

Abstract

Low cost and personalized highlight generation during cycling races

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Abstract: Our smart Sensor-driven Tripod focuses on supplying a unified sensor / video solution to capture personalized highlights for participants of cycling races. It does so by capturing video and sensor data simultaneously. The clipping mechanism is driven by sensing nearby signals of ANT+ capable devices. The hardware is accompanied by an online interface where participants can manage their sensors and discover for which events they can generate clips. The device has been deployed and tested in two amateur level cycling races in which it provided clips for all but one of the registered participants without interruptions.

Keywords: ANT+; sensors; video enrichment; fan engagement

1. Introduction

Making races more engaging and attractive for spectators and athletes is one of the main goals of race organizers. It not only draws more attention to the event, but can also be offered as an incentive to participate in the particular race. Since the rise of social media it is clear that short form video content is an excellent way to share highlights of your race with family, friends or the online community. Normally, this requires an extensive broadcasting setup, which is not always feasible due to the nature of the course (inaccessible regions, too many POIs, limited budget). In order to create personalized clips from this large amount of raw video footage, race organizers need to perform a lot of 'cut & paste activities',



Figure 1. Hardware setup of a STRADA pole.

identify riders, and synchronize the different data streams. Mostly, a lot of time is lost before they can extract meaningful fragments, which provides no added value for fans wanting updates while waiting for the next passage.

2. Materials and Methods

Cyclists of various levels use a mixed collection of sensors. These are primarily

used to measure performance but the broadcasted signals from these devices can be used to sense when a rider is near the STRADA pole as well [1]. Capturing data in real-time is possible with an ANT+ antenna or a WASP device [2]. Each ANT+ device has an identifier (ID) that is used to identify the origin of the data and hence the person wearing the device. ANT+ does not require pairing and is, therefore, both easy to deploy and non-invasive.

The STRADA pole is a modular device built around a Raspberry PI model 4B (RPI) and has an ANT+ antenna connected to it. Video footage is collected using the RPI Camera Module V3. The different components are encased and mounted on top of a tripod, which can be seen in Figure 1. Once activated, the RPI captures sensor signals and video footage simultaneously. One device costs around € 160 to assemble.

3. Results

Two STRADA poles were deployed during two consecutive cycling races with a closed loop parkour. Both poles, stationed at the end of a steep hill, captured a combined 40668 values from 447 unique sensors. Before the races, riders were able to register their sensors on our platform. This allows us to know which sensors are coupled to a single transponder. Knowing this information, we can cross-reference the official race results to check if a rider finished / abandoned / did not start, and calculate how many clips should've been created based on their lap count.

From the 39 registered riders, we filtered out those who did not start or provided an invalid ANT+ ID for the HR monitor (most common). Except for one of the remaining 26 participants, we could provide all riders with clips of their race. The singular exception may be caused by a faulty or dead sensor, spelling mistake, or not picked up by the antennas.

With a direct line of sight, the ANT+ antenna can pick up signals from a Garmin

chest monitor from approximately 75 meters away. This implies that clips will generally be longer when riding solo or in smaller groups since there is much less occlusion compared to someone in the middle of a peloton. Other factors such as sensor position and transmission power also impact clip duration. As a solution, we've implemented dynamic clip extension methods that alter clip duration based on sensor type and camera orientation (if rider and camera are facing opposite, you're likely already in frame before the sensor is picked up).

4. Discussion

STRADA is a data-driven smart camera set-up aimed at generating short, personalized stories of athletes that can be used in training, sports media coverage or shared on social media platforms. This new fully automatic and autonomous system can be used to ease the data collection and processing during training and competition.

5. Practical Applications.

The proposed solution is primarily focussed on improving the experience of spectators. Using the generated clips, a spectator can view short videos and find out in which group a rider is located, if he or she is performing on important climbs, or just provide some entertainment while waiting for the next passage. This prevents the need to continuously travel to different POIs to capture some action of their preferred rider(s). The collected sensor values are a byproduct of the clipping algorithm but can also be used to estimate the difficulty (or rider effort) on course segments. During the tests there were passages with a peloton of 70+ riders with commonly one to three sensors per bike. The recorded data sometimes shows gaps of 2-3 seconds between readings (normal operating range is 1-3 Hz), some of which are caused by occlusion, others by the hardware limit of the antenna. Applying the same procedure to

smaller groups (i.e. breakaway or chasers) does not have this problem.

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References

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