Project Outline Bike-fitting

Nikon Muigg, Felix Raffl

Motivation and Purpose

The correct bike fit is essential for every cyclist, whether a casual rider or a professional athlete. A well-fitted bike can enhance comfort, optimize performance, and prevent non-traumatic injuries. However, professional bike-fitting services are often expensive and inaccessible to many riders. Especially beginners and casual riders don't want to spend a fortune, just to ride safe and comfortable. Therefore, many casual riders think of bike-fitting, as a service for professionals.

With advancements in video joint position estimation, especially tools like OpenPose, it is possible estimate the angles between joints in real-time. This opens the possibility to developing a bike-fitting app that can provide users immediate feedback on the cycling posture. By making use of a camera and pose detection technology, cyclists can receive bike-fitting insights from home or training space.

The motivation behind this app is to make bike-fitting affordable, accessible, and convenient. Cyclists should have the ability to optimize their bike setup regardless of their location or budget.

Methodology

The cycling posture is determined by the angles of the body in the sagittal plane, which is crucial for both performance optimization and injury prevention. To assess this, the system focuses on two critical positions of the legs: the highest and lowest points in relation to the crank during a pedal cycle. These positions correspond to the top of the pedal stroke (maximum knee flexion) and the bottom of the pedal stroke (maximum knee extension).

To ensure accurate analysis, the system uses an algorithm to detect the frame when the cyclist reaches these two extremes in a video recorded by the user. This involves capturing frames in which the leg is at the highest point (when the pedal is closest to the body) and the lowest point (when the pedal is furthest from the body).

To achieve this, the system uses a joint estimation tool, such as OpenPose, which can identify body joints in video frames. Using this tool, the system tracks the cyclist's joints, including the hip, knee, and ankle, to calculate following relevant joint angles in the two important frames:

1. Knee Angle: Measured between the thigh (femur) and the lower leg (tibia).
2. Hip Angle: Measured between the torso and the thigh. This angle affects comfort and power generation.

3. Ankle Angle: Measured between the foot and the lower leg. This angle helps ensure proper foot positioning during cycling, which can influence power transfer and reduce strain on the Achilles tendon.

In addition to analysing the cyclist's posture, the system provides real-time recommendations on adjustments to seat position and handlebar position. This allows the cyclist to change the bike setup and re-run the process until the bike fits properly.