Design of a Relative Body-Movement-Based Omnidirectional CPR Compression Depth Analysis Framework

Yim Somin
Artificial Intelligence Convergence Engineering, Kangnam University, Republic of Korea

Joo Kilhong
Department of Computer Education, Gyeongin National University of Education, Republic of Korea

Seo Jihoon
Artificial Intelligence Convergence Engineering, Kangnam University, Republic of Korea

Abstract

Cardiopulmonary resuscitation (CPR) is a critical emergency medical procedure that directly affects the survival rate of patients experiencing cardiac arrest. International guidelines emphasize maintaining an appropriate compression depth and a consistent rhythm during CPR. Accordingly, CPR education requires not only verification of task execution but also objective evaluation of compression depth accuracy and repetitive consistency. Conventional CPR training and assessment systems largely rely on sensor-embedded mannequins or wearable sensing devices. Although these approaches can provide precise measurements, they suffer from limited scalability in real educational settings due to equipment constraints, cost, and operational complexity. Recently, non-contact motion recognition techniques have been explored for CPR analysis; however, many existing approaches assume fixed camera viewpoints or predefined observation directions, making them vulnerable to rescuer position changes and orientation variations. To address these limitations, this study proposes an omnidirectional CPR compression depth analysis framework based on relative body movements. The proposed framework models CPR compression actions using the relative motion relationships between the rescuer's upper body and arms, without relying on absolute coordinate systems or fixed camera orientations. This design enables robust compression depth analysis under varying rescuer positions and camera viewpoints. This paper focuses on the design rationale, processing pipeline, and educational applicability of the proposed analysis framework. The proposed approach provides a structural basis for interpreting compression stability, repetitive consistency, and posture maintenance in CPR training environments, and demonstrates potential for extension toward non-contact CPR educational assessment systems.

Keywords

CPR education, compression depth analysis, relative body movement, non-contact assessment.