PROGRESS REPORT: Skateboard Trick Recognition through an AI-based Approach

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Contents

Abstract

This is a test

Introduction

Skateboarding dates back to the 1940s when handmade skateboards first appeared [1]. It has since developed into a worldwide phenomenon, with its popularity skyrocketing, after gaining recognition as an official sport in the 2020 Tokyo Olympics [2]. Skateboarding comprises the dynamic activities of riding a skateboard and skillfully performing a repertoire of tricks, manifesting as a popular and exhilarating “extreme sport”.

This dynamic sport encompasses various disciplines and styles of riding, each of them offering unique challenges for skateboarders to explore. Two of the most prominent styles are “vert” and “Street”, vert skateboarding revolves around riding on specialised obstacles, namely, half-pipes and ramps, emphasising areal manoeuvres. Whilst, street skateboarding transpires in urban environments, utilising a diverse array of obstacles that can be found outdoors, including stairs, rails, ledges, gaps or flat ground for skaters to showcase their creativity. [3].

Skateboard tricks are the heart and soul of skateboarding. These tricks originate from the dynamic orchestration of rotations and revolutions of a skateboard along various axes emphasising the significance of precise placement of a skateboarder’s feet to initiate these rotations. These tricks serve as excellent examples of how the skateboarder’s body and skateboard work in perfect harmony. Some common skateboard tricks include:

- **Ollie:** One of the first tricks beginners learn. Where the skateboarder pops the tail of the board while sliding their foot across the board, causing the board to level out in the air, used to jump over obstacles.
- **Kickflip:** A trick where the skateboarder flips the board under their feet while jumping, making it spin 360°around the x-axis.
- **360 kickflip:** A combination of a kickflip and a 360°board rotation around the y-axis.

Skateboarders continually innovate and come up with new trick combinations, contributing to the dynamic nature of the sport.

0.1 Problem Specification

The current lack of a digital and objective mechanism for identifying skateboard tricks during competitions and practice sessions is a significant issue. Judges in live-streamed skateboarding competitions currently announce tricks verbally, without the support of a digital overlay to display the performed trick for the viewers. This reliance on subjective judgement can lead to scoring disparities and conflicts, weakening competition fairness. Furthermore,this absence of an objective method, obstructs skaters' ability to receive real-time feedback, which could be beneficial for skill development. The advent of an AI-based system that delivers a dependable and efficient method of trick recognition will both revolutionise this aspect and contribute to the lack of study in this area.

General Aims and Objectives

The aims and objectives are to design and develop a dependable Artificial Intelligence (AI) model that can identify various skateboard tricks directly from videos. An initial focus will be placed on the recognition three different tricks namely, kickflips, ollies and shuvits. To reach this goal the appropriate ML techniques must be utilised to overcome basic computer vision challenges, such as varying camera angles, lighting conditions and the fast-paced nature of skateboard tricks. By addressing these challenges, this project aims to establish a usable tool that skateboarders, coaches, and skateboard competitions can use.

0.1.1 List of deliverables

- The
- A trained model with favourable accuracy
- The results of the experiments and their visualisations

0.2 Brief overview of the literature

Recent advancements in the ability to recognise human actions in videos have significantly impacted various fields, ranging from the medical sector [4], to security monitoring [5]. Particularly noteworthy is its application in the development of an AI-based skateboard trick classifier, an area that has seen limited research.

In this emergent field,leveraging the techniques of activity recognition from video has led to two primary techniques among researchers. The first technique involves utilising signals obtained from skateboard-mounted accelerometers or signals that have been artificially generated based on findings of prior studies as sample data. These signals are then fed into a study-dependent model for classification, as outlined in [6] and [7]. The second approach employs computer vision techniques,leveraging video footage of skateboard tricks to train and refine models for accurate trick identification, as depicted by the studies [8] and [9].

0.2.1 Accelerometry approach

0.2.2 Computer Vision approach

The paper [8] leverages a custom data set, comprising videos capturing the execution of five distinct skateboard tricks, each attempted five times. Each video spans a duration of two to three seconds, yielding a total of 750 images by extracting 30 frames per video. This study made use of data augmentation techniques to further expand their dataset. Consequently, they introduced an additional 2,250 images, achieving a total of 3,000 images in their data set. On the other hand, Chen [9] compiled a comprehensive data set by collecting videos from multiple platforms including YouTube, Twitter and Instagram. Furthermore, the researcher trained the model using 15 fundamental tricks commonly observed in competitive settings. They collected 50 videos per trick, summing up to a total number of 750 videos. Of these, 45 videos per trick were allocated for training, and the remaining 5 were reserved for validation.

When dealing with a relatively limited dataset, data augmentation techniques, such as flipping, rotating, scaling and colour manipulation might be used. Such techniques not only enhance the size of the original dataset but also lower the likelihood of the model overfitting [10]. The study [8] utilises three rotation augmentation techniques: horizontal rotation, positive 90°rotation and negative 90°rotation.

Chen,[9]

0.3 Planned methodologies

0.4 Project timeline

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