

# Real-time ‘Actor-Critic’ Tracking

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**Abstract.** In this work, we propose a novel tracking algorithm with real-time performance based on the ‘Actor-Critic’ framework. This framework consists of two major components: ‘Actor’ and ‘Critic’. The ‘Actor’ model aims to infer the optimal choice in a continuous action space, which directly makes the tracker move the bounding box to the object’s location in the current frame. For offline training, the ‘Critic’ model is introduced to form a ‘Actor-Critic’ framework with reinforcement learning and outputs a Q-value to guide the learning process of both ‘Actor’ and ‘Critic’ deep networks. Then, we modify the original deep deterministic policy gradient algorithm to effectively train our ‘Actor-Critic’ model for the tracking task. For online tracking, the ‘Actor’ model provides a dynamic search strategy to locate the tracked object efficiently and the ‘Critic’ model acts as a verification module to make our tracker more robust. To the best of our knowledge, this work is the first attempt to exploit the continuous action and ‘Actor-Critic’ framework for visual tracking. Extensive experimental results on popular benchmarks demonstrate that the proposed tracker performs favorably against many state-of-the-art methods, with real-time performance.

**Keywords:** Visual tracking, Real-time tracking, Reinforcement learning

## 1 Introduction

Visual tracking aims to locate the target specified in the initial frame, which has many realistic applications such as video surveillance, augment reality and behavior analysis. In spite of many efforts having been done [1–3], it is still a challenge task due to many factors such as deformation, illumination change, rotation, occlusion, to name a few.

Deep-learning-based tracking algorithms have significantly improved the tracking performance in recent years [4–7]. The pre-trained convolutional neural networks (e.g., AlexNet, VGG-16 and VGG-M) are usually adopted to obtain rich feature representation for robust tracking. Among these methods, the MDNet tracker [5] achieves top-ranked performance in popular benchmarks (such as OTB-100 [8] and VOT2015 [9]).



































