**基於模板比對與粒子濾波器之物件追蹤**

***Object tracking based on template matching and particle filter***

**摘要**

視覺追蹤在許多領域中扮演著重要的腳色，舉凡安全監控系統、人機互動、交通監控等應用皆屬於視覺追蹤的範疇。近年來，視覺追蹤的應用層面持續擴展中，即使相關技術不斷改善，仍然有許多具有挑戰性的問題尚待改善，如外觀急遽變化、光線變化、遮蔽、及時性、物件縮放、複雜場景、相似外表干擾等。

在此篇研究中，我們提出了一套基於模板匹配與粒子濾波器之物件追蹤方法來解決上述提及的挑戰。此方法主要包含三個部分:特徵擷取、模板比對以及粒子加權。除了如急遽外觀變化或光線變化之某些挑戰，透過模板比對可以成功地追蹤物件，並藉此提升效能；由於SURF特徵具有光線變化、縮放及旋轉不變性，藉由SURF的這些特性可以補償模板比對的缺點，因此SURF結合粒子濾波器可以有效地進行失敗追蹤的錯誤修復。

此外我們選擇了幾部具有挑戰性的影片來評估我們的追蹤方法。藉由實驗結果展示方法的效率性與穩健性，透過與其他方法比較也證明了我們的方法在複雜的挑戰下具有一定的競爭力。

關鍵字:物件追蹤、模板比對、粒子濾波器、SURF

**Abstract**

Visual tracking plays an important role in many applications such as intelligent video surveillance, human-computer interaction, and traffic monitoring. In recent years, even though many approaches have been successfully made on this topic, it is still a very challenging problem such as large appearance changes, illumination changes, occlusion, real-time, scale variation, scene change, cluttered background, and similar appearance.

In this research, we propose an object tracking using template matching and particle filter to solve some issues in visual tracking. This method contains three major parts: feature extraction, template matching and particles weighting. Except for some challenging sequences such as sudden appearance change or illumination change of object, the object can be successfully tracked by template matching. To compensate for template matching, particle filter with Speeded Up Robust Features (SURF) is used in the failed tracking.

Experimental results with challenging video sequences are presented to demonstrate the effectiveness and robustness of the proposed method. The comparative performance of the proposed method with other existing techniques is shown as well.

Keywords: object tracking; template matching; particle filter; SURF