Universal CPR AI Assistance Response Engine (U-CARE): Development and Evaluation

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Each year, over 350,000 people in the United States experience out-of-hospital cardiac arrest, and nearly 90% do not survive. Early cardiopulmonary resuscitation (CPR) can triple survival rates. Unfortunately, bystander CPR is performed correctly in fewer than 40% of cases, with three major problems persisting: lack of widespread training, decision paralysis, and recall bias in emergency moments. U-CARE is an integrated, multilingual, low-cost smartphone-based system that can serve as a universal CPR guide in training environments and emergency situations, and was evaluated using a comprehensive multimodal evaluation framework. Inspired by a mid-air cardiac arrest, U-CARE comprises an adaptive large language model (LLM)-powered verbal guidance system that provides objective next-best steps and real-time feedback in multiple languages, coupled with a computer vision model that continuously assesses CPR technique and compression rate, depth, and hand placement in emergency scenarios. It additionally includes a library of CPR education material and a text-based guidance system for training scenarios. By providing direct guidance in real-time scenarios, U-CARE mitigates the major problems that persist in bystander CPR administration. U-CARE was evaluated not only with traditional Computer Vision accuracy and performance comparisons against ground truth data, but also with system and verbal usability scores, and with the quality of model responses using HumanELY and MedHELM. Future work entails further validating U-CARE in clinical situations, including offline use in remote, in-flight, and maritime settings. Overall, U-CARE has the potential to enable universal access to CPR training and real-time guidance for cardiac arrest, saving countless lives.

Awards Won:
Third Award of $1,200
K. Soumyanath Memorial Award: First Award of $3,000
K. Soumyanath Memorial Award: $1,000 will be awarded to the winner's school.