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Electroencephalography-Based Intention Recognition and Consensus Assessment during Emergency Response

Authors : Siyao Zhu, Yifang Xu

Abstract : After natural and man-made disasters, robots can bypass the danger, expedite the search, and acquire unprecedented situational awareness to design rescue plans. The hands-free requirement from the first responders excludes the use of tedious manual control and operation. In unknown, unstructured, and obstructed environments, natural-language-based supervision is not amenable for first responders to formulate, and is difficult for robots to understand. Brain-computer interface is a promising option to overcome the limitations. This study aims to test the feasibility of using electroencephalography (EEG) signals to decode human intentions and detect the level of consensus on robot-provided information. EEG signals were classified using machine-learning and deep-learning methods to discriminate search intentions and agreement perceptions. The results show that the average classification accuracy for intention recognition and consensus assessment is 67% and 72%, respectively, proving the potential of incorporating recognizable users' bioelectrical responses into advanced robot-assisted systems for emergency response.

Keywords : consensus assessment, electroencephalogram, emergency response, human-robot collaboration, intention recognition, search and rescue
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