Deviations of the physiological cervical sagittal profile are associated with clinical symptoms and may require surgical intervention. Both preoperative planning and postoperative evaluation require the exact determination of central parameters of the cervical spine. However, manual measurements are time-consuming and depend on the physician's experience. A fully automated artificial intelligence (AI) based algorithm could contribute to an objective analysis and save time by supporting physicians in such clinical routine tasks. In this validation study, pre- and postoperative neutral lateral cervical X-rays of 129 patients undergoing anterior cervical discectomy and fusion or cervical disk arthroplasty were manually measured by two independent physicians. The following parameters were measured twice by both physicians: C2-C7 lordosis, C1-C7 sagittal vertical axis (SVA), C2-C7 SVA, C7 slope, and T1 slope. An AI-based algorithm consisting of four interlinked deep convolutional neural networks was implemented to measure the aforementioned parameters on the validation images. Manual and automatic measurements were compared, and agreement was quantified by mean errors (95% confidence interval (CI)) and single measure intraclass correlation coefficients (ICC) for absolute agreement. Following the recommendation by Cichetti (1994), ICC-values exceeding 0.75 were considered excellent. Manual measurements within (intra-rater ICC-range: 0.92–1.0) and between human raters (inter-rater ICC-range: 0.91–1.0) showed excellent agreement. Furthermore, automatic measurements had excellent agreement with manual measurements (PreOP ICC-range: 0.80-1.0; PostOP: 0.86-0.99). Exemplarily for the comparison between the AI algorithm and manual measurements of one physician, mean errors were lowest for C1-C7 SVA (PreOP: -0.5mm (95% CI: -0.8– -0.2 mm), PostOP: 0.6mm (0.1–1.0 mm)) and highest for C2-C7 lordosis (PreOP: -2.0° (-2.8– -1.3°), PostOP: -2.5° (-3.7– -1.8°)). Automatic measurement was possible in 98% of images for all parameters except T1 slope, which had a lower detection rate of 50% due to frequent occlusion by the shoulder. Nevertheless, the ICC-value were excellent for the automatically detected T1 slopes (PreOP ICC-range: 0.80-0.85; PostOp: 0.85-0.90). The presented AI-algorithm can accurately and reliably determine cervical sagittal balance parameters. It may be integrated into the measurement routine by physicians doing manual measurements and be used for the independent analysis of large-scale datasets for research purposes.