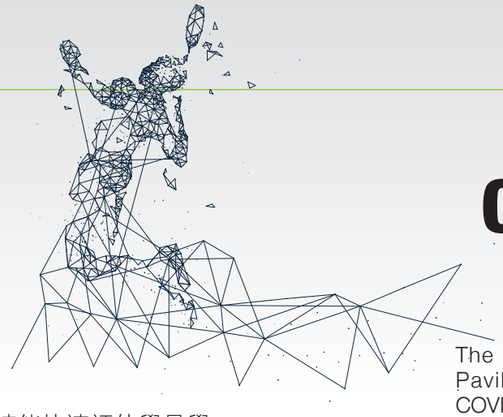
CoachAI 團隊
打造智慧羽球「教練盒子」



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一年一度的科技盛會「臺灣創新技術博覽會——未來科技館」在嚴峻疫情考驗下圓滿落幕，透過線上與實體雙軌並行模式，展出高達 350 項前瞻技術應用成果。本院資訊科學與工程研究所易志偉教授所組建的「CoachAI：金準羽球團隊」，透過結合電腦視覺、深度學習等技術，所開發的羽球擊球動作分析輔助工具「教練盒子」亦在超過 500 件申請案中突破重圍，經科技部評選為「未來科技獎」得主，於實體博覽會中大放異采，獲得眾多媒體報導。

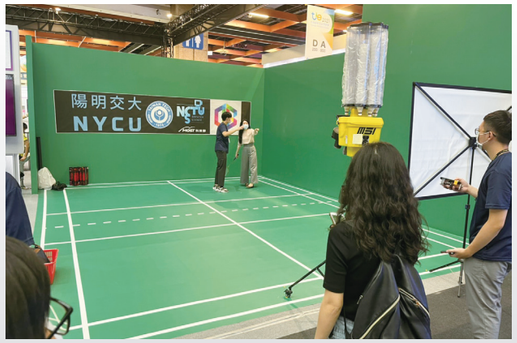
「教練盒子」的概念發想，除了源於易志偉教授自身對羽球運動的熱忱和深度觀察外，主要技術應用是衍生自科技部「精準運科」專案的「CoachAI：金準羽球」計畫成果，結合用於偵測擊球動作和分析擊球點位、姿勢是否正確的電腦視覺、深度學習、機器學習技術，搭配上大數據分析，以及物聯網、穿戴式應用、自動化設備等產業趨勢技術。以上述整合技術為核心，開發出比賽拍拍情蒐系統、CoachAI 技戰術分析與視覺化系統、智慧球拍及智聯發球機等科技輔助工具。希望能藉由將運動科學和前瞻科技技術結合，提供運動員專業羽球訓練輔助的同時，推廣羽球運動以促進運動人口增長，進一步提升羽球產業競爭力。

「教練盒子」的具體應用方式可搭配上羽球發球機，當學員在教練指引下完成一系列擊球動作，攝影機將記錄下擊球姿態、揮拍動作、羽球球速及擊球落點等資訊，透過電腦影像處理及深度學習等技術轉化為可視化的 3D 建模影像，同時以擴增實境的方式加註各項數據。透過動作數據與影像的分析結果，使教練能快速評估學員學習狀況，覺察擊球姿勢、控球穩定度等顯在和潛在的問題，作為兩者有效溝通的媒介，精簡並精實訓練曲線，大幅提升學習效率與成效。

具備前國手身份的王志全教練在校隊暑期集訓後，便以此輔助工具對集訓成果進行評估。用羽球發球機餵球讓學員進行十次殺球，並以「教練盒子」錄影，截取殺球時的影像資訊進行分析。分析結果提供可從各種角度觀察的殺球動作 3D 建模、學員關節點位置、肢體角度、殺球球速及殺球落點等數據，從中可看出學員動作正確一致程度為何，及控球穩定性是否達標。可見「教練盒子」不單可用以評估學員的球力、學習進度和各項優劣勢，亦可做為教練對學員授課說明的具體素材。

「教練盒子」目前將目標市場鎖定於教學領域，除用以推廣學校的體育課程外，亦可作為校隊、夏令營等訓練導向的社團和活動的教學輔具，提供雙向師生溝通，高效達成學習成效。此外，「教練盒子」亦可作為球力分級檢測工具，用以提供業餘學員因材施教教程和專業選手培養篩選。同時，待未來虛擬實境與擴增實境技術發展成熟，與之結合將能跨足電競娛樂市場。

本院易志偉教授與其團隊成員，透過純熟技術應用與深入觀察，將所學與所愛相結合，放眼未來，以產學合作模式開發出「教練盒子」分析輔助工具，將為羽球運動推廣、選手培養帶來創新高效的革新。



CoachAI Creates "CoachBox" for Smart Badminton Training

The 2021 “Taiwan Innotech Expo - Future Tech Pavilion” came to a successful end during the COVID-19 pandemic. The Expo integrated both virtual and physical environments to present up to 350 innovative solutions online and offline. The "CoachAI: Precision Badminton Team" advised by Dr. Chih-Wei Yi, Professor of Institute of Computer Science and Engineering from NYCU, developed a badminton stroke analysis auxiliary tool "CoachBox" with the combination of computer vision, deep learning, and other technologies. “CoachBox”, the winner of the "Future Technology Award", was selected from more than 500 applications by the Ministry of Science and Technology as well as won acclaim in physical exhibition and attracted considerable attention in media reports.

Apart from the concept of "CoachBox" originating from Professor Chih-Wei Yi’s enthusiasm and in-depth observation in badminton, the key technology is derived from the "CoachAI" project of the Ministry of Science and Technology. The integrated technologies of "CoachBox", including computer vision, deep learning, machine learning, IoT, wearable applications, automation equipment, and big data, are used for hitting action detection and posture analysis. With the core technology mentioned above, diverse auxiliary tools have been developed, such as badminton game analysis system, CoachAI tactical analysis and data visualization, smart racket and intelligent badminton shooting machine. As the integration of sports science and emerging technology provides athletes with professional badminton training assistance, we hoped that promoting playing badminton would increase the sports population to further enhance the competitiveness of the badminton industry.

One application scenario of "CoachBox" is to work with a badminton shooting machine. When a player completes a series of hitting actions under the guidance of a coach, the player’s actions such as hitting posture, swing motion, shuttlecock speed, and end point of shuttlecock trajectory will be recorded. While a visual 3D modeling image is created with computer vision processing and deep learning, various related information is overlaid in augmented reality. Through activity data analysis and image analysis, coaches can quickly assess players’ learning performance, and perceive any explicit and potential problems such as hitting posture and stroke performance to greatly improve learning efficiency and effectiveness.

Coach Chih-Chuan Wang, who was a former member of Chinese Taipei national badminton team, used this auxiliary tool to analyze the data collected from the school team's summer training camp. Each player performed 10 smash strokes with a badminton serving machine. He used "CoachBox" to do video recording and analyze the motion of each player during the smash stroke. The system built the 3D model of the smash stroke that supported different viewing angles associated with the player’s data such as joint position, angle of the limbs, smash speed, and placement for a smash shot. Simultaneously, it can be used to examine movement accuracy and stability as well as stroke performance of each player. Therefore, "CoachBox" can be used for not only each player’s evaluation such as performance, learning progress, advantages and disadvantages, but also a medium of coach's instructions to the players.

Currently, the target market of "CoachBox" is in the education sector. In addition to the promotion of physical education in schools, it can be used as a teaching aid for training-oriented clubs and activities such as school teams and summer camps to provide two-way communication between instructors and students to achieve efficient and effective learning. In addition, "CoachBox", as a performance evaluation tool, helps amateur players choose the proper courses in accordance with their aptitude and facilitate the training plan design and screening process for professional players. At the same time, when virtual reality and augmented reality technologies mature in the future, the further integration will expand to the eSports market.

With proficient technical application experience and in-depth observation, Professor Chih-Wei Yi and his team exploit their knowledge with enthusiasm and look towards the future to create a badminton stroke analysis auxiliary tool "CoachBox" in industry-academia collaboration. We all expected that "CoachBox" would bring an innovative revolution to badminton promotion and player training.