

Assessing flight task related workload prediction across simulation fidelity levels

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Abstract. This study investigates how simulator fidelity affects physiological responses during flight tasks and how these differences impact machine learning-based workload prediction. Electrocardiographic (ECG) signals are collected from aerospace engineering students performing comparable flight tasks in two simulation environments: a full-flight simulator and a low-fidelity simulator

Heart rate variability (HRV) features are extracted to describe autonomic nervous system activity under similar task demands across the two levels of simulation. The first objective is to evaluate whether physiological indicators of workload change when the same tasks are performed in environments with different levels of realism. The second objective is to assess whether machine learning models trained on physiological data can reliably predict workload across simulator conditions.

Ensemble learning algorithms, including Random Forest and AdaBoost, are trained and tested for workload classification using HRV-derived features. Model performance is evaluated both within each simulator environment and across fidelity levels to determine the robustness and transferability of workload prediction models.