



UNIVERSITY COLLEGE LONDON

Computational Modelling for Biomedical Imaging - Individual Report

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Task 1 - Registration assessment

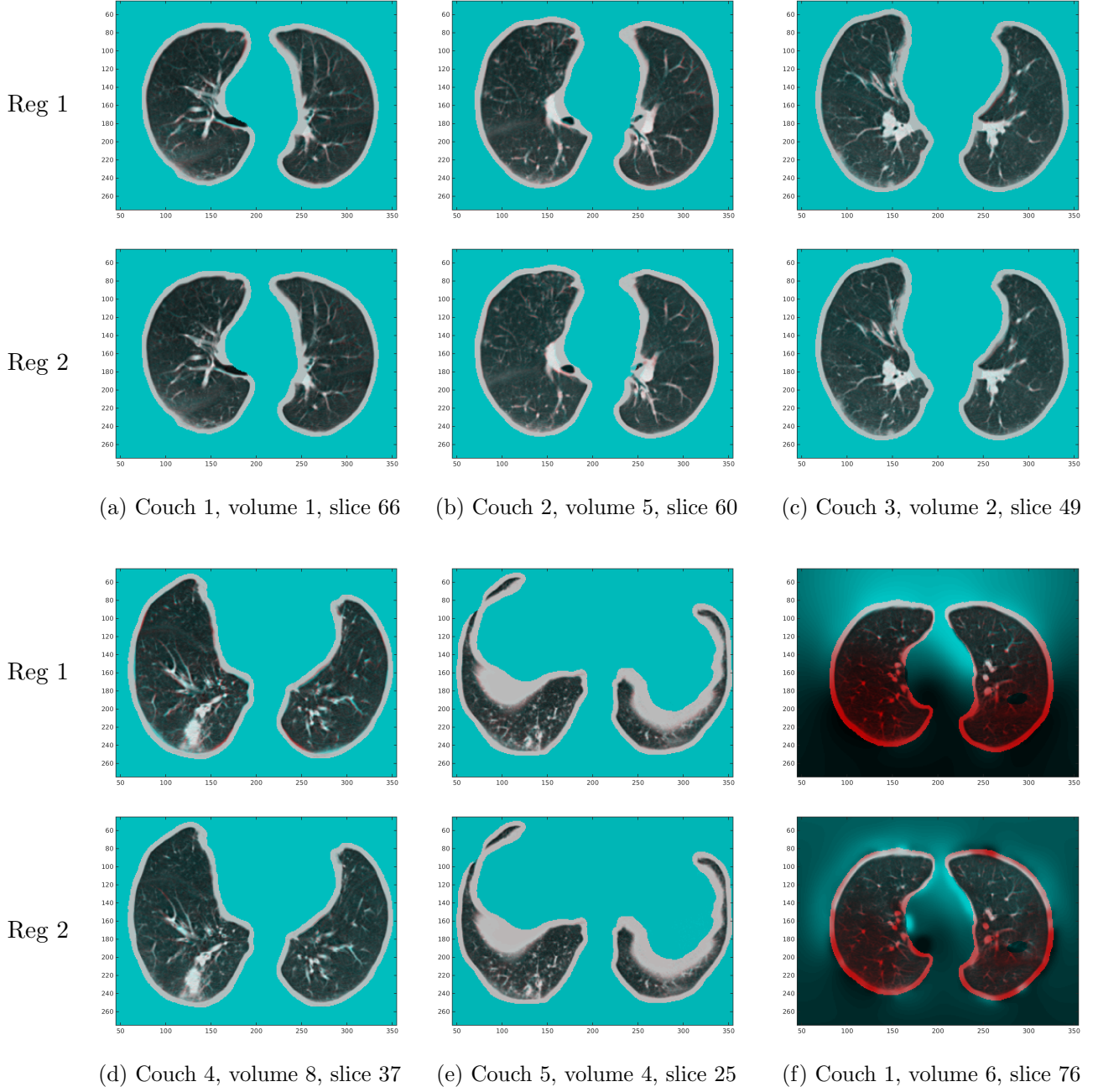


Figure 1: Registration results at several different slices and volumes for each couch position. For each subfigure, registration 1 and 2 are shown in the upper and lower figures respectively.

Figure 1 shows the registration results for a few representative slices and volumes over all couch positions. Both registrations perform equally well subfigures (1a - 1e), but yielded a bad registration in subfigure 1f. Similar bad registrations have been observed in the last slice of each volume. The images show us that there is a considerable ammount of respiratory motion across different slices which needs to be modelled. The shape of the lung is also dramatically different across different couch positions, reaching a concave shape at couch 5. Nevertheless, the segmentation and registration worked fine even for these slices.

Task 2 & 3 - Fitting the models

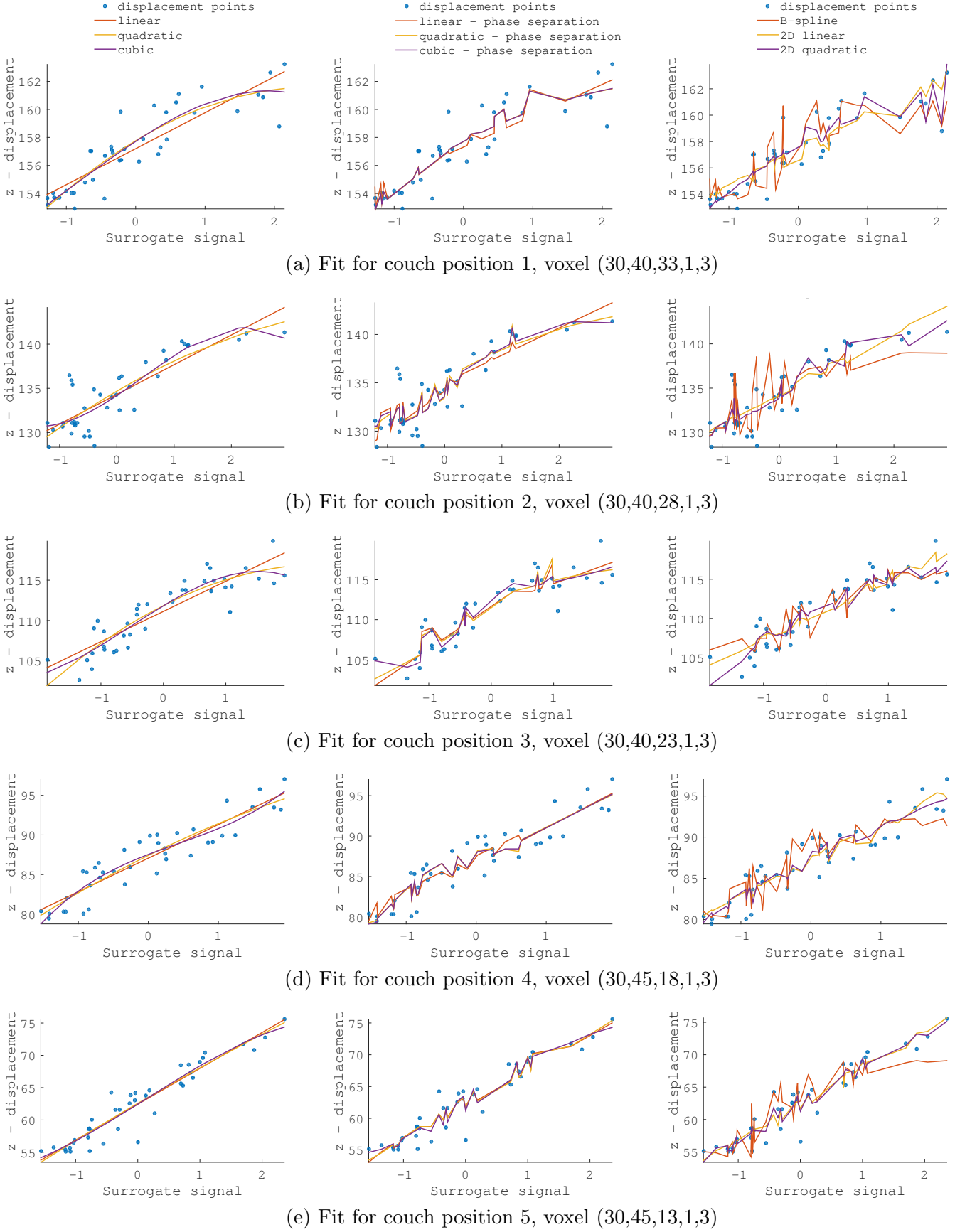


Figure 2: Fit of 9 different models across 5 voxels each from a different couch position. The first column shows the fit for the three basic models: linear, quadratic and cubic. The second column shows the same models with phase separation, while the last column shows the fit for the B-spline, 2D linear and 2D quadratic models.

Figure 2 shows the fit for 9 different models:

- | | | |
|--------------|---------------------------------|-----------------|
| 1. linear | 4. linear - phase separation | 7. B-spline |
| 2. quadratic | 5. quadratic - phase separation | 8. 2D linear |
| 3. cubic | 6. cubic - phase separation | 9. 2D quadratic |

Task 4 - Evaluation of the motion models

Visual Assessment



Figure 3: Visual assessment of the 9 deformation models using leave-one out cross-validation on couch 1, volume 1, slice 66.

Deformation Field Error

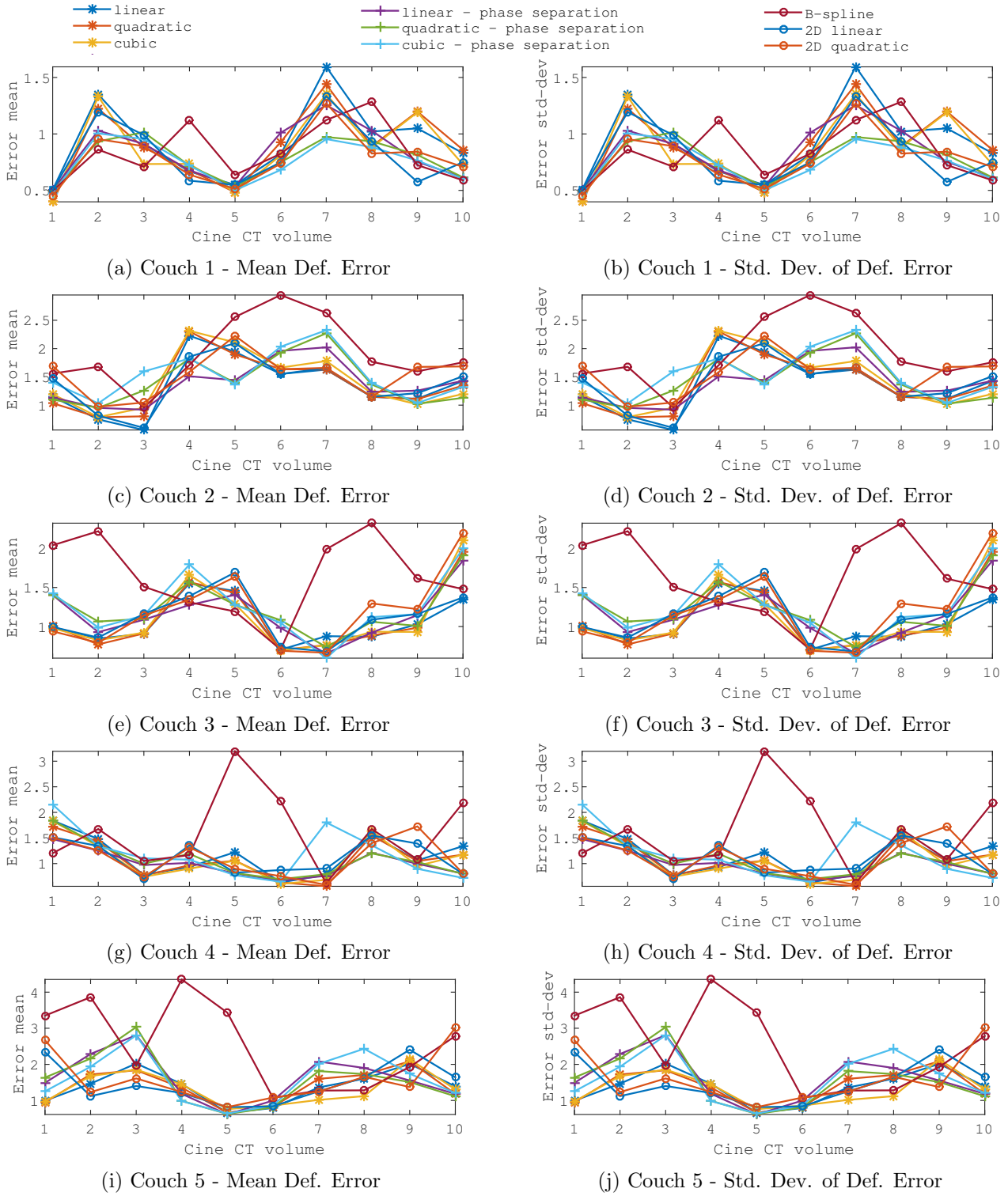


Figure 4: Deformation Error mean and standard deviation for all 5 couch positions, 10 Cine CT volumes and 9 models.

Landmark Error

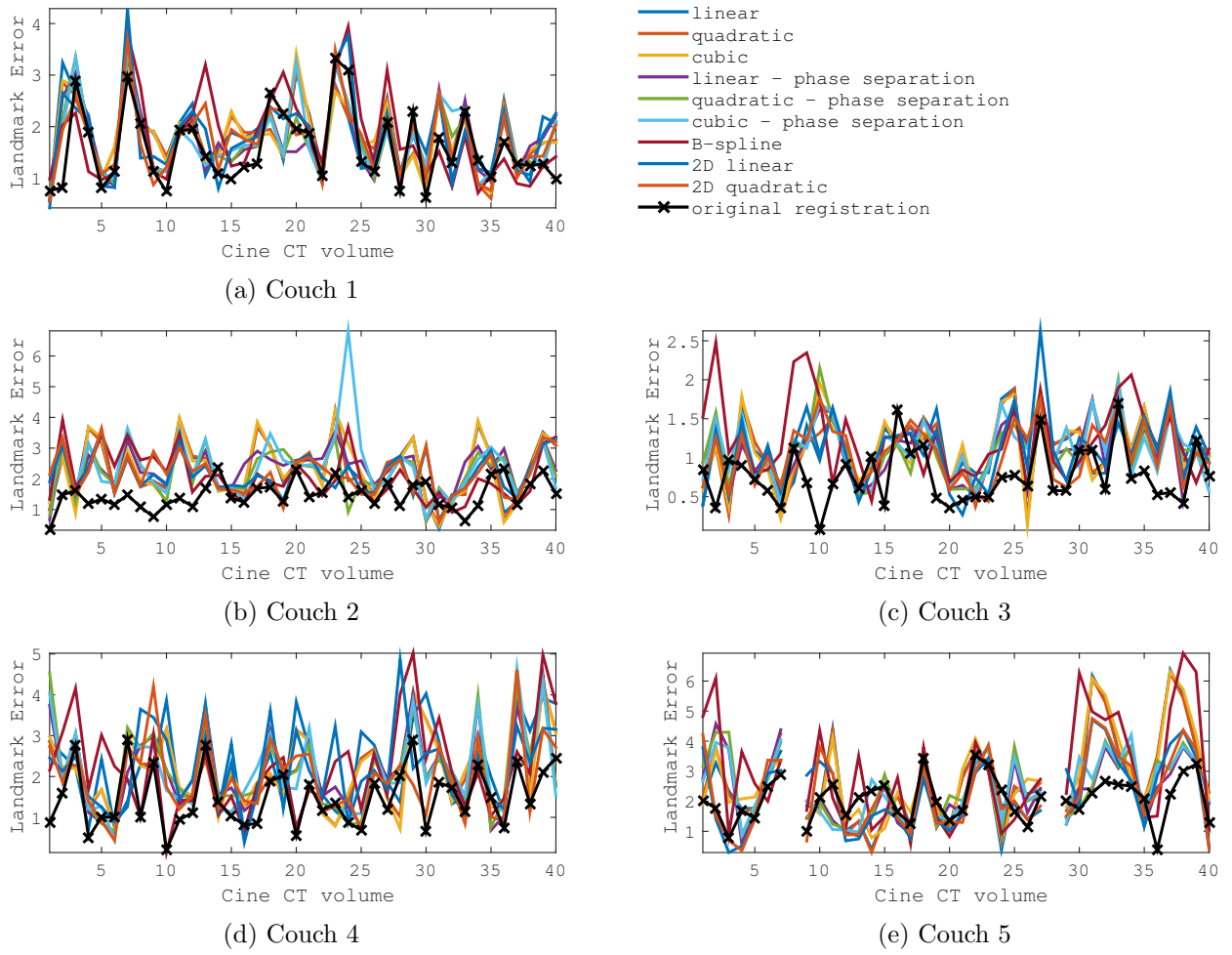


Figure 5: Landmark error for all 5 couch positions, 40 Cine CT volumes and 9 models.

Task 5 - Parameter uncertainty

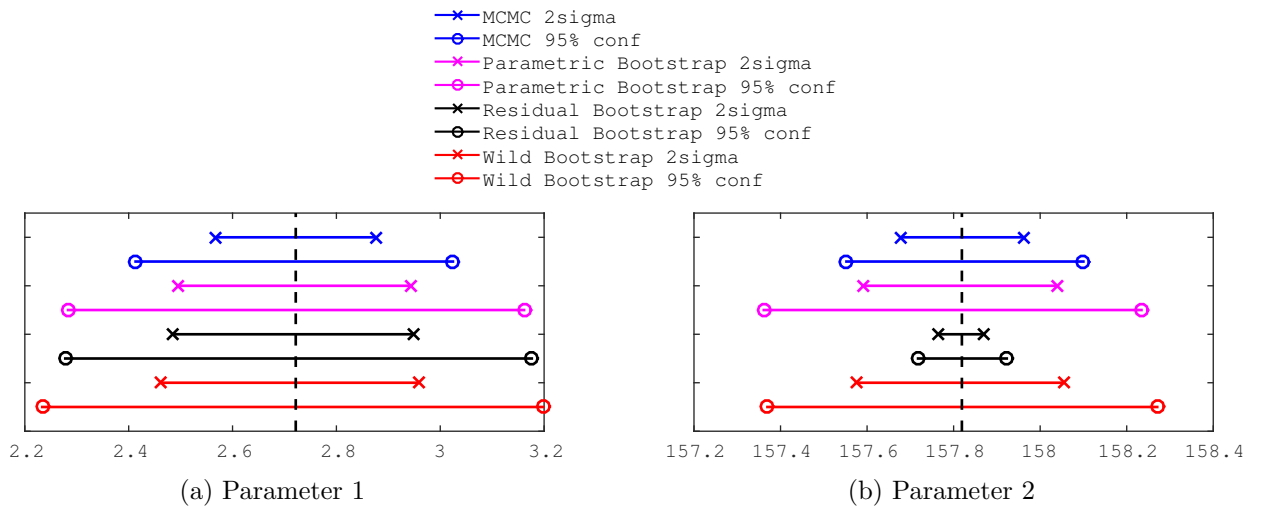


Figure 6: Parameter uncertainty for the linear model.

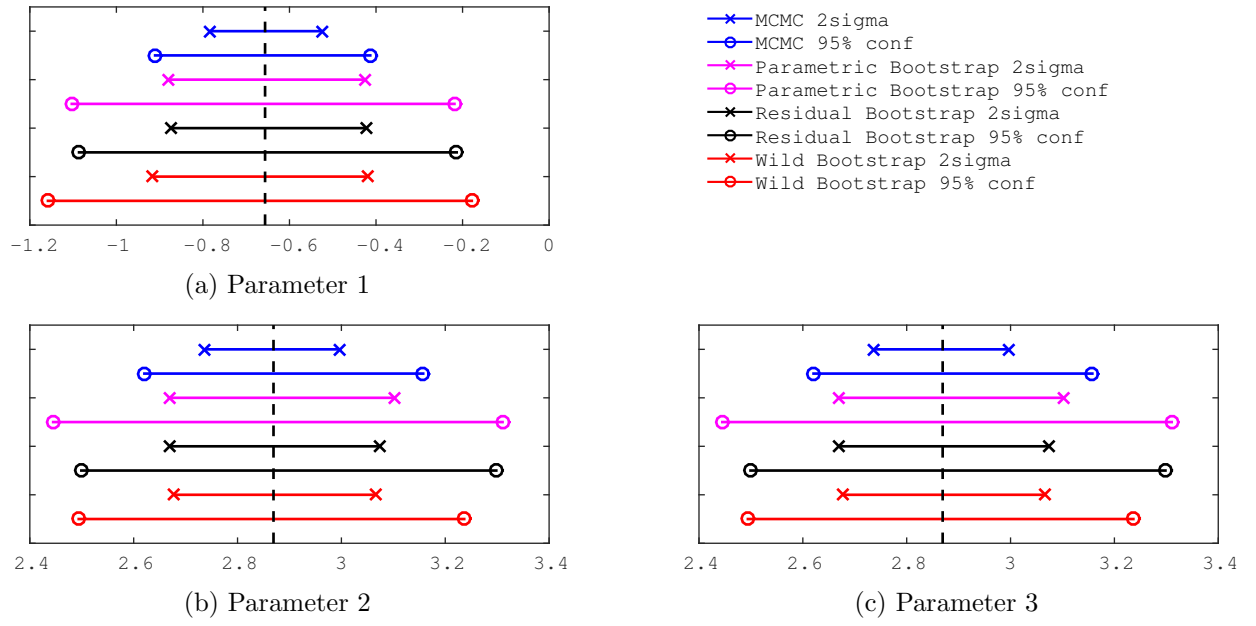


Figure 7: Parameter uncertainty for the quadratic model.

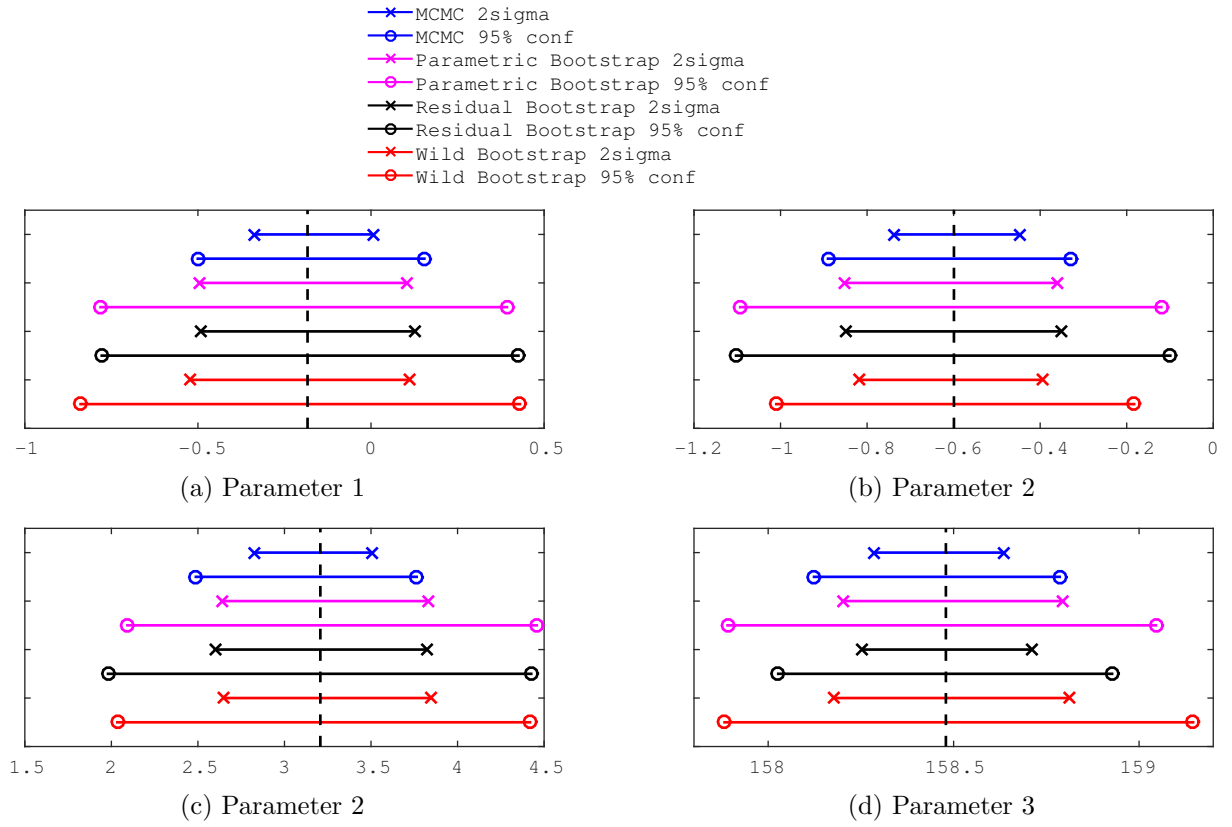


Figure 8: Parameter uncertainty for the cubic model.

Advanced tasks