

# Dual-Agent Deep Reinforcement Learning for Deformable Face Tracking

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**Abstract.** In this paper, we propose a dual-agent deep reinforcement learning (DADRL) method for deformable face tracking, which generates bounding boxes and detects facial landmarks interactively from face videos. Most existing deformable face tracking methods learn models for these two tasks individually, and perform these two procedures subsequently during the testing phase, which ignore the intrinsic connections of these two tasks. Motivated by the fact that the performance of facial landmark detection depends heavily on the accuracy of the generated bounding boxes, we exploit the interactions of these two tasks in probabilistic manner by following a Bayesian model and propose a unified framework for simultaneous bounding box tracking and landmark detection. By formulating it as a Markov decision process, we define two agents to exploit the relationships and pass messages via an adaptive sequence of actions under a deep reinforcement learning framework to iteratively adjust the positions of the bounding boxes and facial landmarks. Our proposed DADRL achieves performance improvements over the state-of-the-art deformable face tracking methods on the most challenging category of the 300-VW dataset.

**Keywords:** Deformable face tracking; Reinforcement learning; Deep learning

## 1 Introduction

Deformable face tracking has received considerable attention in computer vision recently with numerous applications such as human computer interaction, facial expression analysis, and person identification. The aim of deformable face tracking is to detect the key points around facial components and facial contours across all frames of a given face video. It is a challenging problem in practice because face samples are usually captured in unconstrained conditions, where large poses, heavy occlusions, illumination variations and motion artifacts usually occur.

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