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SPATIO-TEMPORAL VISUALIZATION OF BIG DATA ANALYTICS DURING SPACEFLIGHT

Abstract

Technological advancements continue to extend the capacity of clinical decision support aboard the spacecraft, while improve physiological monitoring practices, presenting new opportunities for clinical discovery and early detection monitoring. Preservation of health and performance of astronauts remains paramount for the success of the mission and safety of the entire crew. Increasing scientific evidence demonstrates effectiveness of the use of big data analytics to support provision of medical care in space, providing the necessary tools for development of an autonomous comprehensive clinical decision support system. In prior work, the big data analytics framework, known as the Artemis, was presented, demonstrating its capacity to analyse large volumes of physiological data streams, which could be effectively combined with other relevant clinical and environmental data. Preliminary studies focused on re-engineering of algorithms assessing adaption to enable them to run within an Online Analytics component of the Artemis platform, to assess the level of wellness and tolerance of adaptation mechanisms to the conditions of spaceflight, in real-time. Conventional data visualisation methods limited representation of data to 2-d scatter graphs, which depicted the dynamicity of functional states, yet provided no task-specific or temporal detail, hindering the ability to understand the trajectory of changes that occur in response to changing physiological and environmental conditions. The ability of the Artemis platform to support real-time analytics has necessitated exploration of new data visualization techniques, to enable accurate representation of the functional state of the body, while depicting the trajectory of movement, signifying deviation from the norm and the risk of development of pathology. A spatio-temporal visualization technique for representation of big data analytics has been explored and demonstrates great potential to depict task-specific and time-specific dynamics of the functional health states, while improving the adaption knowledge for end-users, aiding results interpretation. The use of spatio-temporal data visualization technique has been approbated during terrestrial simulation experiments and will be incorporated into an overarching Russian-Canadian space experiment "Cosmocard 2018", focusing on modernization of software systems for use on the International Space Station.