



ABSTRACT FORM

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Title (capital letters)	Automatic Detection of Artifact and Events in Vital-Signs Traces: A Comparison of Two Machine Learning Based Models
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Text (250 words Max)

AIM: Previous work [1] on a model for prediction of arterial hypotension showed that up to 30% of potential hypotension events were confounded by either missing or artifactual data. This study (work in progress) addresses this issue by developing and comparing two machine-learning based models for detection of artifact in vital signs recordings from patients during their management in Neuro-intensive care.

METHODS: High frequency waveform data from 9 patients with Brain Injury were annotated for blood sample (BS) events (n=64), Damped arterial trace (DT) events (n = 32) and endo-tracheal suction (TS) events (n=53). Using these annotations as ground truth, two adaptive models, the Factorial Switching Linear Dynamical System (FSLDS) [2] and the Discriminative Switching Linear Dynamical System (DSLDS) were compared for detection accuracy of these specific events on the processed waveform data.

RESULTS: In all cases except for the “X-Factor” events (abnormal data not identified as BS, DT or TS events), the DSLDS model showed better accuracy (area under curve: AUC) for detection of BS, DT and TS events, see Table 1. As both models can be run simultaneously, an α -mixture of the two models yields the best performance overall.

AUC	Blood sample	Damped trace	Suction	X-factor
DSLDS	0.94	0.92	0.74	0.65
FSLDS	0.89	0.83	0.67	0.73
α -mixture	0.97 ^(-2.8)	0.94 ^(-2.7)	0.78 ^(0.9)	0.74 ^(0.8)

CONCLUSIONS: When complete (n = 20 patients), this study will provide the ground work for prospectively assessing in real time the application of such automatic artifact detection models for influencing the calculation of physiological summary measures and prognostic scores such as APACHE coding.

REFERENCES [1] Donald R, Howells T, Piper I, Chambers I, Citerio G, Enblad P, Gregson B, Kiening K, Mattern J, Nilsson P, Ragauskas A, Sahuquillo J, Sinnott R, Stell A. Early warning of EUSIG-defined hypotensive events using a Bayesian Artificial Neural Network. *Acta Neurochir Suppl.* 2012;114:39-44.

[2] Factorial Switching Linear Dynamical Systems applied to Physiological Condition Monitoring. John A. Quinn, Christopher K.I. Williams, Neil McIntosh. *IEEE Trans. on Pattern Analysis and Machine Intelligence* 31(9) pp 1537-1551 (2009).