

AI-assisted High-Density Near-Infrared Spectroscopy System for Cerebral Oxygen Saturation Measurement in a Porcine Ischemia Model

Seongkwon Yu^{1,*}, Tae Jung Kim^{2,3,*}, Hayoung Kim^{4,*}, Jae-Myoung Kim⁵, Heesu Park⁴, Woon Yong Kwon⁴, Bumjun Koh¹, Jimin Lee¹, Hyeon-Min Bae^{1,+}, and Sang-Bae Ko^{2,3,+}

¹Korea Advanced Institute of Science and Technology, School of Electrical Engineering, Daejeon, 34141, Republic of Korea

²Seoul National University, College of Medicine, Department of Neurology, Seoul, 03080, Republic of Korea

³Seoul National University Hospital, Department of Critical Care Medicine, Seoul, 03080, Republic of Korea

⁴Seoul National University Hospital, Department of Emergency Medicine, Seoul, 03080, Republic of Korea

⁵OBELAB Inc, Department of Research and Development, Optics Brain Electronics Laboratory, Seoul, 06211, Republic of Korea

*These authors contributed equally to this work

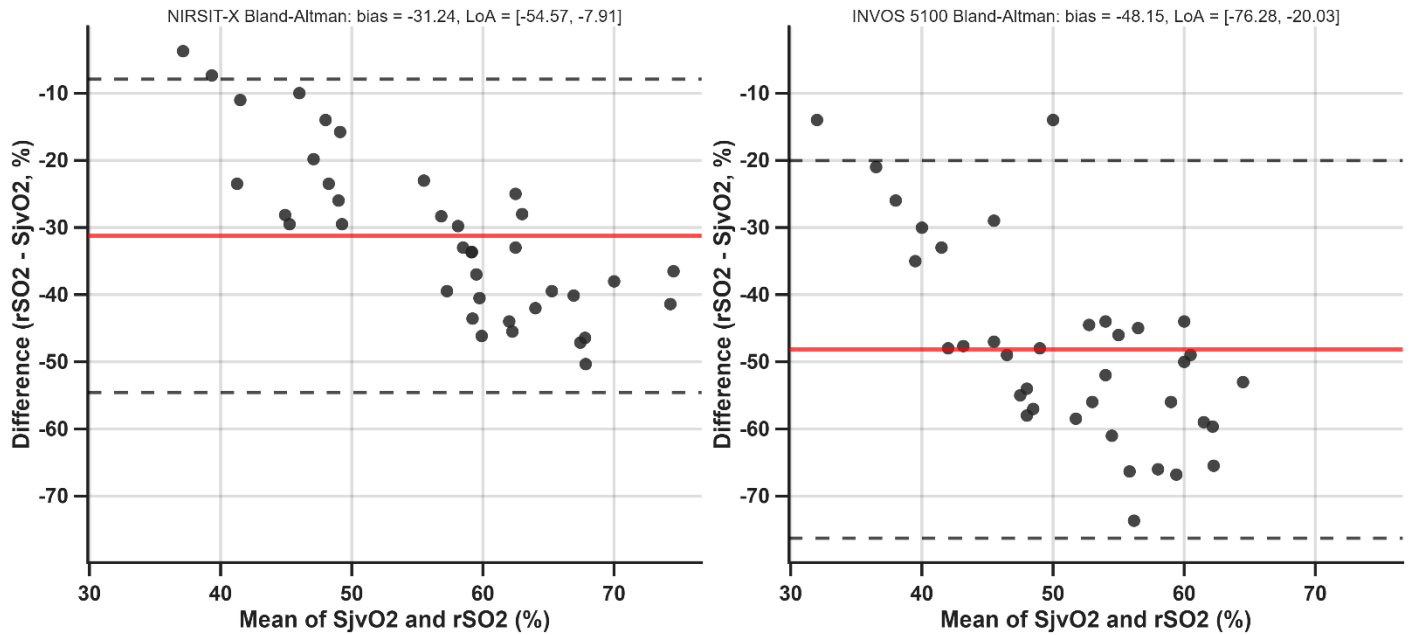
⁺Correspondence should be addressed to H.-M.B. (hmbae@kaist.ac.kr) or S.-B.K. (sangbai1378@gmail.com).

Supplementary Table 1. Pairwise Wilcoxon signed-rank comparisons of hemodynamic and respiratory variables. Holm–Bonferroni adjustment was performed within each variable across four comparisons: Baseline vs T1, Baseline vs T2, Baseline vs T3, and T1 vs T2. The table displays the three baseline-relative comparisons; T1 vs T2 was included in the multiplicity family but is not shown. Effect size was calculated as $r = |Z|/\sqrt{N}$.

Variable	Comparison	Baseline median [IQR]	Compared median [IQR]	Raw p	Holm-adjusted p	Z value	Effect size r
MBP	Baseline vs T1	54.367 [12.909]	66.379 [10.326]	0.018	0.072	2.366	0.894
MBP	Baseline vs T2	54.367 [12.909]	63.233 [5.681]	0.128	0.256	1.521	0.575
MBP	Baseline vs T3	54.367 [12.909]	65.867 [6.358]	0.063	0.189	1.859	0.703
SBP	Baseline vs T1	77.233 [23.597]	93.533 [13.893]	0.018	0.072	2.366	0.894
SBP	Baseline vs T2	77.233 [23.597]	90.400 [14.170]	0.128	0.256	1.521	0.575
SBP	Baseline vs T3	77.233 [23.597]	92.300 [6.175]	0.063	0.189	1.859	0.703
DBP	Baseline vs T1	37.133 [13.522]	51.621 [5.739]	0.028	0.112	2.197	0.831
DBP	Baseline vs T2	37.133 [13.522]	42.000 [10.193]	0.237	0.256	1.183	0.447
DBP	Baseline vs T3	37.133 [13.522]	50.655 [7.758]	0.128	0.256	1.521	0.575
SpO2	Baseline vs T1	99.567 [1.567]	99.567 [1.888]	0.528	0.926	0.631	0.257
SpO2	Baseline vs T2	99.567 [1.567]	98.400 [1.975]	0.237	0.710	1.183	0.447
SpO2	Baseline vs T3	99.567 [1.567]	99.000 [2.408]	0.463	0.926	0.734	0.300
HR	Baseline vs T1	135.133 [21.025]	138.500 [23.887]	0.063	0.252	1.859	0.703
HR	Baseline vs T2	135.133 [21.025]	134.167 [29.900]	1.000	1.000	0.000	0.000
HR	Baseline vs T3	135.133 [21.025]	132.300 [26.483]	0.310	0.931	1.014	0.383
EtCO2	Baseline vs T1	21.000 [2.000]	22.000 [2.608]	0.180	0.719	1.342	0.949
EtCO2	Baseline vs T2	21.000 [2.000]	20.000 [4.800]	0.593	0.923	0.535	0.309
EtCO2	Baseline vs T3	21.000 [2.000]	20.000 [4.000]	0.180	0.719	1.342	0.949

Supplementary Table 2. Baseline-relative pairwise Wilcoxon signed-rank comparisons of rSO₂ values for NIRSIT-X and INVOS. Holm–Bonferroni-adjusted p values and effect sizes ($r = |Z|/\sqrt{N}$) are shown.

Device	Comparison	Raw p	Holm-adjusted p	Z value	Effect size r
NIRSIT-X	Baseline vs T1	0.012	0.035	2.450	0.866
NIRSIT-X	Baseline vs T2	0.012	0.035	2.450	0.866
NIRSIT-X	Baseline vs T3	0.018	0.035	-2.282	0.862
INVOS	Baseline vs T1	0.018	0.054	2.282	0.862
INVOS	Baseline vs T2	0.021	0.054	2.240	0.792
INVOS	Baseline vs T3	0.068	0.068	-1.750	0.619



Supplementary Figure 1. Repeated-measures Bland–Altman plots for agreement analysis between SjvO₂ and rSO₂ measured by NIRSIT-X (left) and INVOS 5100 (right). The x-axis shows the mean of SjvO₂ and rSO₂ for each paired observation, and the y-axis shows the difference (rSO₂ – SjvO₂). The red solid line denotes the mean bias, and the black dashed lines denote the 95% limits of agreement (LoA). The estimated bias and LoA were –31.24% and [–54.57%, –7.91%] for NIRSIT-X, and –48.15% and [–76.28%, –20.03%] for INVOS 5100.