Abstract Title: Development of a reinforcement learning model for dynamic ventilation control in surgical patients during emergence from general anesthesia

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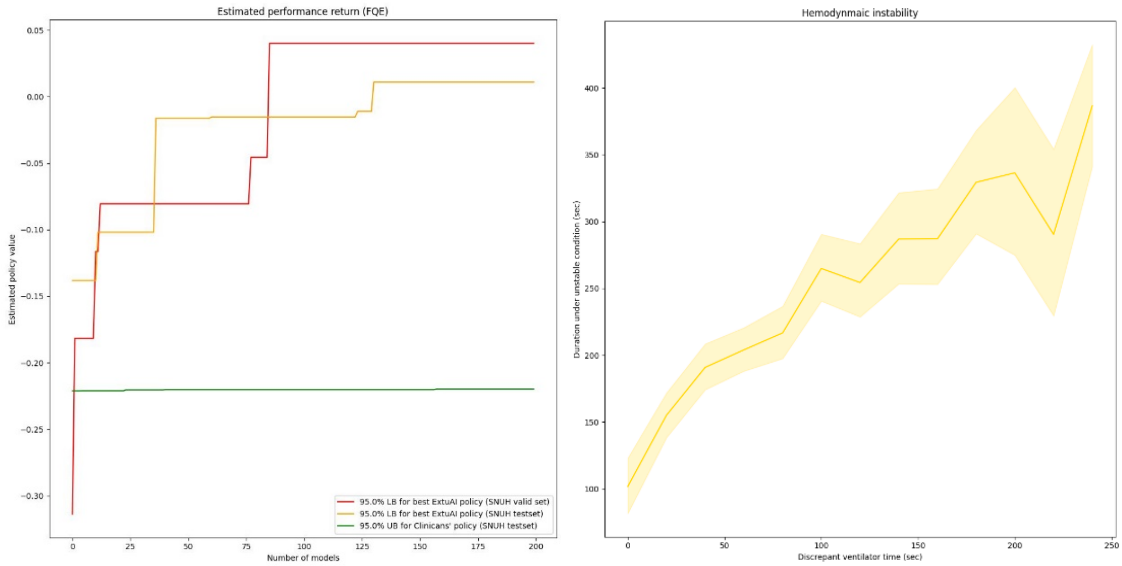
Abstract Content

Since recovery from general anesthesia is dynamic, controlling ventilation at the optimal timing is challenging, reflecting the patient's spontaneous breathing should be sufficiently restored while hemodynamic instability should be minimized. From data from 15,842 surgical cases, we developed a reinforcement learning (RL) model, Smart-Vent, to suggest the optimal timing of ventilation control during emergence and externally validated the model in a different dataset. We adopted conservative-Q learning to optimize mechanical ventilation for patients with inconsistent responses [1]. We evaluated the discrepancy between the model's policy and clinician's policy. The estimated performance return of the Smart-Vent's policy was significantly better than the clinicians' policy. Hemodynamic instability and increased peak inspiratory pressure occurred more frequently when the discrepancy between the policies was significant. PIP and spontaneous breathing were the two most influential factors for ventilation control. In summary, the Smart-Vent can suggest the optimal timing of ventilation control in surgical patients during emergence in the operating room.



References: [1] Kumar, A., Zhou, A., Tucker, G. & Levine, S. Conservative Q-Learning for Offline Reinforcement Learning. Arxiv (2020) doi:10.48550/arxiv.2006.04779.