Automatic behaviour recognition using wearable sensors for improving horse health and welfare

Kai Liu, City University of Hong Kong, HKSAR, China
(Pump-prime Funding: HKD 294,987)

Over the past decades, the advances of digital technologies, such as digital cameras, microphones, and wearable devices (e.g., smartwatch, smart band, GPS chip, RFID tag), has availed the use of automation and precision tools in behaviour monitoring and health assessment of animals. Among these technologies, various wearable devices including GPS, RFID, and motion sensors, with the characteristics of lightweight, small size, low power consumption, high reliability, good stability, and easy integration, have become increasingly popular in animal monitoring applications. With the aid of multiple wearable motion sensors and the use of machine learning and the emerging deep learning in recent years, activity recognition has been studied extensively on farm animal species including cattle, sheep, goats, and pigs, and on application scenarios such as lameness detection, estrous and farrowing prediction, and spatio-temporal behaviour pattern recognition. However, studies on equines with wearable sensors are relatively rare and to a large extent have been restricted to gait activity analysis (e.g., walk, trot, canter) in equestrian sports. Indeed, automatic equine behaviour recognition enables caretakers to monitor behavioral variations of equines continuously and remotely over time, provides a rich insight about equine health and welfare, and contributes to improved equine husbandry and management and reduced workloads and costs in veterinary clinics. Therefore, it is of significant importance to investigate and develop an automatic behaviour recognition system for equines.

In this project, with using the state-of-the-art deep learning algorithms, the main aim is to develop a wearable motion sensor-based automatic behaviour recognition and monitoring system for racehorses housed in stables. This project has three specific objectives: 1) to create a large-scale, high-quality, and well-annotated open dataset containing time-series motion data and behaviours of racehorses in stables for behaviour recognition advancement; 2) to assess the performance of state-of-the-art deep learning methods in behaviour recognition of racehorses using wearable motion sensors and develop a deep learning framework that enables robust, rapid, and accurate behaviour recognition of racehorses in stables; and 3) to present a proof-of-concept demonstration of a mobile application for monitoring the behaviour (e.g., eating, drinking, lying, standing, walking, headshaking, scratch biting, rolling, shaking, and rubbing) and health conditions (e.g., lameness) of racehorses in stables. The project will be conducted at the horse stables of Lo Wu Saddle Club and Hong Kong Jockey Club. 20 retired racehorses housed in stables will be used for the project and motion data will be collected by attaching wearable sensors to the mane and halter of each horse, respectively. By the completion of this project, we expect to provide a viable solution to the equine industry for improved horse husbandry and management, therefore benefit the equine industry by improving horse health and welfare.