Analysing ultrasound images is notoriously difficult, and until recently, relied completely on manual identification of the region of interest, e.g. a fascicle or an aponeurosis. In 2011, Glen Lichtwark and I published a paper where we validated a new semi-automated method of tracking fascicle length changes during locomotion. Later, Dominic Farris (along with Lichtwark) extended this work and made several improvements, releasing a new version called Ultratrack.

While this software has greatly assisted the analysis of ultrasound videos, it still leaves some issues unsolved. Firstly, for analysing single images, it does not produce any time savings, because the first image of a sequence does need to be labelled with the existing method. It is also only possible to measure fascicle length (and pennation angle, but in a somewhat convoluted way).

Recently, I teamed up with my good friend Olivier Seynnes to start developing a fully automated method of analysing single images. We decided to implement it in ImageJ, since this software is free, easily extensible, and familiar to most people working in this field.

Below is an example of an original image on the left, and the result of running our analysis programme on the right. In the processed image, you can see the upper and lower aponeuroses of the gastrocnemius muscle shown in green. The yellow boxes represent 3 regions of interest, and the blue line depicts an individual muscle fascicle. These results are all obtained without the user needing to label any features manually- they simply tell the software where to find the image.
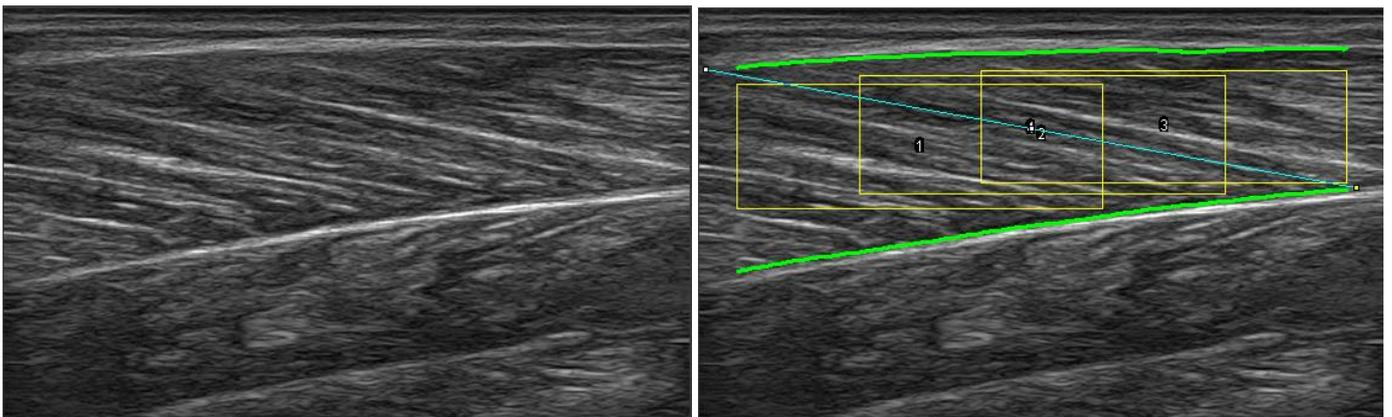
Below is another example which is a bit more complicated. Both ends of the target muscle fascicle extend beyond the edges of the image, so extrapolation is needed. In these cases, there is no objective way of deciding whether or not the tracking is 'correct' (technically true of all 2D analyses), but this example does look promising.
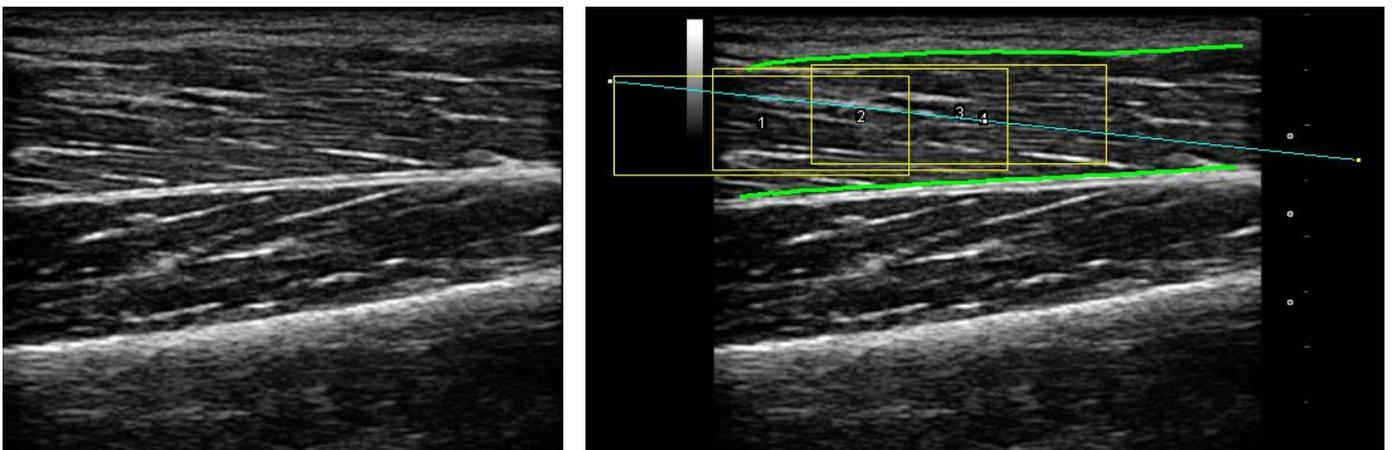
Here's a third example, demonstrating the scaled results that are output by our programme: fascicle length, pennation angle and muscle thickness. Once again, the software is required to extrapolate beyond the edges of the image, but again seems to do this very well.
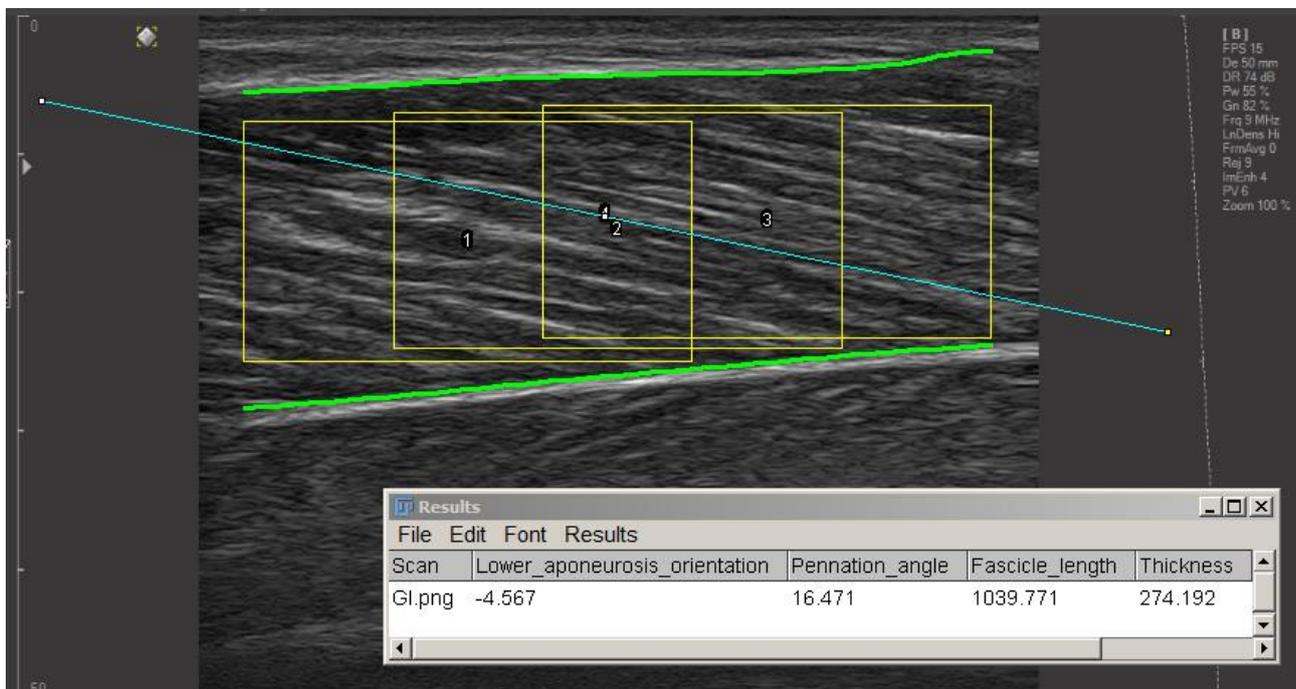
Whether analysing single or multiple images at a time, the results can easily be output as a text file, and each annotated image is saved along with the original image.

We are currently finalising the software and tidying up some loose ends. We hope to submit a manuscript based on this work in the near future. The programme will be open source and easy to use, so no programming experience is required to use it- all that is needed is the Fiji software, which is a (free) variant of ImageJ, and works in a very similar way. For those interested in developing it further, this will also be possible. It will essentially consist of a single macro file (+ a few plugins), and we welcome outside contributions to improve it further.