# Lab vs. Home Comparison of a Computer Vision System for Remote Clinical Testing

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## Summary

We present a computer vision-aided approach for quantifying various metrics automatically from video during common clinical tests. Here we compared the same individuals performing a range of tests in a controlled lab environment versus at home without supervision. We found strong agreement between the two test settings, suggesting that this approach could be feasible for use as part of remote test protocols.

## Introduction

Numerous clinical conditions are associated with reduced mobility. For example, axial spondylarthritis (axSpA) is a common condition that leads to chronic back pain, joint stiffness and reduced spinal mobility. In axSpA, as well as in other populations, it would be beneficial to be able to test mobility remotely, to minimise the time and resources needed for in-person treatment. In this study, we examined the feasibility of a computer vision (CV) approach for monitoring movement metrics from a range of clinical tests in the lab and remotely in the home.

## Methods

Sixty-two participants (53% female) with a mean age of 45 (SD 14) completed the study; 31 participants with axSpA (42% female, 54 (SD 13) years old) and 31 non-back pain participants (65% female, 36 (SD 10) years old). Participants performed a range of tests twice in the lab: once recorded by a camera and analysed with our CV method, and once analysed manually by a qualified physiotherapist. They then completed the same tests at home 1 week later, which were analysed with our CV method. Comparisons of CV vs. physiotherapist results were published previously [1,2]. Here we present CV comparisons between lab and home performance.

For the CV method, OpenPose [3] was used to predict x, y coordinates for each body part detected in the image, and these coordinates were used to compute metrics such as joint angles and distances (in pixels) between two body parts. To translate distance values into real-world distances, at the start of each movement, the participant or investigator held up a calibration checkerboard parallel to the camera and at the same distance at which the movement was performed; Python's OpenCV was then used to convert distances from pixels into cm.

## Results and Discussion

All the axSpA participants completed the home testing and returned the videos. In the non-back pain group, one participant didn't complete the home recording. In one case per group, participants did not use the calibration grid correctly, so distance metrics could not be computed for these individuals.

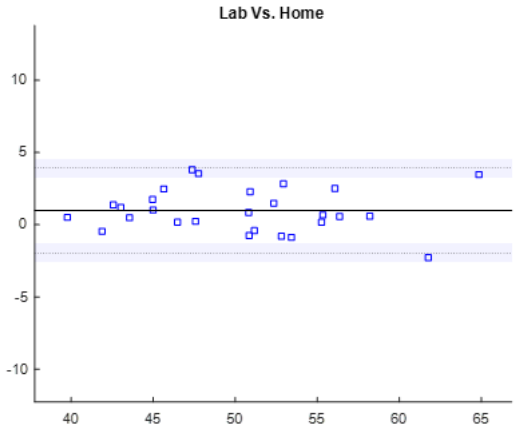


**Figure 1**: Bland-Altman plot of lab vs. home data for all participants and tests.

Across all subjects, the mean difference in computed values between home and lab results was 0.38-1.76cm or 0.43-3.42º depending on test (see Bland-Altman plot in Figure 1).

## Conclusions

The similarity of within-participant results between lab and home settings suggests that our CV approach can feasibly be used remotely, i.e. outside of a lab and without any supervision. This could ultimately reduce the need for in-person treatment, thereby reducing healthcare costs.

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## References

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