



Figure S1 Correlation between femoral head volume and cam morphology volume in male (A) and female (B) patients.

Table S1 Comparison of the present study with related works on the proximal femur, femoral head, and hip joint segmentation in magnetic resonance imaging data

Study	Segmentation description	Subjects	MRI strength (T)	Average DSI
(13)	Proximal femur: multi-atlas method in 3D	30	3.0	0.95
(13)	Proximal femur: active shape models in 3D	30	3.0	0.946
(14)	Femoral head bone: focused shape models in 3D	25	3.0	0.98
(34)	Proximal femur: parametric deformable model in 3D (Dataset 1)	1	3.0	0.883
(34)	Proximal femur: parametric deformable model in 3D (Dataset 2)	1	3.0	0.883
(30)	Proximal femur: 3D U-net	20	–	0.987
(29)	Proximal femur: 2D and 3D U-net	86	3.0	0.95
(25)	Proximal femur: multi-level latent shape space constrained 3D U-net	25	–	0.954
(26)	Proximal femur: 3D U-net	20 (images)	–	0.987
(35)	Proximal femur: deep volumetric shape learning in 3D	24	–	0.933
(31)	Proximal femur: 3D tiled convolution in 3D	25 (images)	–	0.9814
(32)	Proximal femur: holistic decomposition convolution in 3D	25 (images)	–	0.9814
(33)	Proximal femur: random forest classifier with deformable model registration	25	1.5	0.9637
(36)	Proximal femur: deep segmentation in 2D U-net	6	1.5	0.8694
(36)	Proximal femur: deep segmentation in 2D Ref-Net	6	1.5	0.8617
(28)	Proximal femur: 2D CNN	13	1.5	0.8973
(27)	Femur bone: Resnet50-segnet	38	1.5	0.907
Our network	Proximal femur: 3D U-net	97	3.0	
U-net results				0.958
U-net + FSM results				0.964

FSM, focused shape model; 3D, three-dimensional; 2D, two-dimensional; CNN, convolutional neural network; MRI, magnetic resonance imaging; DSI, Dice similarity index.

Table S2 Comparison of the cam morphology quantification results with related works

Study	Method description	N	Image modality	μ volume (σ) (cm ³)		Volume range (cm ³)	μ SA (σ) (cm ²)	μ height (σ) (mm)	Max height (σ) (mm)
				M	F				
(38)	Mimics segmentation; femoral head and neck radii constraints	7 (M)	CT	–	–	–	3.735 (1.547)	–	–
(39)	Mimics segmentation; femoral head radii constraints	5	CT	–	–	–	–	SNS: 8.26	–
(10) FAI results	Manual segmentation; estimation of normal surface	5	3T MRI	SNS: 0.188 (0.247)	–	–	SNS: 0.52 (0.60)	SNS: 3.9 (2.1)	–
(40)	Mimics segmentation; femoral head radii constraints	M:F 69:69	CT	M: 0.433 (0.471); F: 0.089 (0.124)	–	–	–	M: 1.51 (0.75); F: 0.66 (0.61)	–
(45)	Region growing segmentation	M:F 20:23	CT	M: 6.7 (2.5); F: 4.3 (3.4)	1.2–12.5	–	–	–	–
(9)	Region growing segmentation	M:F 13:14	CT	SNS: 4.6 (2.6)	–	–	–	–	–
(37) abnormal FAI results	Region growing segmentation	79	CT	SNS: 7.96 (2.78)	–	–	–	–	–
(41) MR results	Mimics segmentation	7	CT and MRI	SNS: 0.940 (0.537)	–	–	SNS: 6.158 (2.324)	SNS: 1.6 (0.4)	SNS: 3.7 (0.9)
Ours	3D U-net and FSM	M:F 56:41	3T MRI	M: 1.136 (0.659); F: 0.338 (0.280)	M: 0.022–3.002; F: 0–1.164	M: 6.574 (2.030); F: 3.069M: 1.94 (0.86); F: 1.00M: 3.89 (1.51); F: 2.23 (1.09)	–	–	–

FAI, femoroacetabular impingement; MR, magnetic resonance; 3D, three-dimensional; FSM, focused shape model; M, male; F, female; CT, computed tomography; MRI, magnetic resonance imaging; μ, mean; σ, standard deviation; SNS, sex not specified; SA, surface area.

Table S3 Comparison of the femoral head volume results with related works

Study	Method description	Subjects	Image modality	μ volume (σ) (cm ³)			Volume range (cm ³)	μ radii (σ) (mm)
				Male	Female	Sex not specified		
(40)	Mimics segmentation; manual femoral head centre initialization; iterative search: σ to point cloud minimization	M:F 69:69	CT	–	–	–	–	M: 25.4 (1.3); F: 22 (1.3)
(45)	Region growing segmentation	M:F 20:23	CT	62.9 (10.8)	41.8 (8.6)	–	24.4–85.2	–
(9)	Region growing segmentation	M:F 13:14	CT	–	–	49.7 (11.5)	–	–
(37) abnormal FAI results	Region growing segmentation	79	CT	–	–	47.84 (9.65)	–	–
(21)	Manual analysis	M:F 44:53	1.5T MRA	57.16 (9.71)	37.98 (5.71)	–	–	–
(22)	Cadaveric measurements	1,090 hips	–	–	–	58.194 (11.998)	–	–
Ours	3D U-net, Hough transform, spherical fitting	97	3T MRI	66.12 (7.67)	46.02 (6.83)	–	M: 52.39–81.03; F: 34.31–59.49	–

FAI, femoroacetabular impingement; σ, standard deviation; 3D, three-dimensional; M, male; F, female; CT, computed tomography; MRA, magnetic resonance arthrography; MRI, magnetic resonance imaging; μ, mean;