Supplemental Material for Trustworthy Visual Analytics in Clinical Gait Analysis: A Case Study for Patients with Cerebral Palsy

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Abstract

Three-dimensional clinical gait analysis is essential for selecting optimal treatment interventions for patients with cerebral palsy (CP), but generates a large amount of time series data. For the automated analysis of these data, machine learning approaches yield promising results. However, due to their black-box nature, such approaches are often mistrusted by clinicians. We propose gaitXplorer, a visual analytics approach for the classification of CP-related gait patterns that integrates Grad-CAM, a well-established explainable artificial intelligence algorithm, for explanations of machine learning classifications. Regions of high relevance for classification are highlighted in the interactive visual interface. The approach is evaluated in a case study with two clinical gait experts. They inspected the explanations for a sample of eight patients using the visual interface and expressed which relevance scores they found trustworthy and which they found suspicious. Overall, the clinicians gave positive feedback on the approach as it allowed them a better understanding of which regions in the data were relevant for the classification.

Index Terms: Human-centered computing—Visualization—Visualization application domains—Visual analytics; Computing methodologies—Machine learning; Applied computing—Life and medical sciences

1 Description

This document contains screenshots of the visual interface for a sample of eight patients. For the purpose of screenshots, the left part of the user interface and the scrolling were removed. The line plot legend was moved from the bottom right to the top-most line plot.

Each figure depicts the patient in group comparison mode on the left and in explainability mode on the right. Please zoom in to view the screenshots in their original resolution and consult the manuscript for a description of the design.

Acknowledgments

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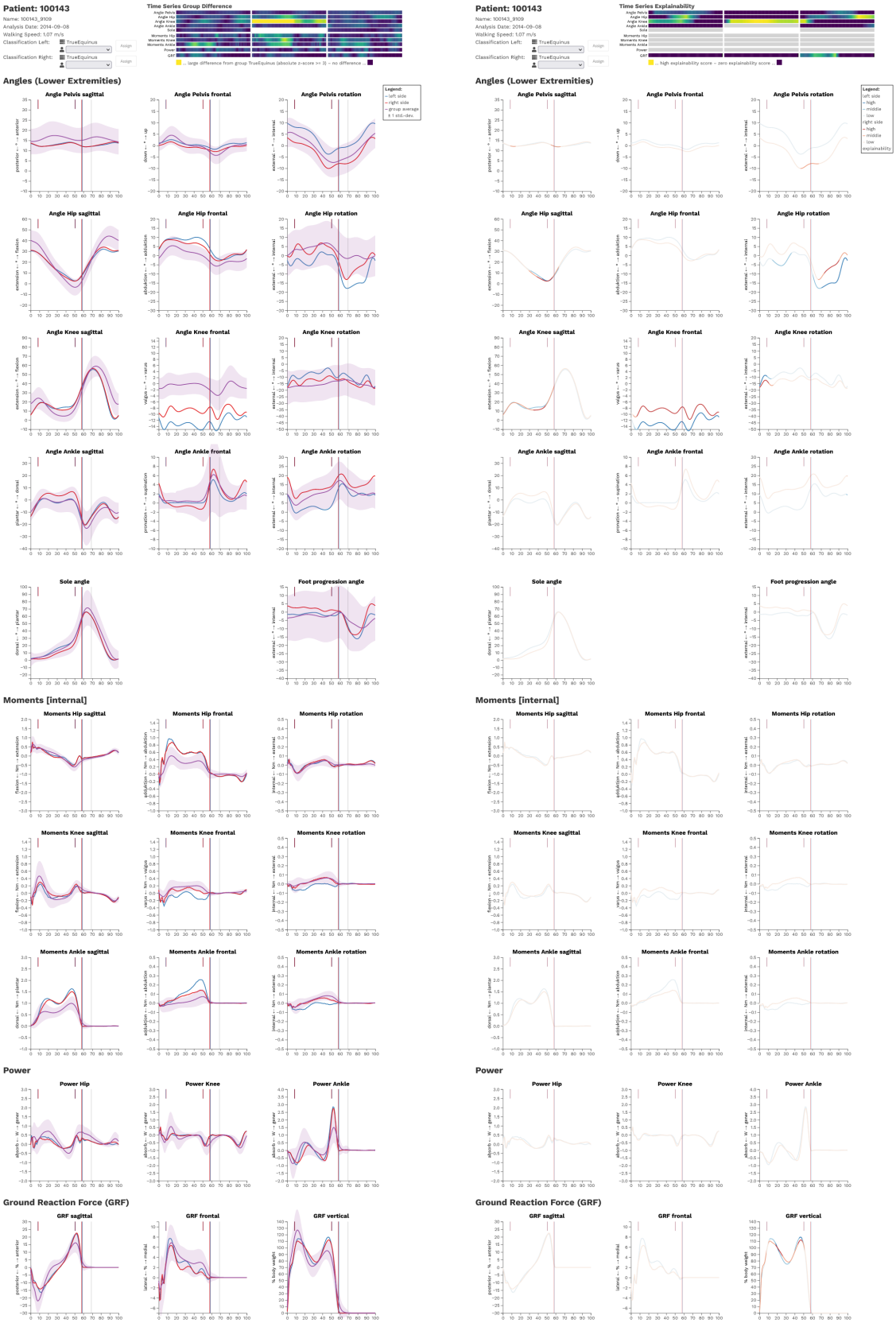

Figure 1: Patient 100143 (left: TrueEquinus, right: TrueEquinus, group: TrueEquinus)

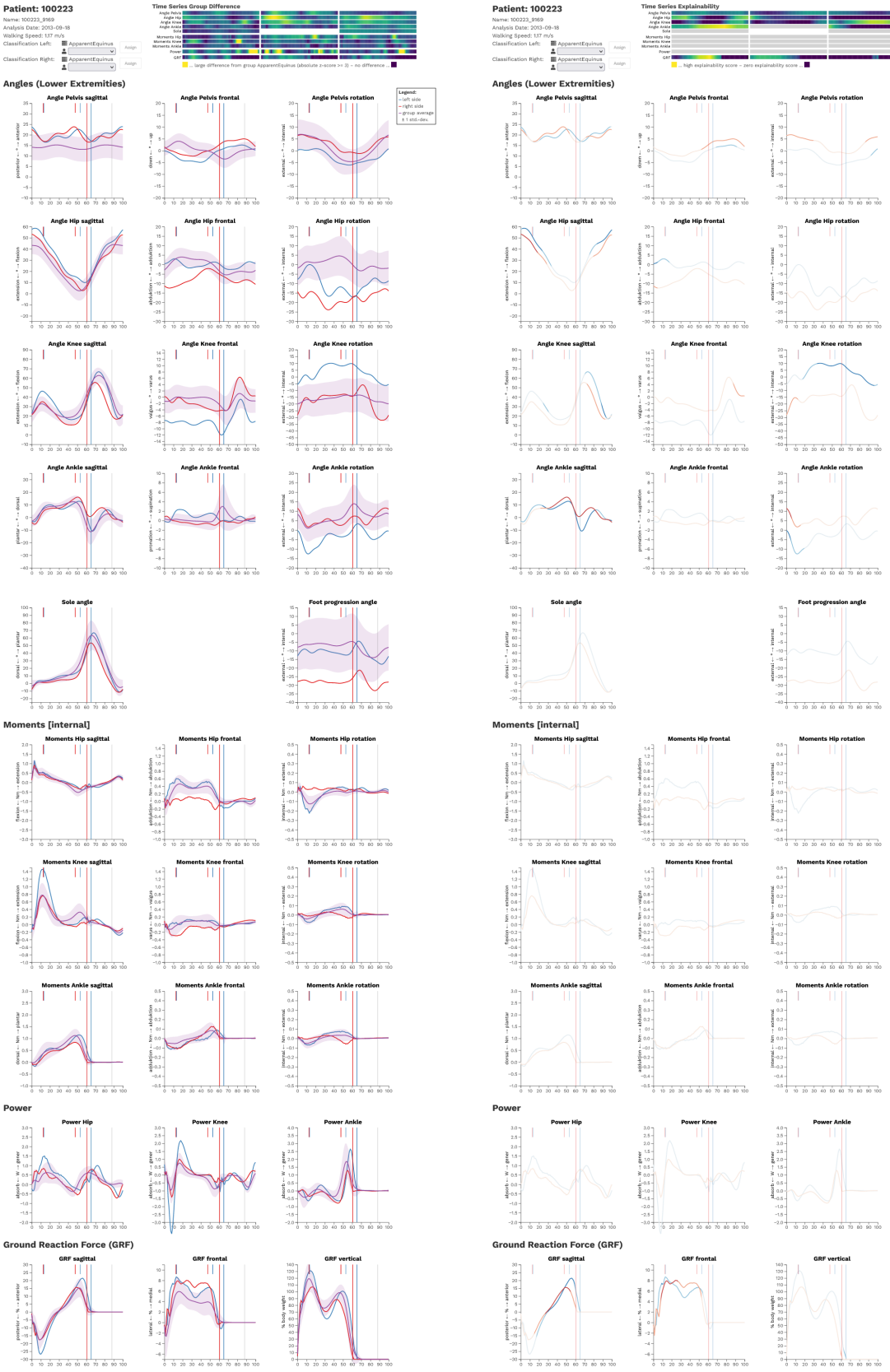

Figure 2: Patient 100223 (left: ApparentEquinus, right: ApparentEquinus, group: ApparentEquinus)

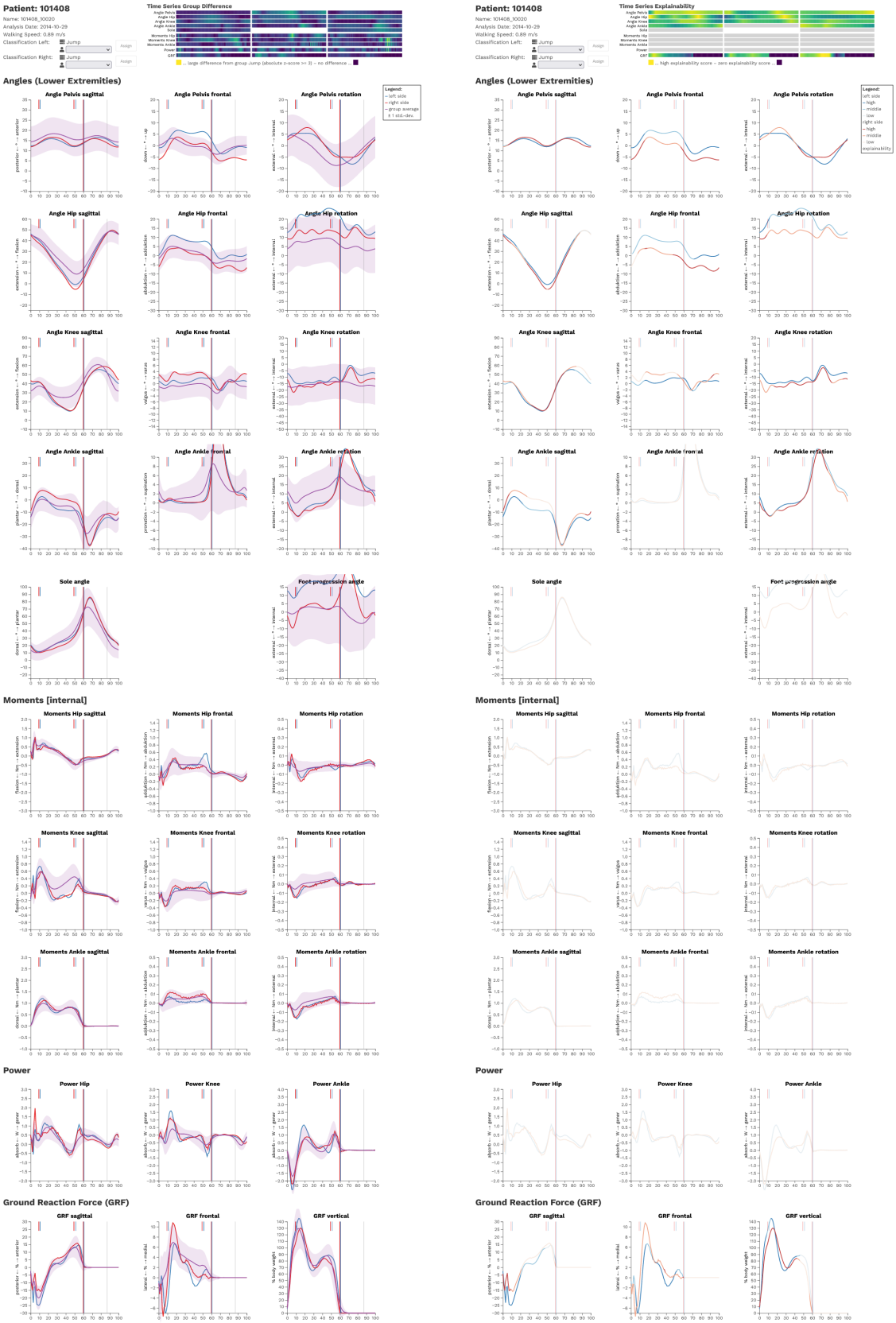

Figure 3: Patient 101408 (left: Jump, right: Jump, group: Jump)

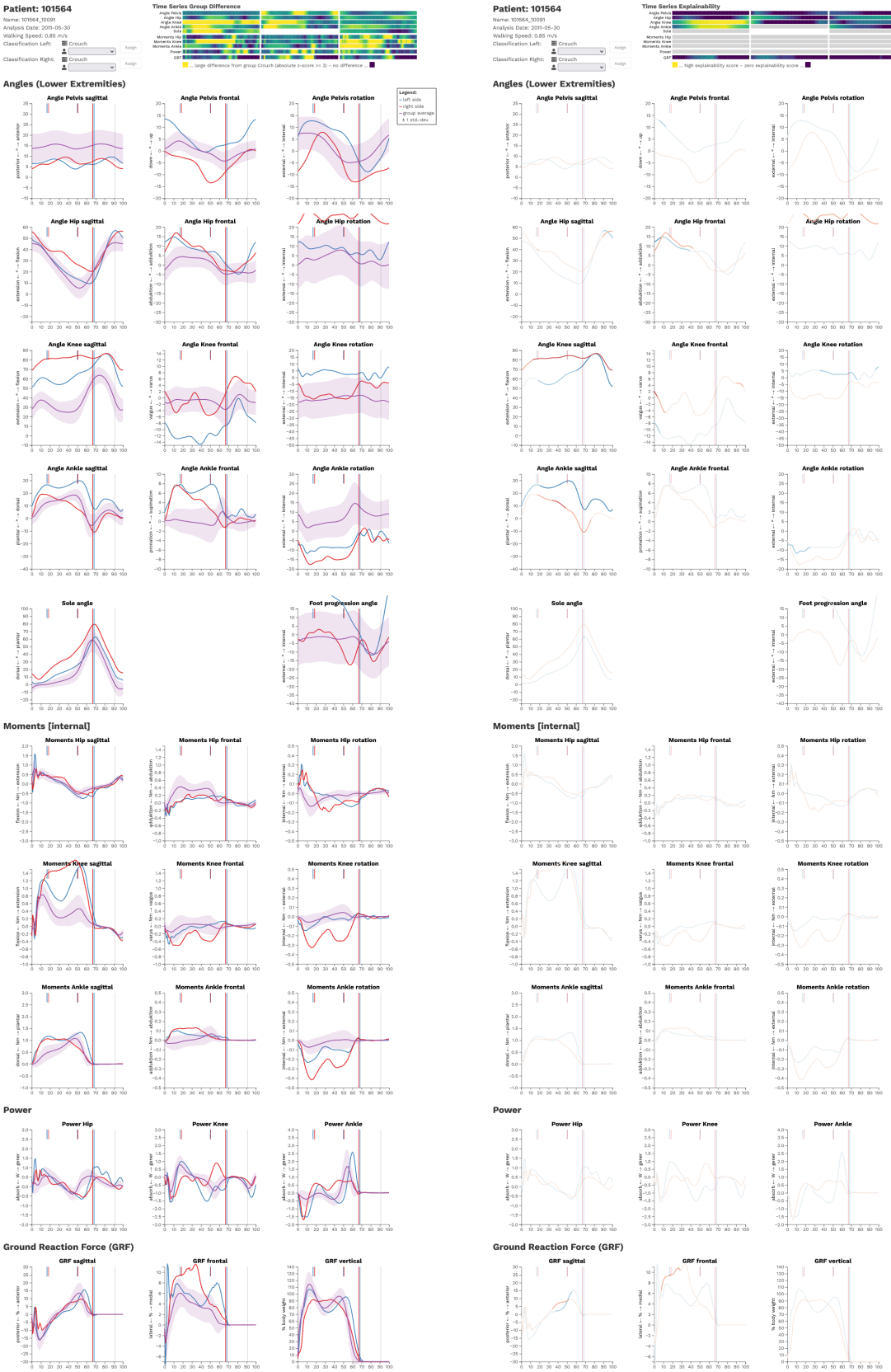

Figure 4: Patient 101564 (left: Crouch, right: Crouch, group: Crouch)

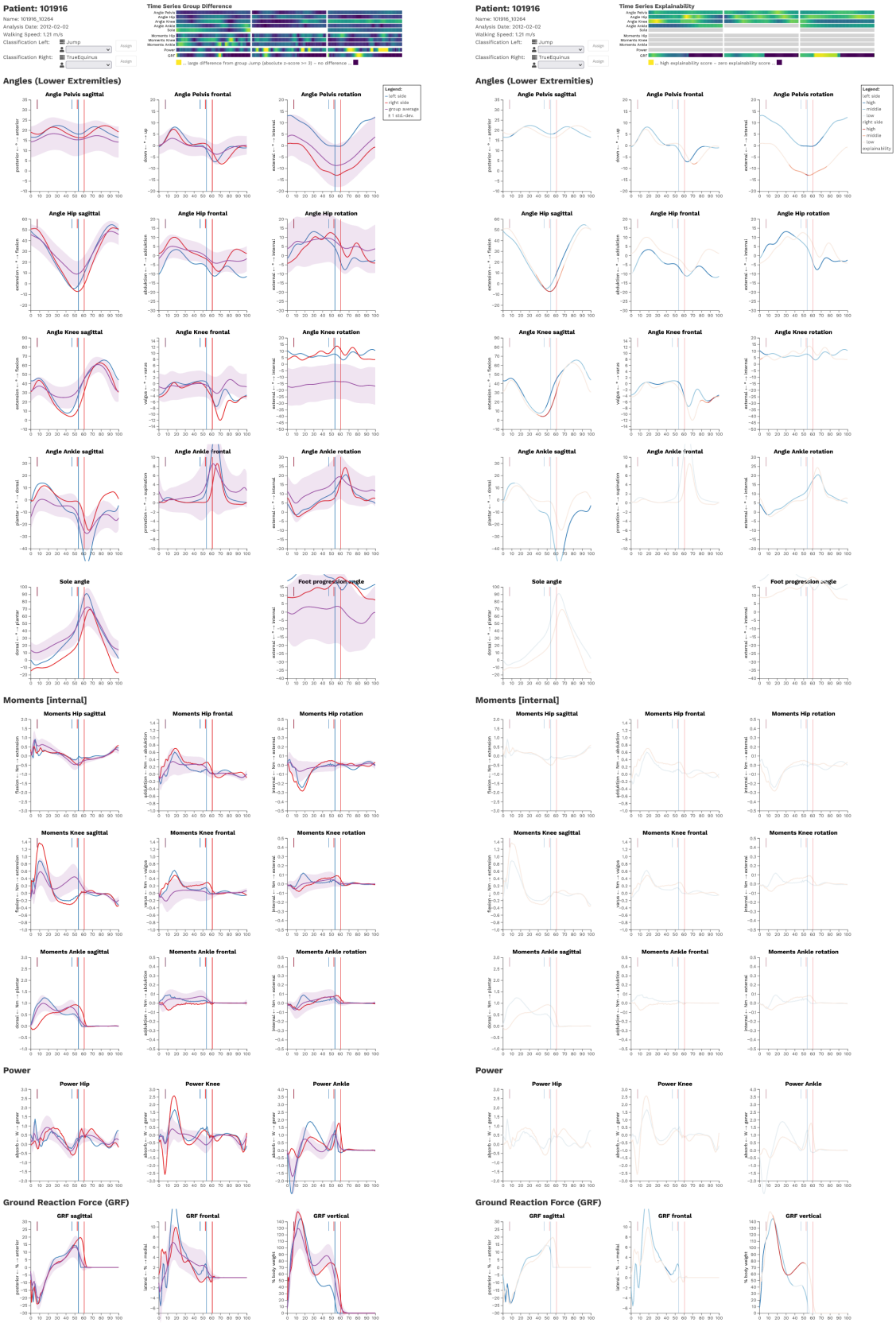

Figure 5: Patient 101916 (left: Jump, right: TrueEquinus, group: Jump)

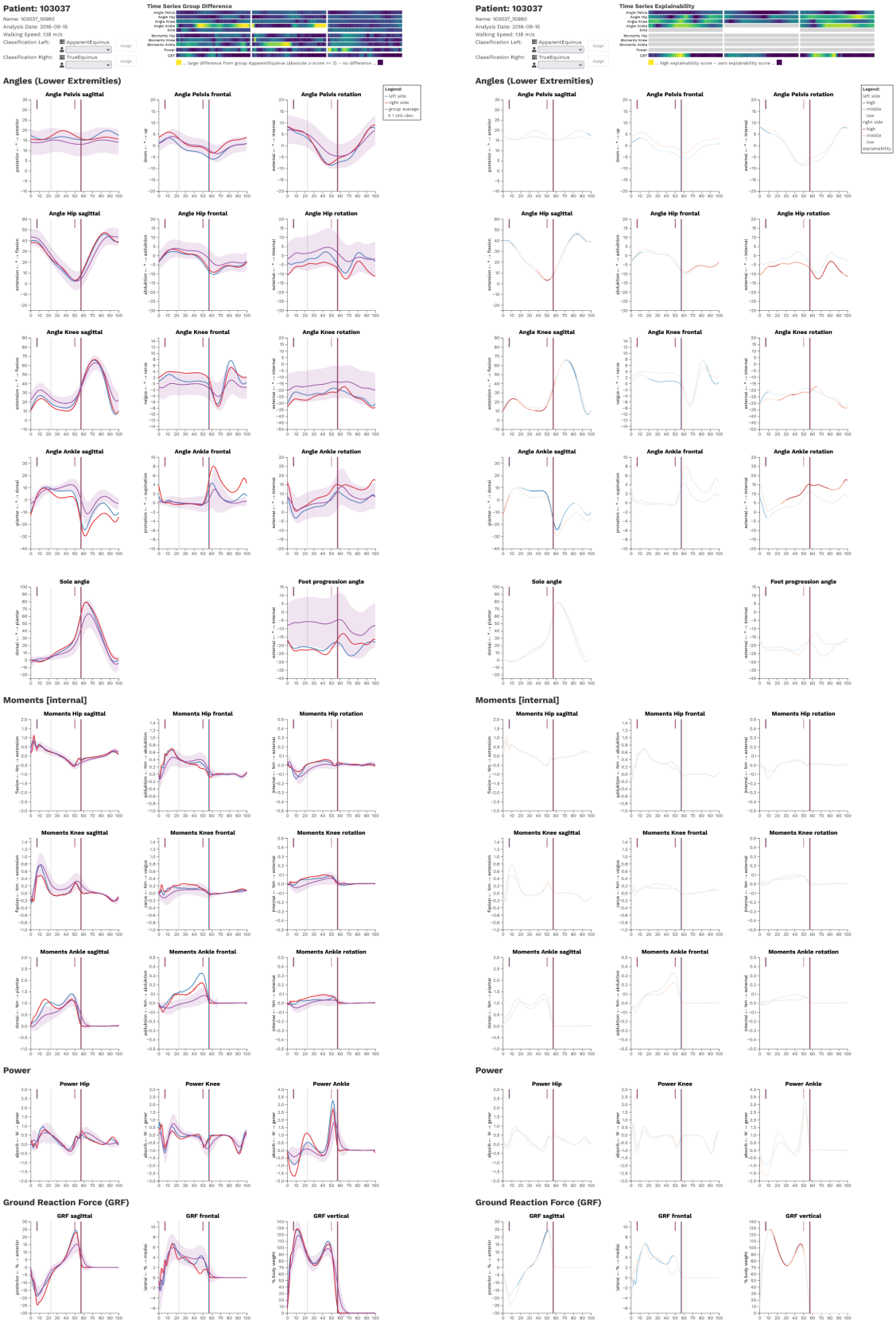

Figure 6: Patient 103037 (left: ApparentEquinus, right : TrueEquinus, group: ApparentEquinus)

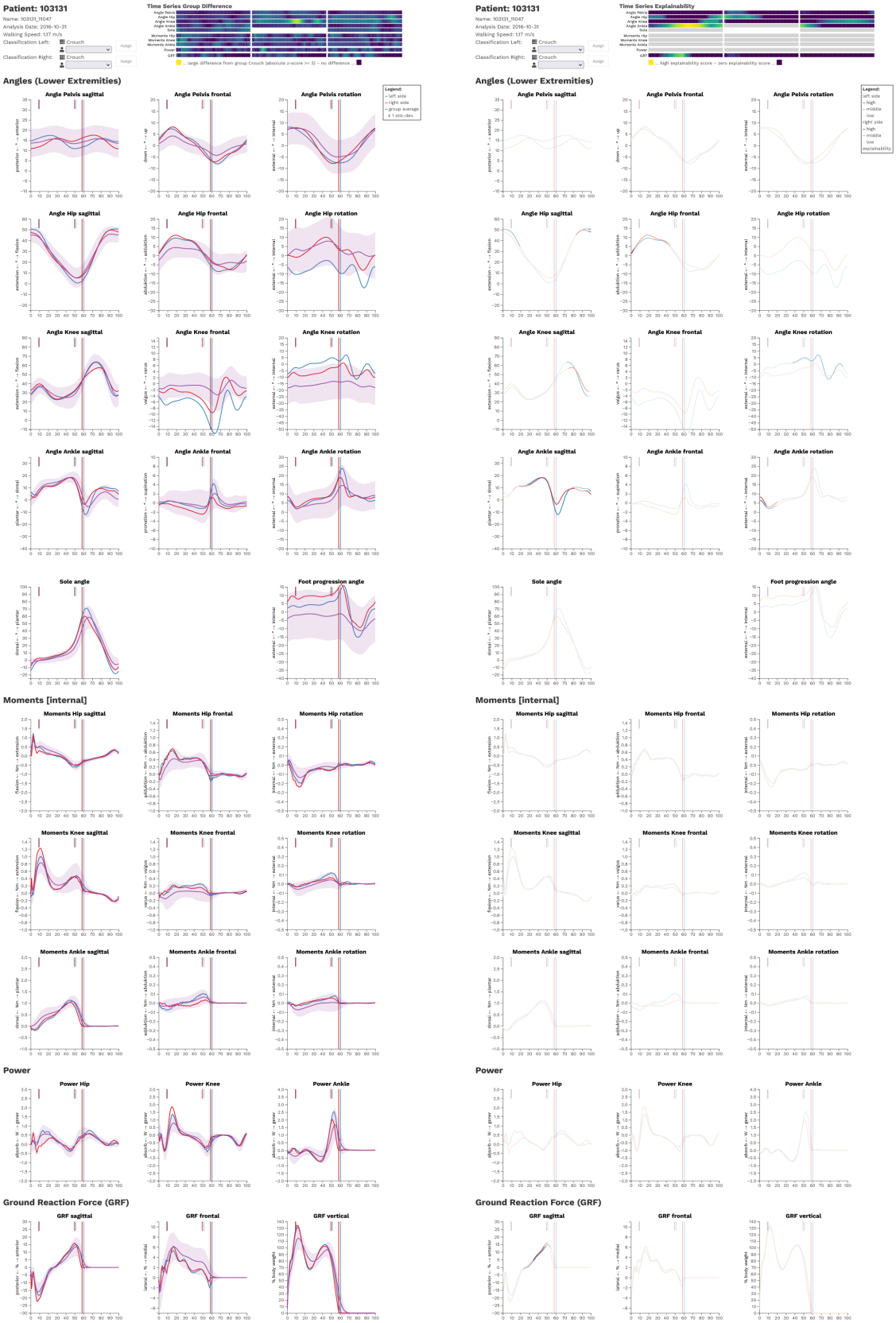

Figure 7: Patient 103131 (left: Crouch, right: Crouch, group: Crouch)

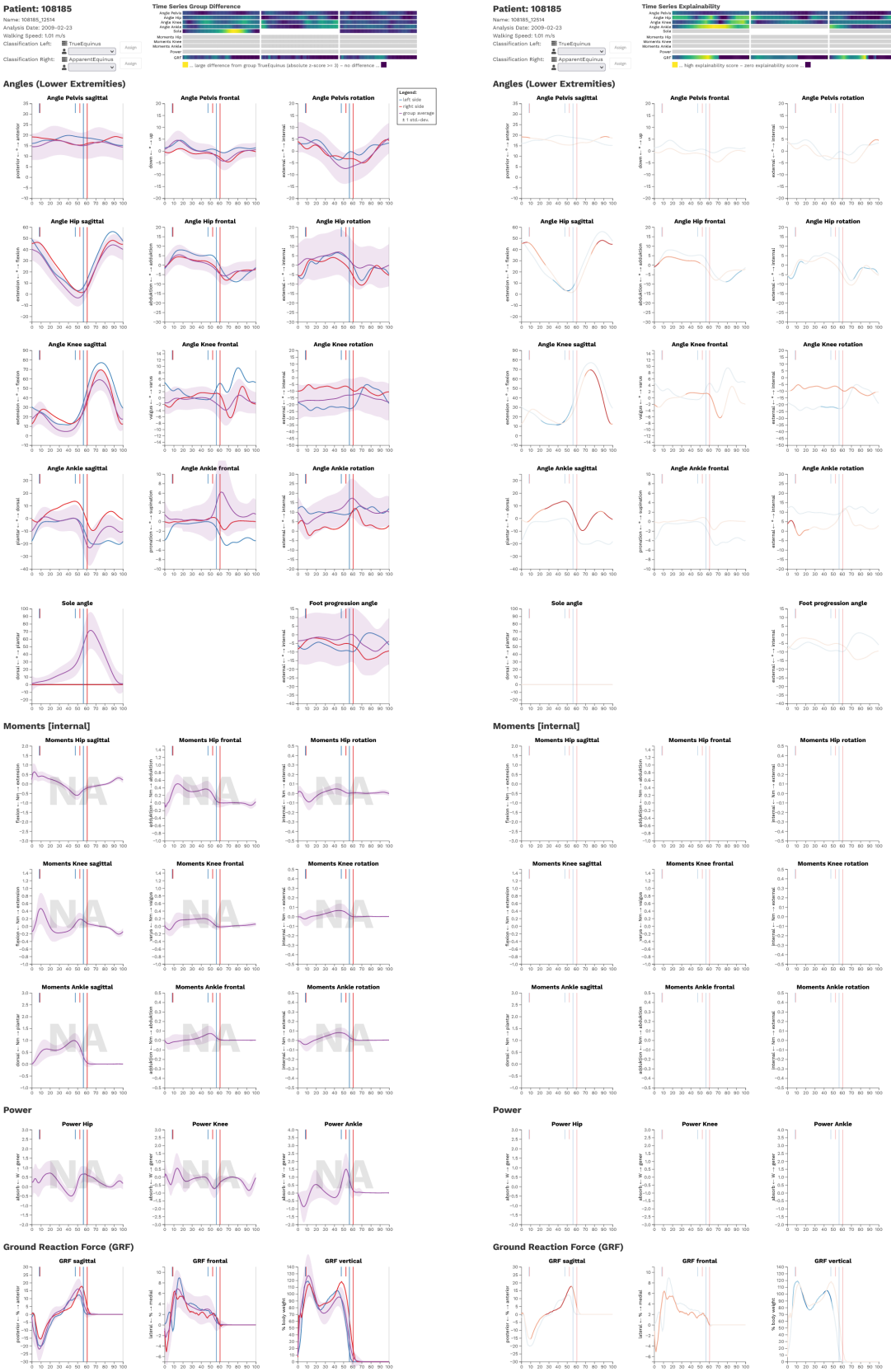

Figure 8: Patient 108185 (left: TrueEquinus, right: ApparentEquinus, group: TrueEquinus)