Development of Heart Rate Detection Algorithm for Doppler Ultrasound Recordings

In recent decades, technological developments in assistive breathing devices and prompt advertisements of recreational underwater activities have led to an increase in scuba diving popularity around the world. With minimal experience and limited awareness about the dangers of voyaging in a foreign environment, most of the divers, especially amateurs, are exposed to various factors that lead to serious health issues where bubbles develop in the bloodstream. Bubble grading systems such as the Spencer's scale and Kisman-Masurel code have been used to quantify the severity of post-dive bubbles in order to help health professionals find the best mode of intervention for treating any resulting illness related to decompression sickness. However, it is difficult to implement these systems efficiently since these grading systems require aural experts to be present on-site in order to interpret the data collected. Various automated technologies such as the EMD-based algorithm have been developed to streamline the process of bubble detection which would allow for standardized, continuous, real-time decompression stress assessment and later optimize diving safety procedures. Yet, these systems still have difficult time generalizing data from different sources. Therefore, validation against exact bubble numbers and temporal locations in the recordings are desirable to better evaluate accuracy. To convert this information back to VGE grading, the precise locations of the start and end time of each cardiac cycle are needed. So far, our research has worked on developing a heart rate algorithm in Doppler Ultrasound recordings to set the stage for assessing venous gas emboli risk.