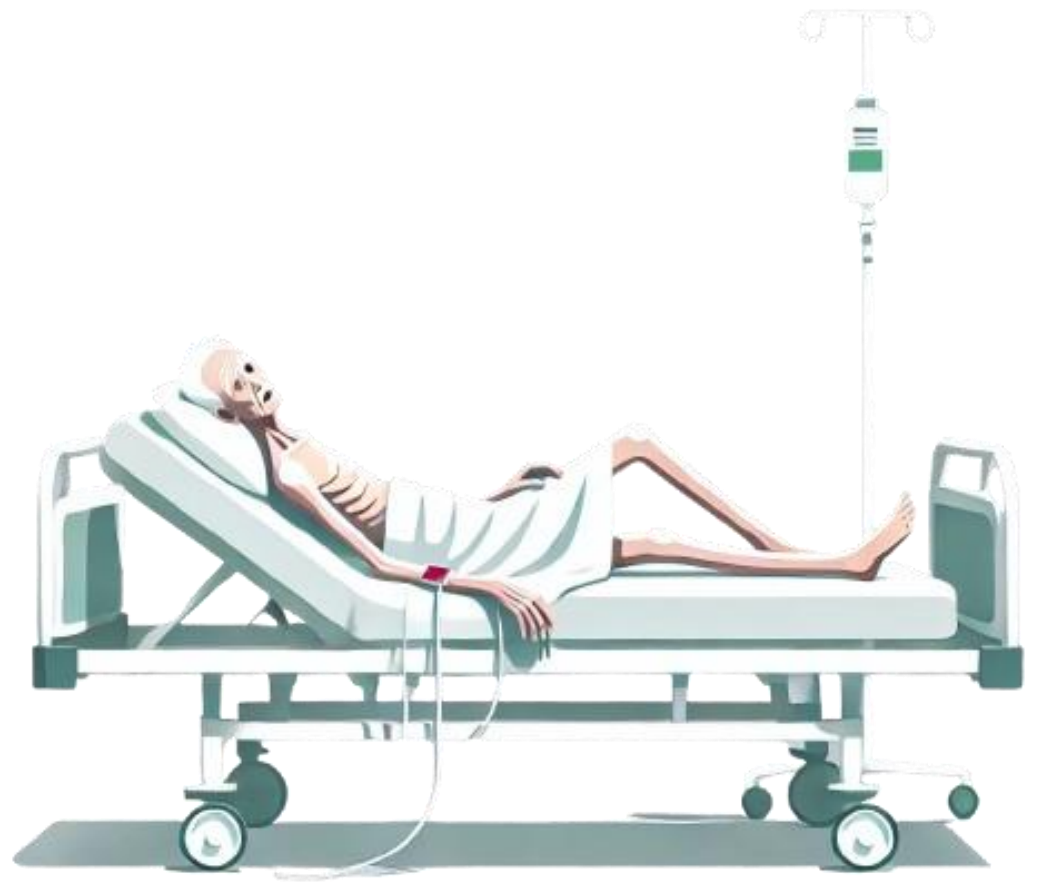
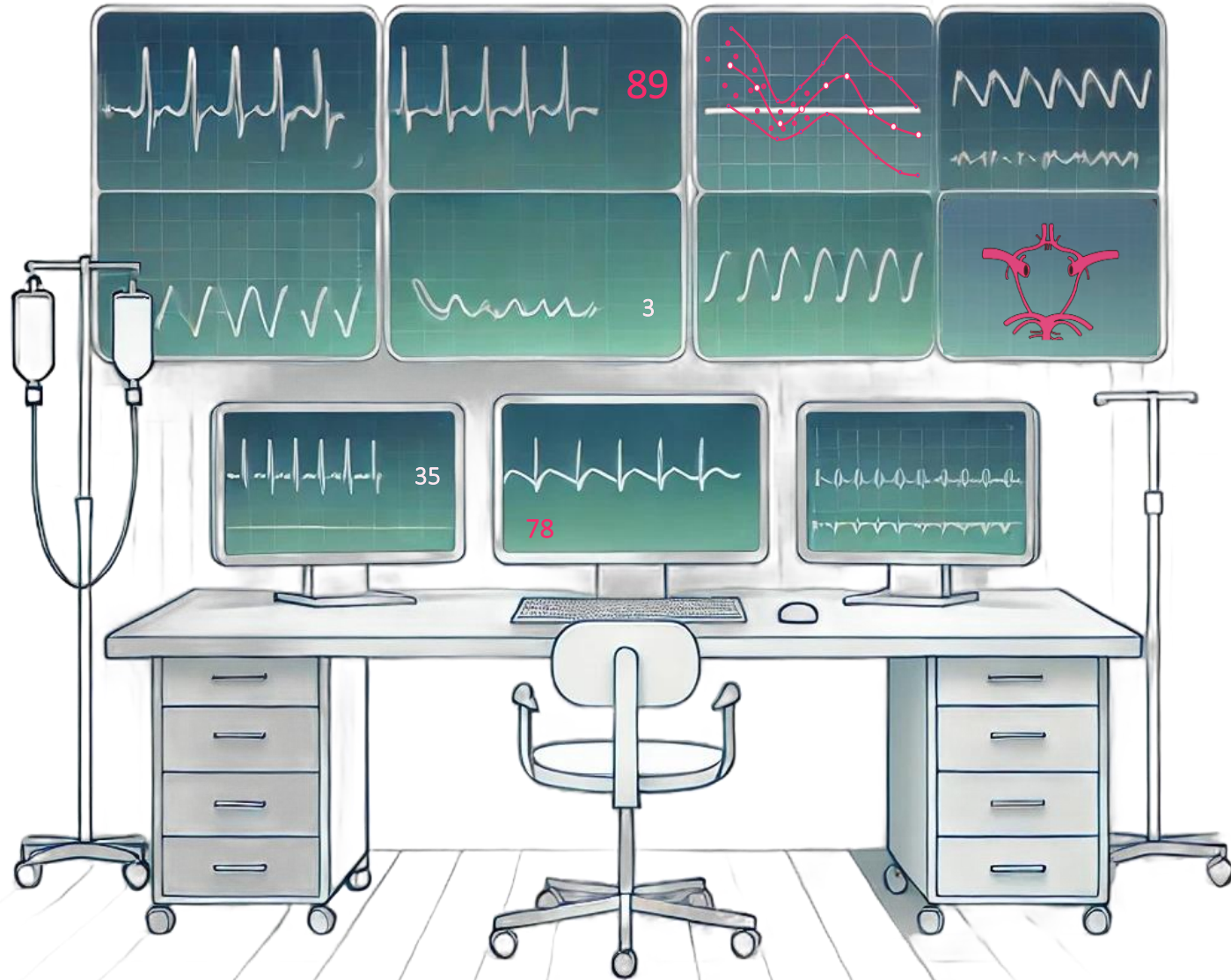


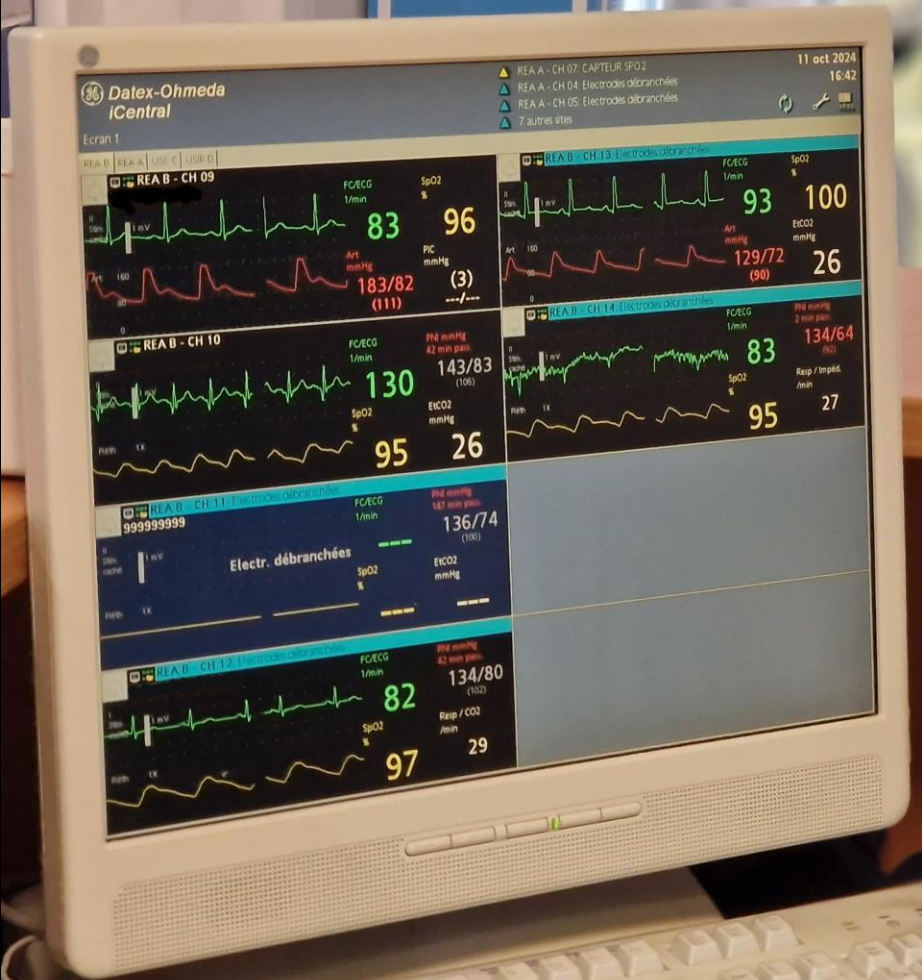
Dynamic prediction of functional outcome after stroke

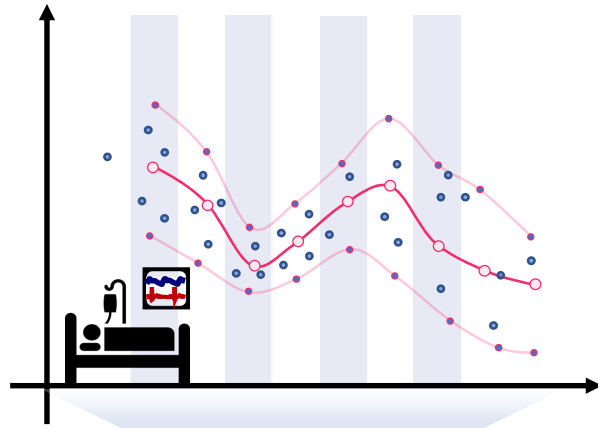




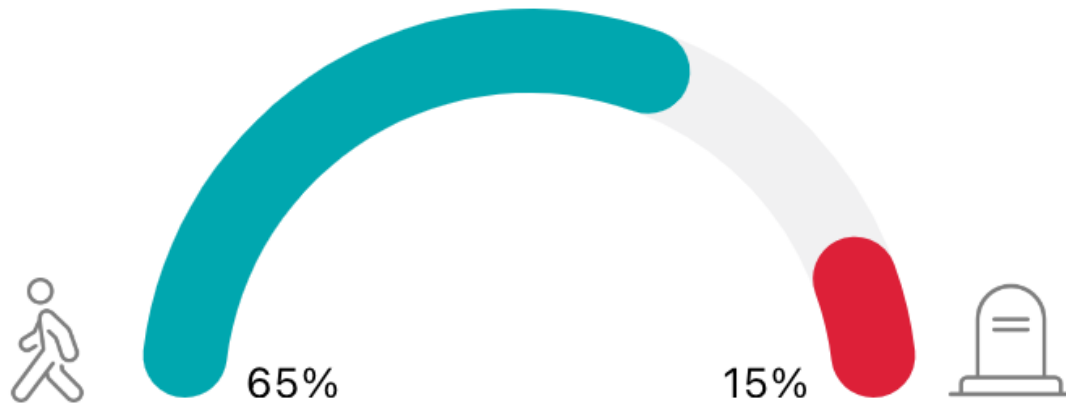


- CEPILLO QUIRURGICO SECO, ESTERIL, LIMPIADOR DE UÑAS
- ESCUVA QUIRURGICA SECO, ESTERIL, C/LIMPIA UÑAS
- TORR. PREOPERATIV. TUVATSWAMP, STERIL, NAGELRENGORARE
- TORR. QUIRURGISK NEGLERBRISTE, STERIL, M/NEGLERENSER
- TORR. QUIRURGISK SKRUBB, BRISTE, STERIL, NEGLERENSER
- SZCZOTKA CHIRURGICZNA, SUCIĄ, STERYLNA, CZYSZĄ DO RĘKONCJI



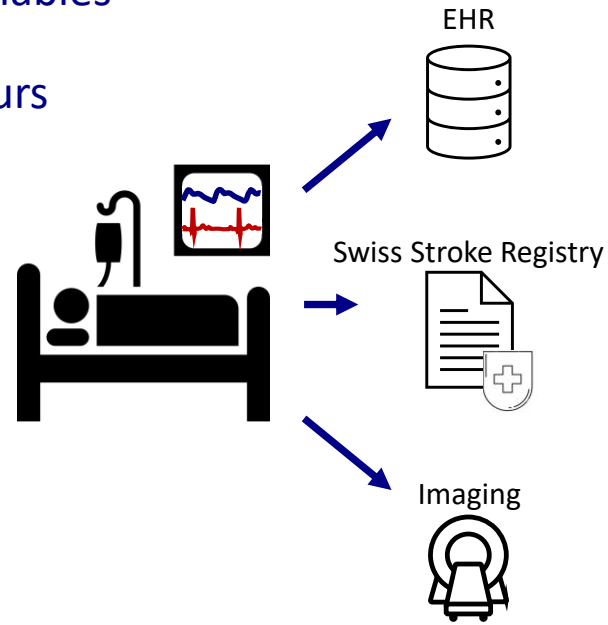


Model



84 variables

72 hours



Development
Geneva Hospital
2018-2021

2739 Patients

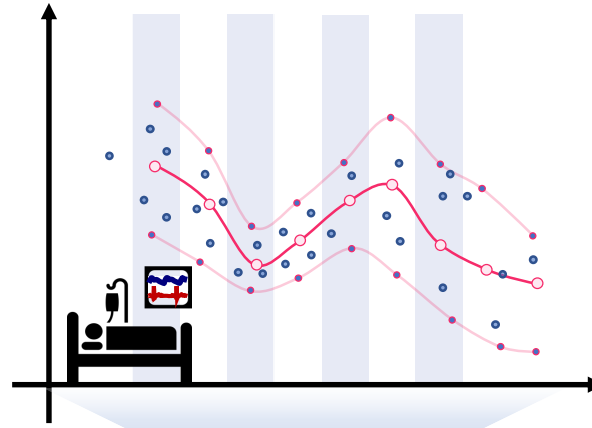
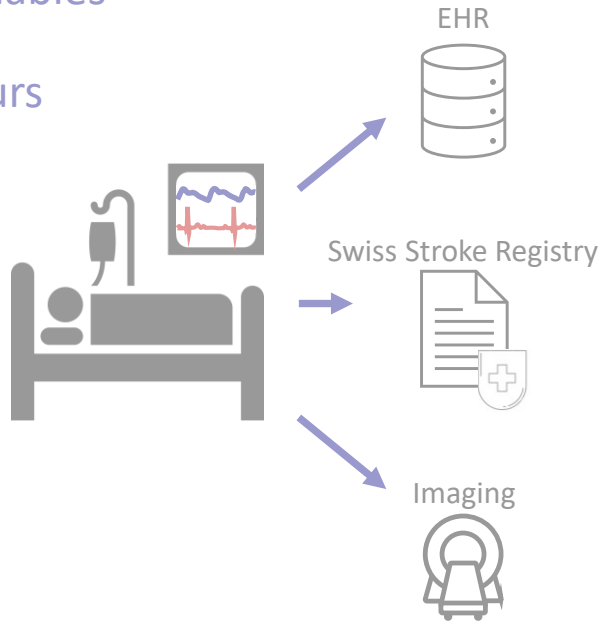


External validation
Beth Israel Deaconess
2008-2014
MIMIC-III

247 Patients

84 variables

72 hours



Linear Embedding

Positional Encoding

Self-Attention

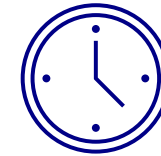
Add & Normalize

Add & Normalize

x Layers

Encoder

Linear Classifier



Hourly

updated predictions



Development
Geneva Hospital
2018-2021



External validation
Beth Israel Deaconess
2008-2014
MIMIC-III

2739 Patients

247 Patients



Hourly

updated predictions



Death

ROC AUC = 0.893



mRS \leq 2

ROC AUC = 0.894



Hourly

updated predictions



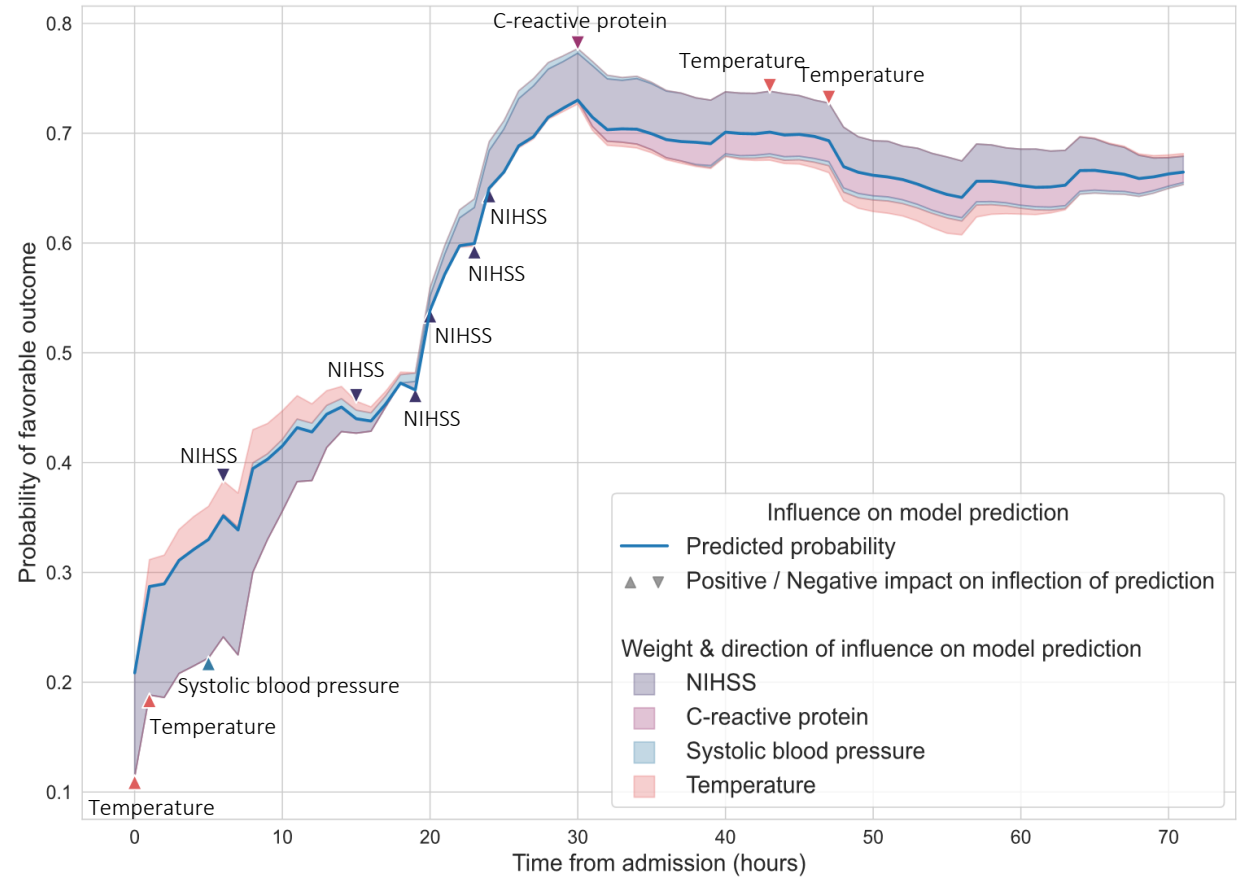
Death

ROC AUC =
0.893



mRS ≤ 2

ROC AUC =
0.894





Hourly

updated predictions



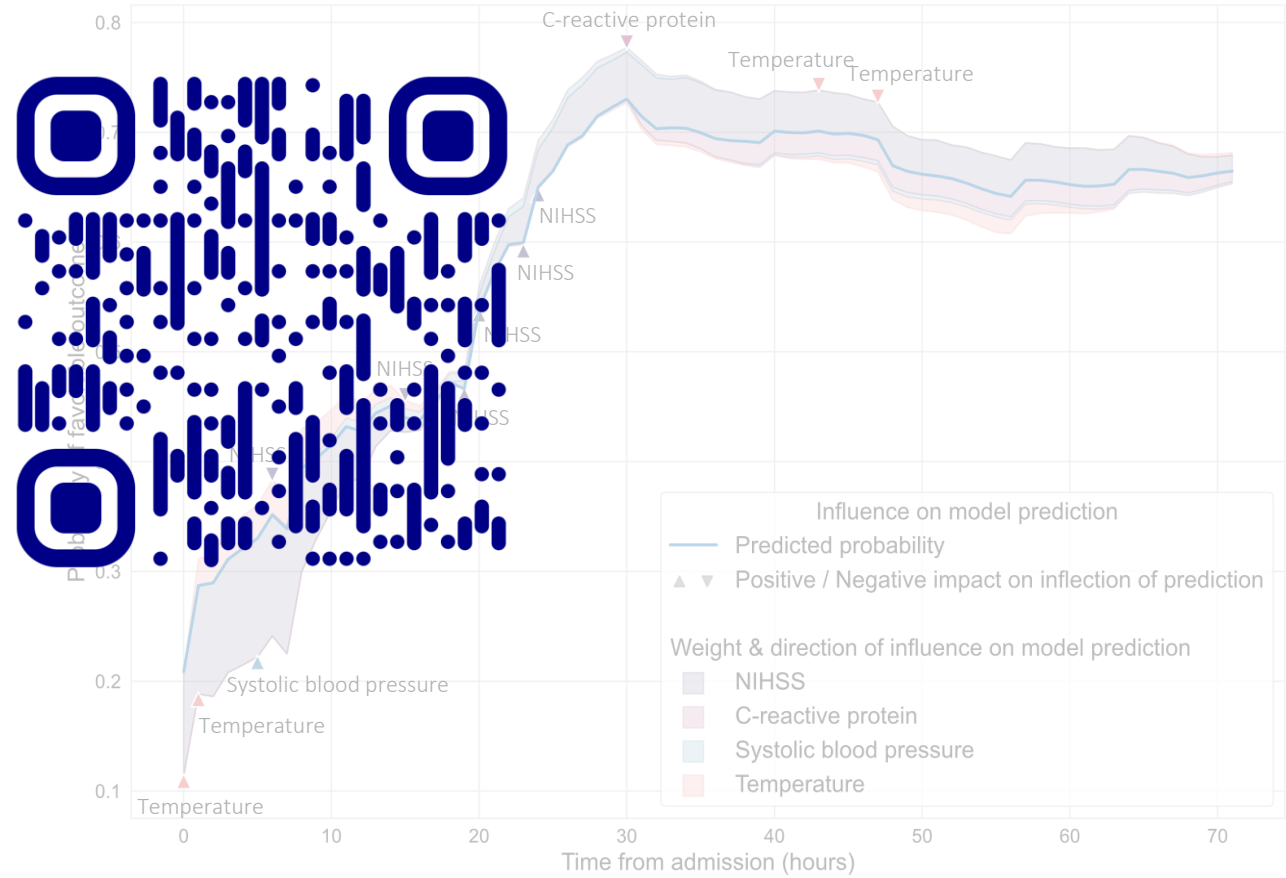
Death

ROC AUC =
0.893

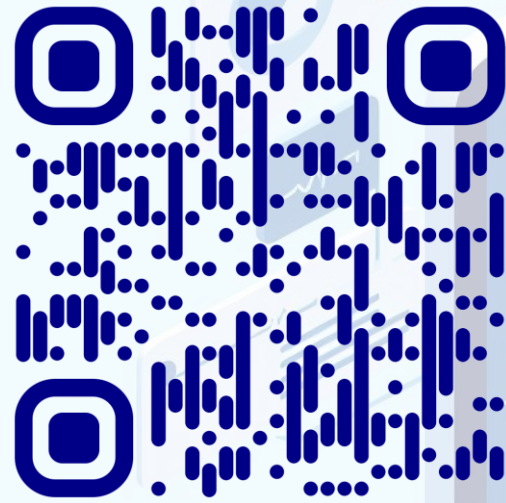


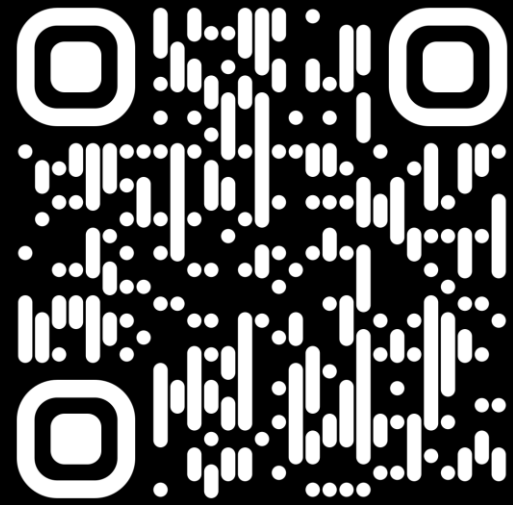
mRS ≤ 2

ROC AUC =
0.894

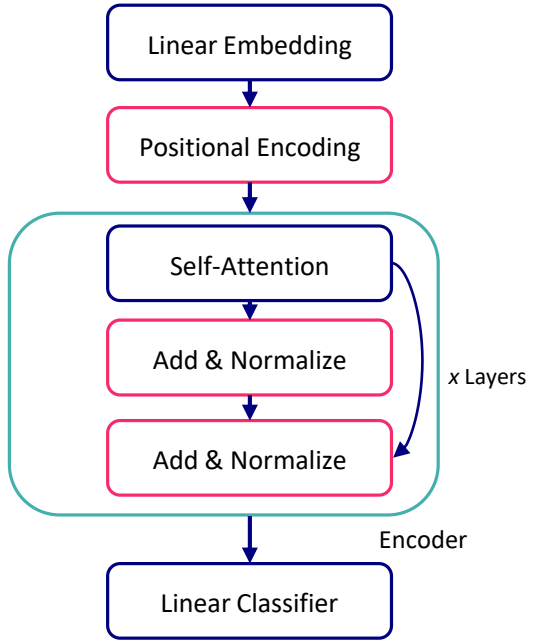
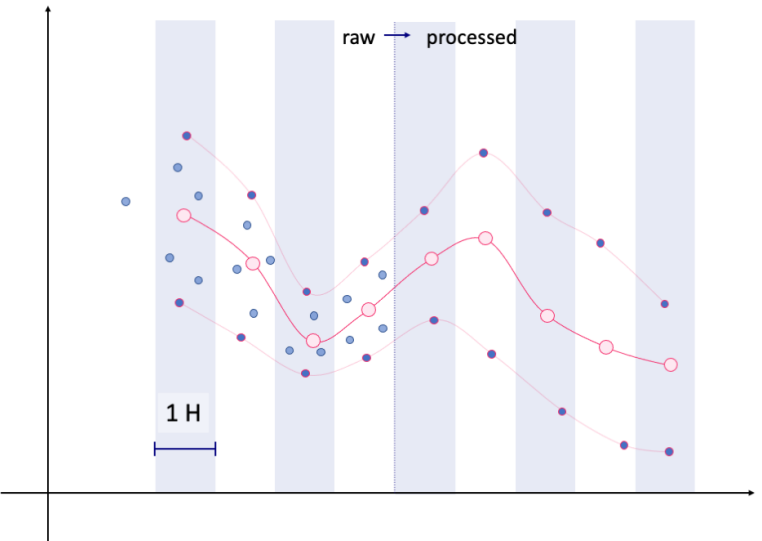


Dynamic prediction of functional outcome after stroke





Transformer encoder

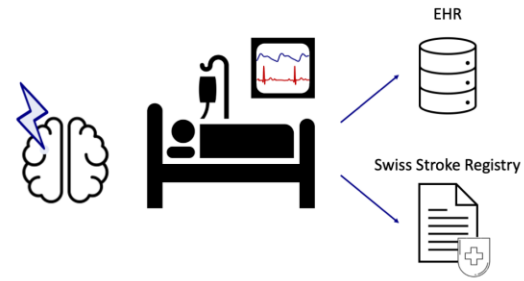


6 layers

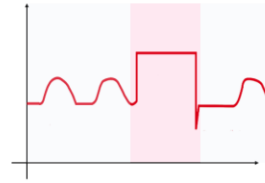
1024 hidden dimension

151M parameters

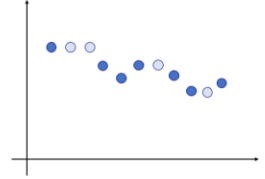
A. Data collection and preprocessing



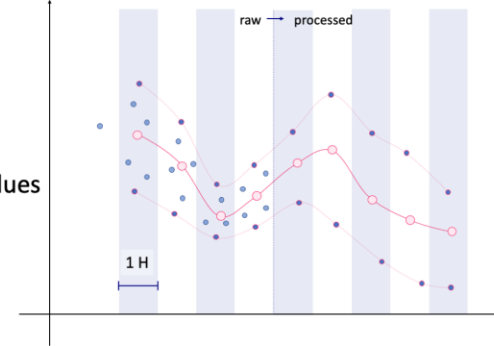
I. Artifact removal



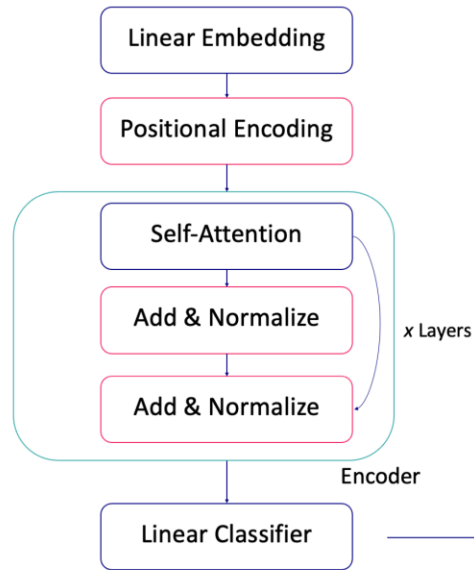
II. Imputation of missing values



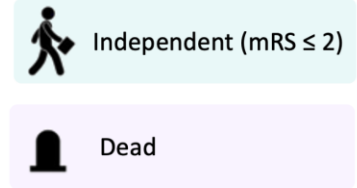
III. Hourly feature extraction



B. Model development

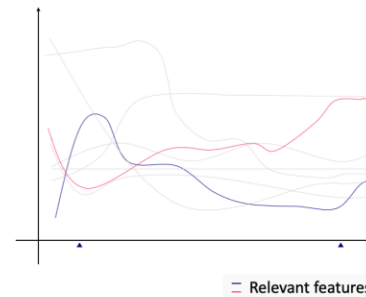


I. Clinical outcomes recorded at 3 months



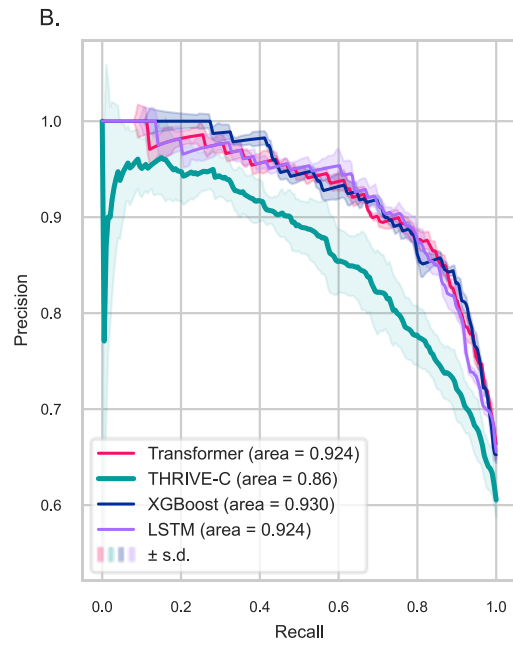
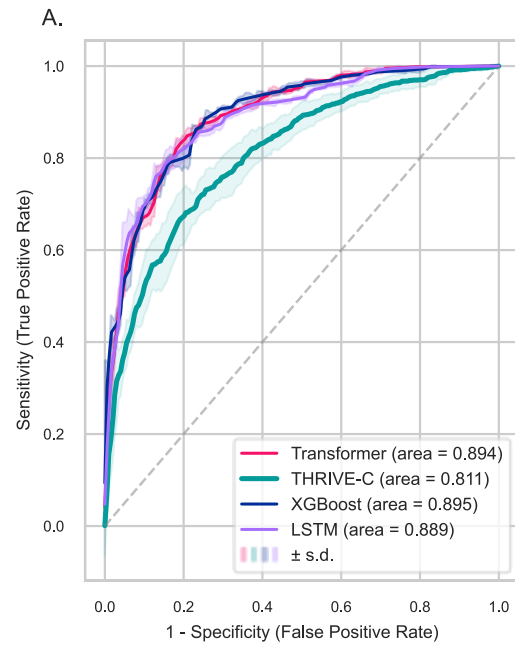
II. Identification of relevant features

SHAP Model

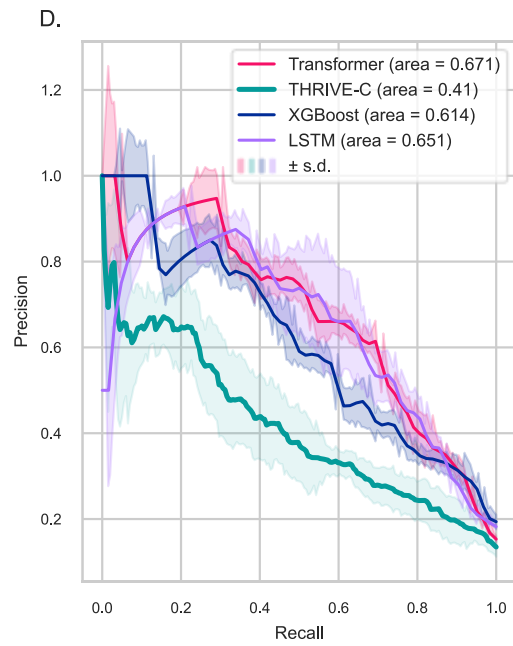
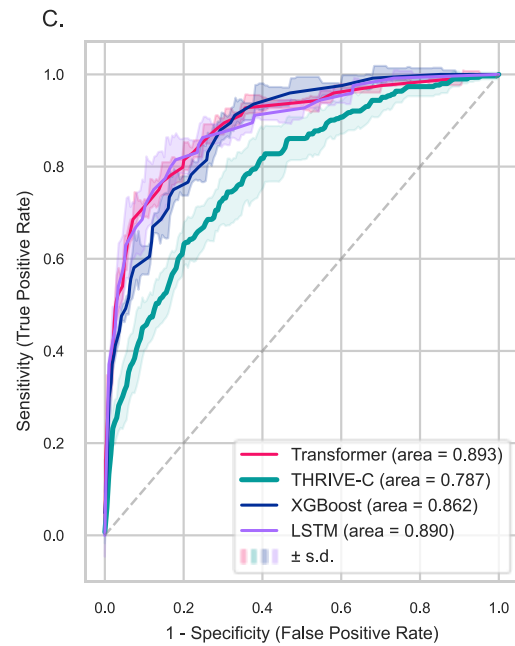


	Geneva Stroke Dataset		MIMIC-III
	Training dataset (n=1812)	Holdout test dataset (n=441)	External validation dataset (n=247)
Age, years	76 (64-84)	77 (66-85)	73 (58-82)
Sex, male	1006 (55%)	242 (54%)	122 (49%)
Pre-stroke disability, mRS	0 (0-1)	0 (0-1)	2 (1-2)
BMI, kg/m ²	24 (21-27)	24 (21-27)	30 (25-48)
Hypertension	1238 (68%)	287 (65%)	168 (68%)
Diabetes	393 (21%)	85 (19%)	54 (21%)
Atrial fibrillation	377 (20%)	96 (21%)	77 (31%)
NIHSS on admission	3 (1-7)	3 (1-9)	13 (7-19)
IVT	414 (22%)	115 (26%)	159 (64%)
IAT	220 (12%)	54 (12%)	50 (20%)
Disability at 3 months, mRS	2 (0-4)	2 (0-4)	/
Mortality at 3 months	258 (14%)	62 (14%)	51 (20%)

I. Prediction of functional outcome

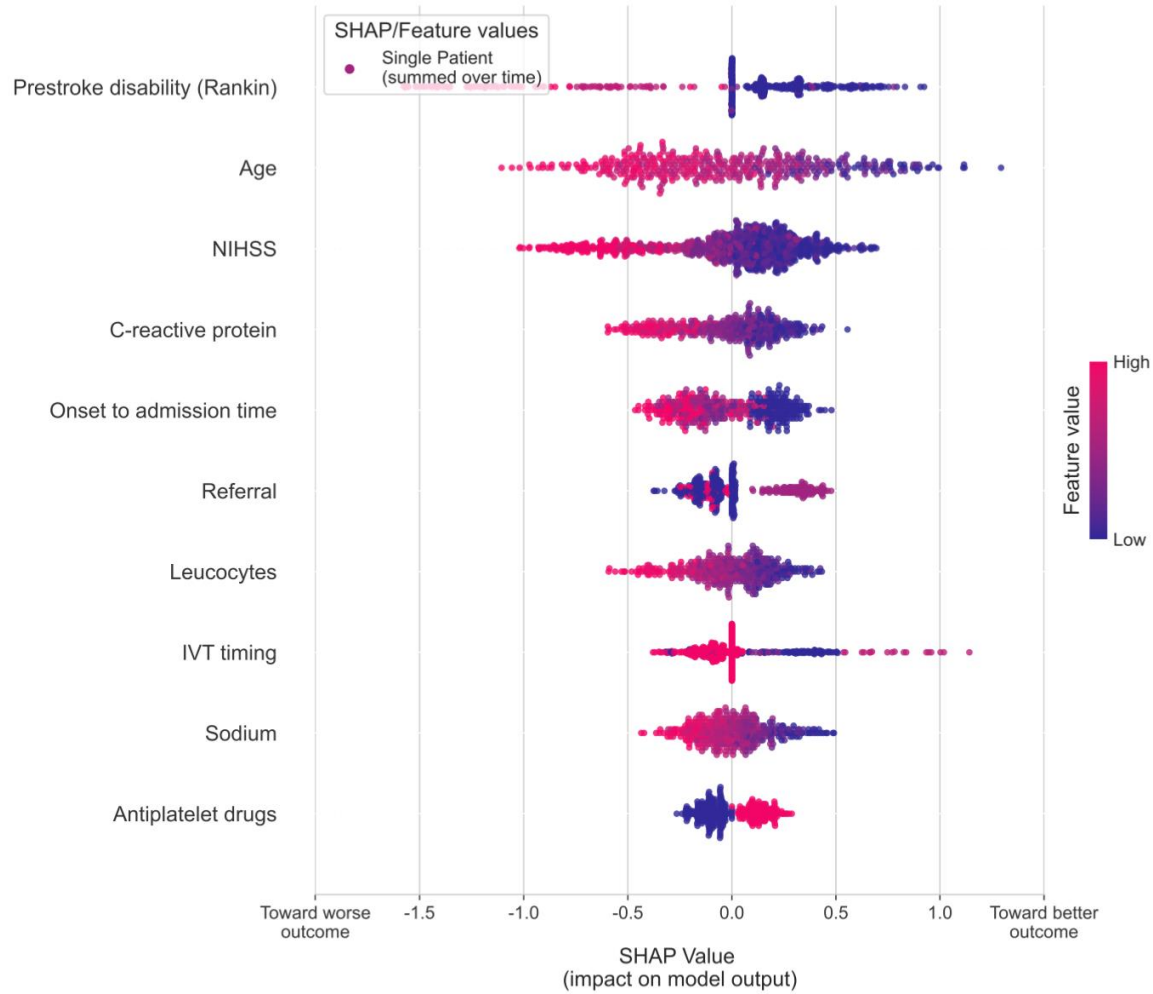


II. Prediction of mortality

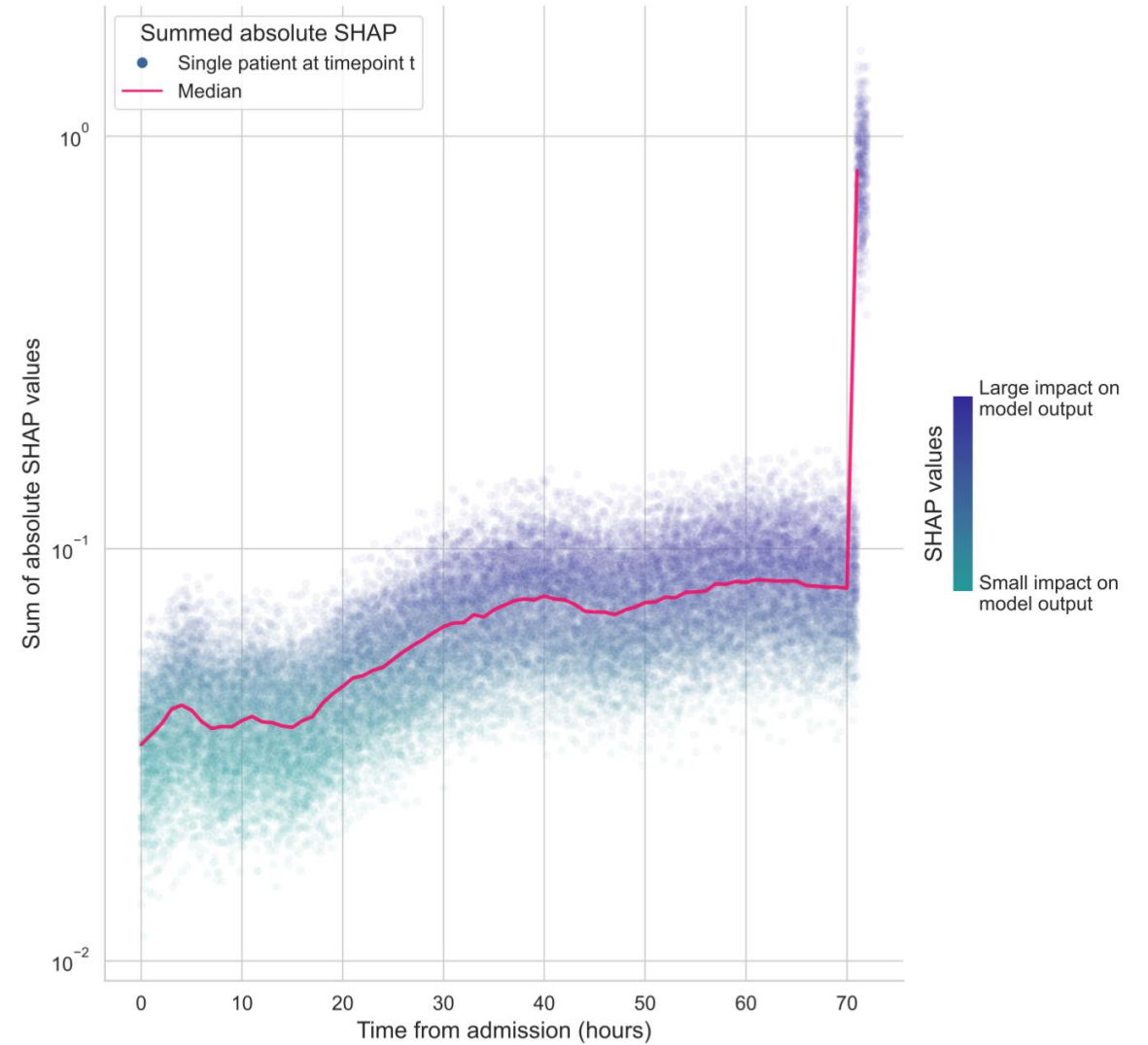


I. Prediction of functional outcome

A.

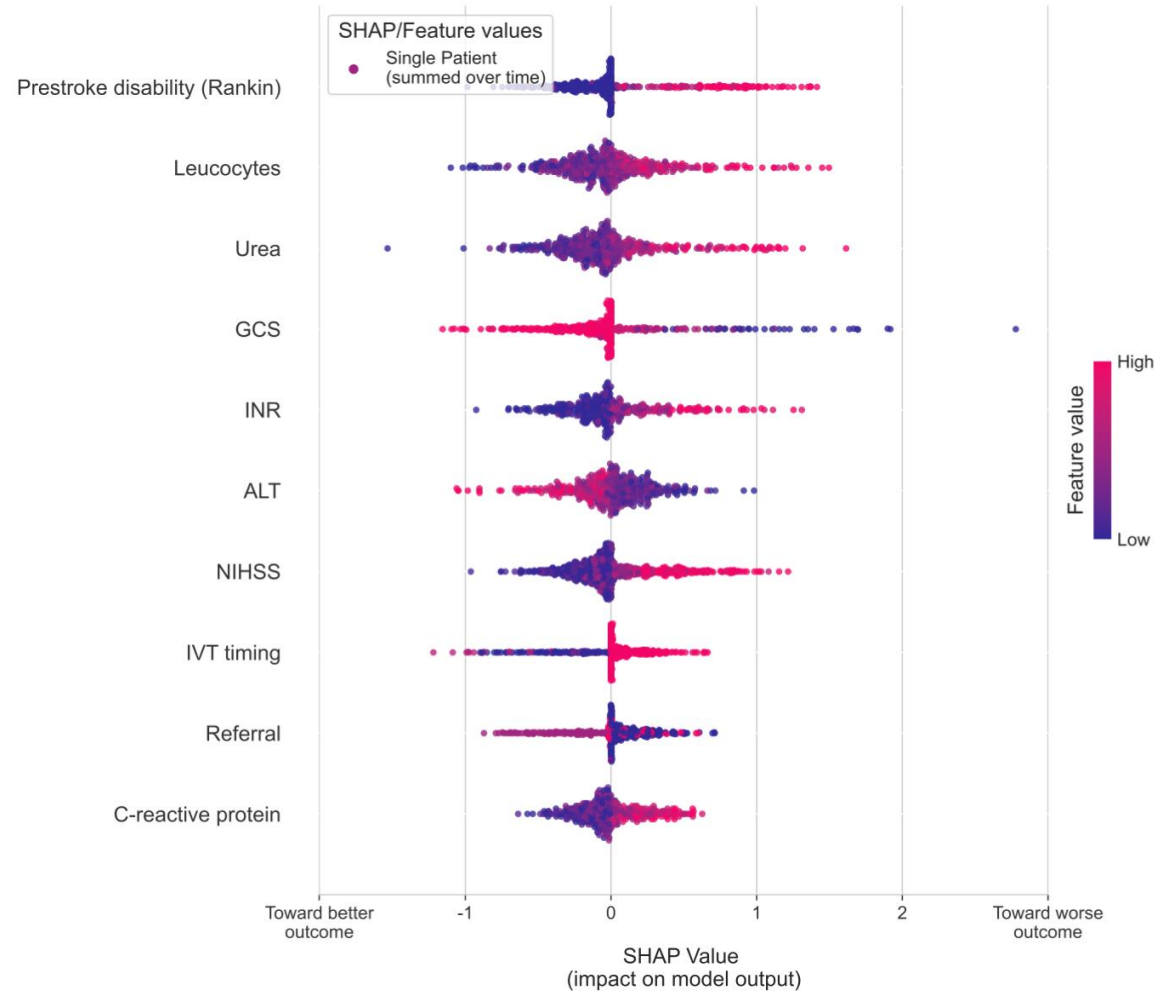


B.

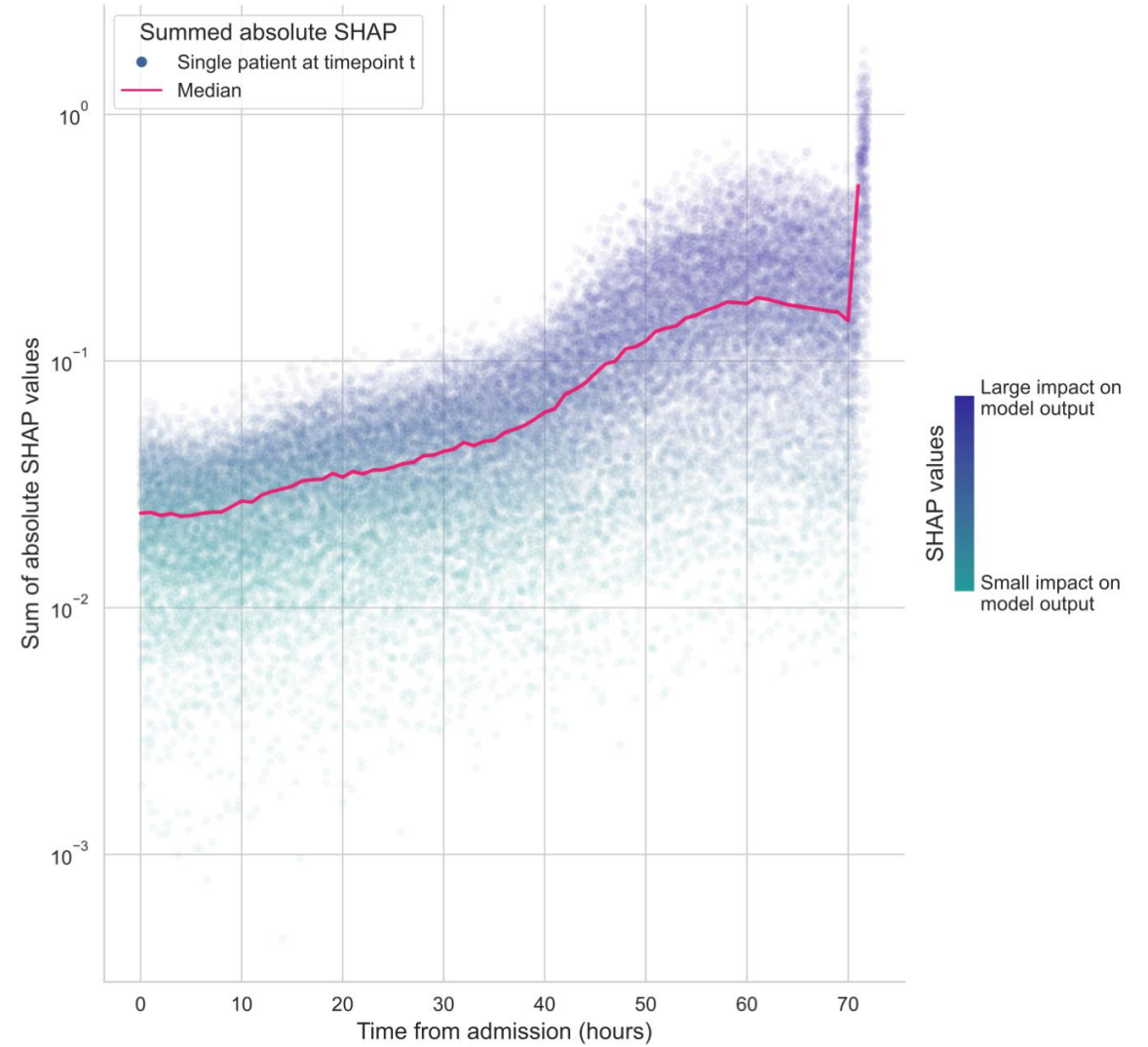


II. Prediction of mortality

C.

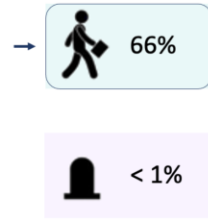


D.

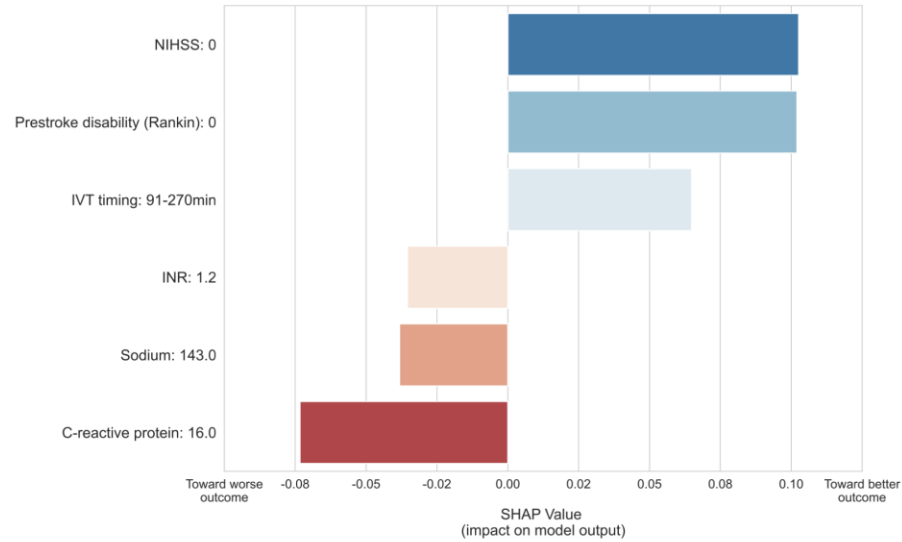


A. Example of a prediction for an individual patient

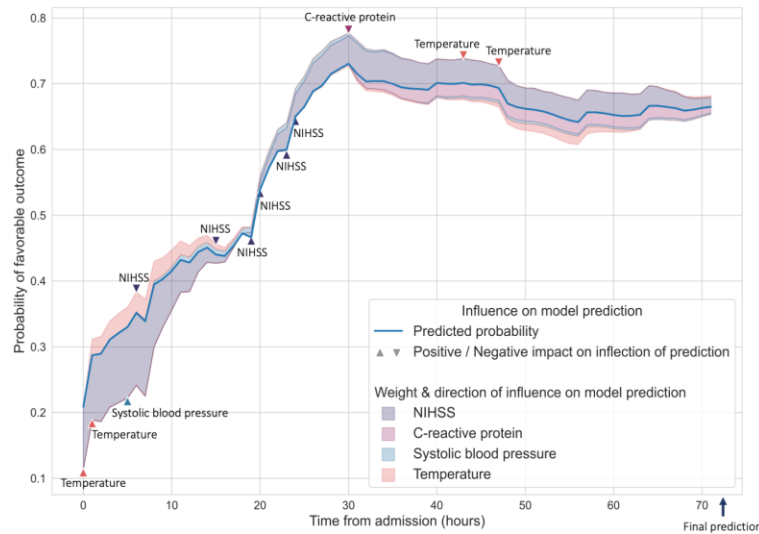
I. Predicted outcome probabilities



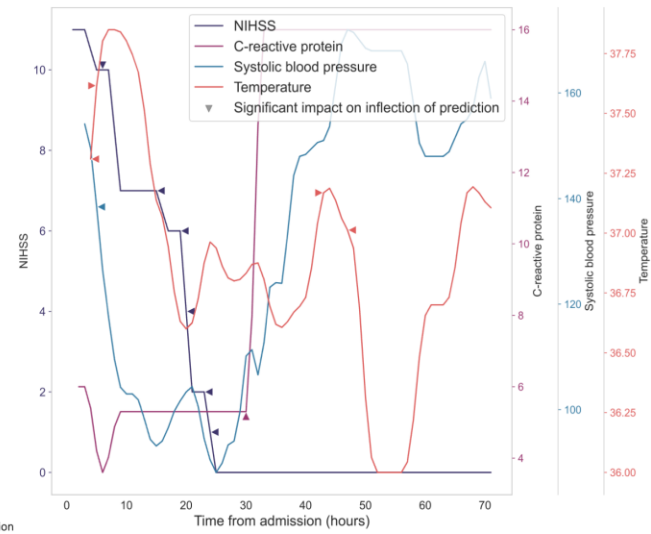
II. Weighting of main features driving the predicted outcome at t = 72h

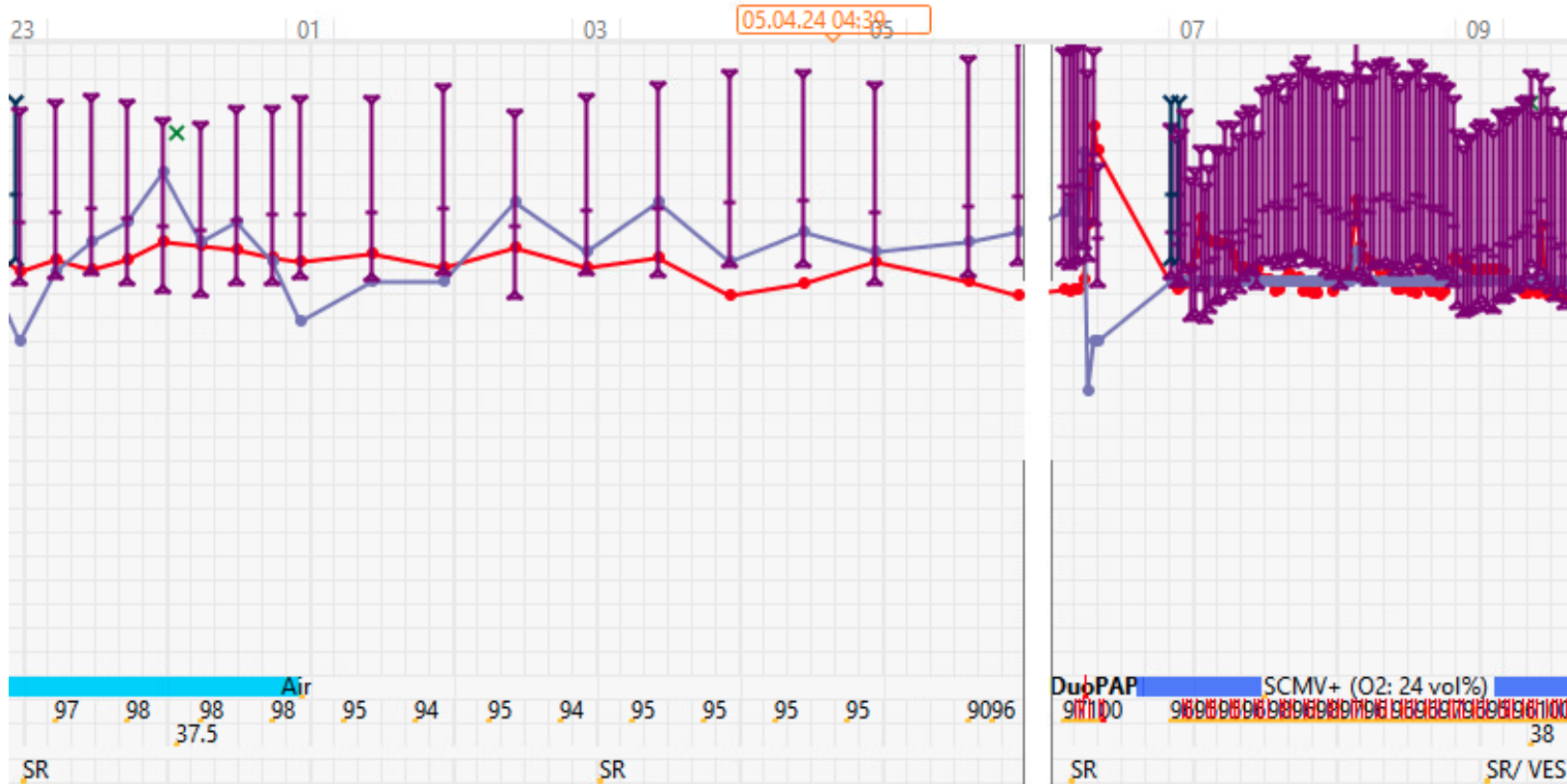


III. Evolution of predicted probability of a favorable outcome



IV. Evolution of selected features





SR SR SR SR/ VES

GCS: 14 GCS: 13 GCS: 12 GCS: 12 GCS: 13 GCS: 11 GCS: 10 GCS: 3 (intubated) GCS: 3 (intubated)

4.8+4.6+0.87 mm/s+1.33 mm/s+2.4 mm+3.5 mm

4.8 4.8 4.7

4.6 4.8 4.6

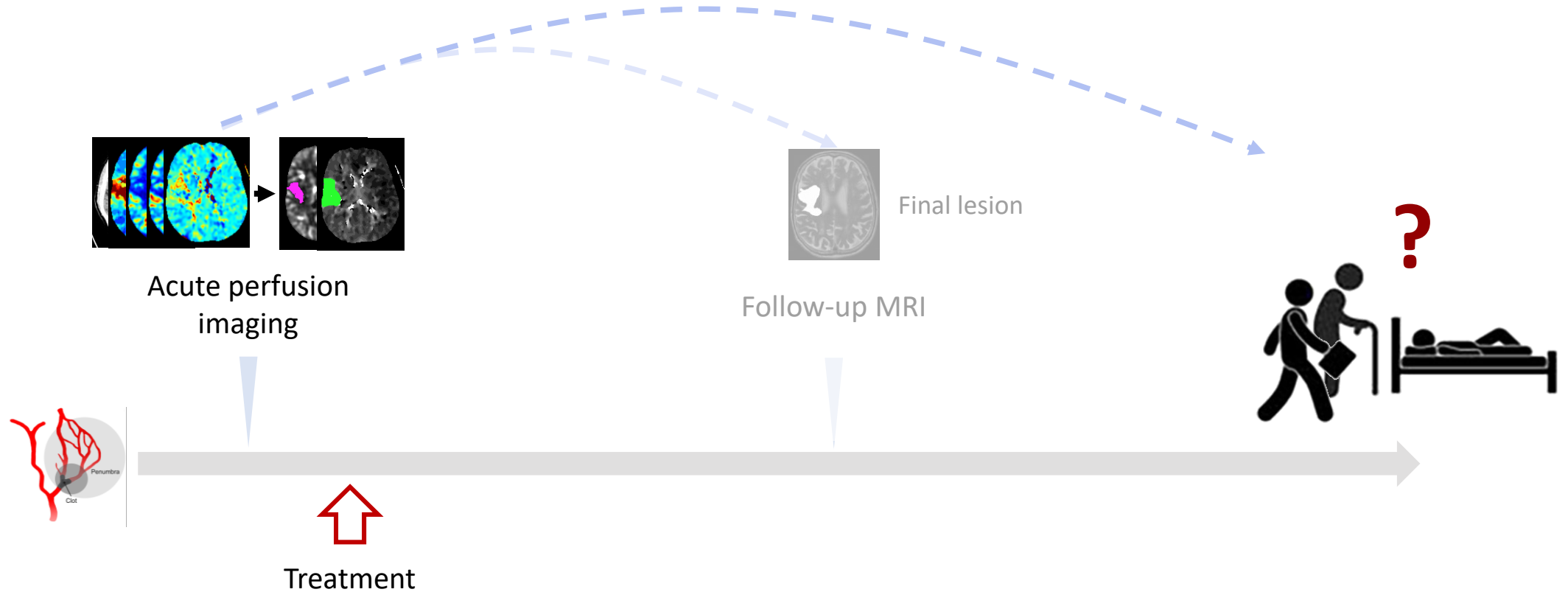
0.87 mm/s 1.4 mm/s 10 mm/s

1.33 mm/s 0.68 mm/s 1.34 mm/s

2.4 mm 2.8 mm 3.0 mm

3.5 mm 2.4 mm 3.5 mm

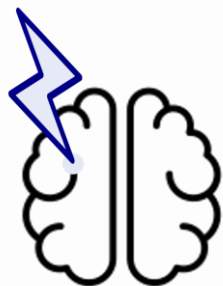
Clinical outcomes



Early dynamic prediction of functional outcome after stroke using machine learning

Collected Data

2739 Patients with acute ischemic stroke
84 variables over
72 hours



Cohorts

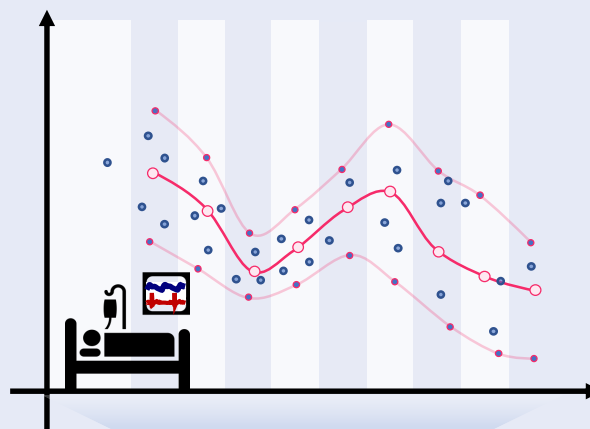


Development
Geneva Hospital
2018-2021



External validation
Beth Israel Deaconess
2008-2014
MIMIC-III

Transformer model



Linear Embedding

Positional Encoding

Self-Attention

Add & Normalize

Add & Normalize

x Layers

Encoder

Linear Classifier

Continuous prediction of 3-month outcome



Hourly

updated predictions



Death

ROC AUC =
0.893



mRS \leq 2

ROC AUC =
0.894

Real-time

identification of
relevant features

