Calculating mountain bike suspension settings using image analysis

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Introduction

The suspension on a mountain bike plays a vital part in the rider's performance, with some suspension units costing upwards of £1000 it is vital that they are setup correctly as incorrect setup can damage the suspension or cause injury.

The vital setting is Sag. This is how much the suspension sits into its travel when the rider is on the bike. It is 20% - 30% of the travel and adjusted by changing the spring of the shock. This requires measuring the shock and adjusting accordingly.

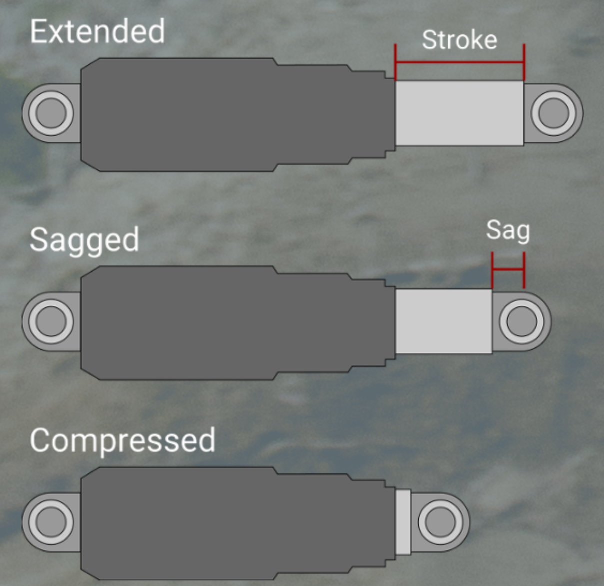

Fig 1: Diagram of shock states

The purpose of this project was to produce a application which uses image analysis to carry out the measurements and calculations to produce a sag setting. Intended for use in a mobile app, this would make it easier for beginner and intermediate riders to correctly setup their suspension.

Method

The application was written in Python because it is more suitable for writing scripts and small applications. This is due to it reading more like a book than code. The imaging library is also simple to access and use in Python.

OpenCV is an open source imaging library for C, C++, Java, and Python. It provides access to image processing and analysis techniques such as edge detection, contour finding, and more. OpenCV was chose as it is free to use, well tested, and well documented.

Results

Using two images of the shock set at known pressures first a reference point of known size is found. This produces a pixels per millimetre metric for use when measuring in the image. The reference is found by masking red objects from the image and drawing a bounding circle round the reference.

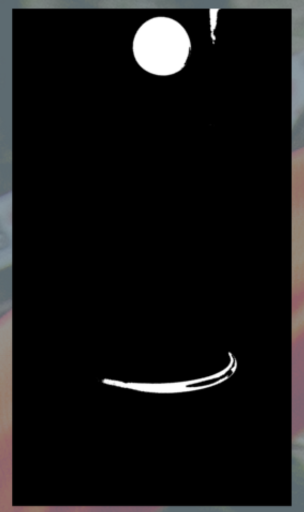

Fig 2: Image Mask

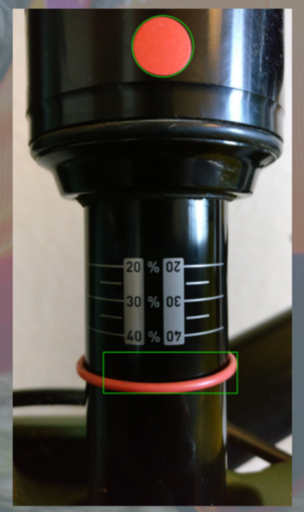

Fig 3: Reference objects

Edge detection is then carried out on the original image to find vertical lines between the top of the stanchion and the marking o-ring. The distance between the top and bottom points in these lines is the measurement in pixels. This measurement can be converted to mm using the px per mm metric.

Fig 4: Edge detection

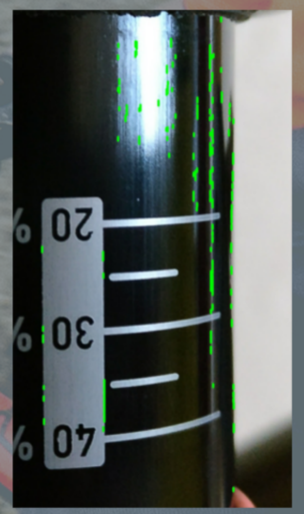

Fig 5: Measurement lines

This process is carried out on both images and then the values are virtually plotted. A line can be drawn through these two points and using the function of this line and desired sag amount, a suitable pressure for the rider can be produced.

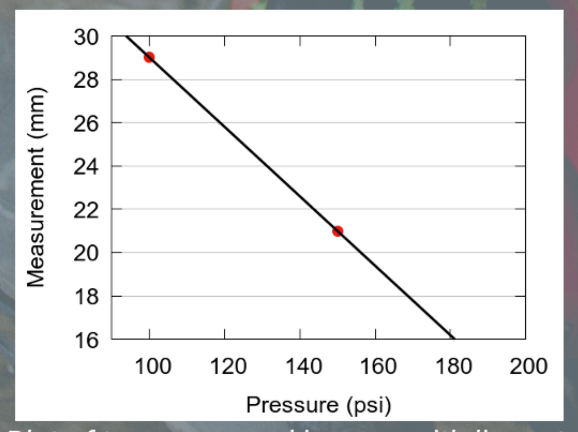

Fig 6: Plot of two measured images with linear trendline

Conclusion

The application produced by this project is capable of calculating a sag setting from two images and two numbers. This makes it much simpler for riders to ensure their suspension is correctly set-up before riding. This is unlike other products as it is standalone and can work with any air shock.

Future Work

Future work for this project includes implementation into a mobile application by either including the current work via a wrapper or using the produced algorithms and rewriting them in the native language. This would move the project closer to being a marketable product. Inclusion of other suggested settings would also be useful. As well as sag there are up to 5 different settings for suspension which could be suggested from an online database or another algorithm.

Information

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Background