

Supporting information

Fully Automatic Target Detection and Quantification Strategy Based on Object Detection Convolutional Neural Network YOLOv3 for One-step X-Ray Image Grading

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Table S1. The characteristics of knee OA at different KL grades.

KL grade	Severity	Description
Grade 0	Normal	No changes
Grade 1	Doubtful	Doubtful JSN, Possible osteophytic lipping
Grade 2	Minimal	Definite osteophyte, Possible JSN
Grade 3	Moderate	Moderate osteophytes, Some sclerosis, Definite JSN, Possible deformity of bone ends
Grade 4	Severe	Large osteophytes, Severe sclerosis, Marked JSN, Deformity of bone ends

Table S2. Comparison between reported deep learning methods for knee OA detection.

Method	Strategy	Dataset	Multiclass accuracy (%)	Reference
End-to-end CNN integrating local feature detectors	One-step	OAI and MOST public dataset	64.3	33
Integration of FCN and CNN	One-step	OAI and MOST public dataset	64.6	34
SVM followed by siamese CNN	Two-step	OAI and MOST public dataset	66.71	32
FCN followed by CNN	Two-step	OAI and MOST public dataset	61.9	22
SVM followed by deep CNN	Two-step	OAI public dataset	59.6	18
OsteoHRNet	Two-step	OAI public dataset	71.74	37
YOLOv2 followed by VGG-19-Ordinal CNN	Two-step	OAI public dataset	70.4	28
Integrated CNN based on YOLOv3	One-step	OAI public dataset and clinically collected data	74.91	Current study

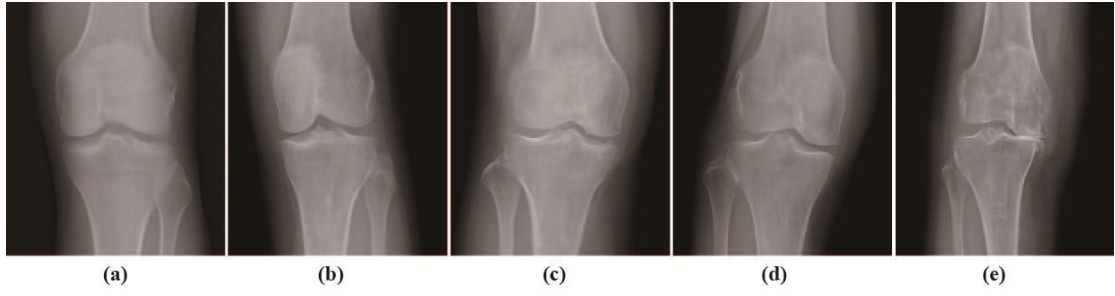


Figure S1. Typical images at different KL grades from the Third Xiangya Hospital:

(a) Grade 0, (b) Grade 1, (c) Grade 2, (d) Grade 3, and (e) Grade 4.

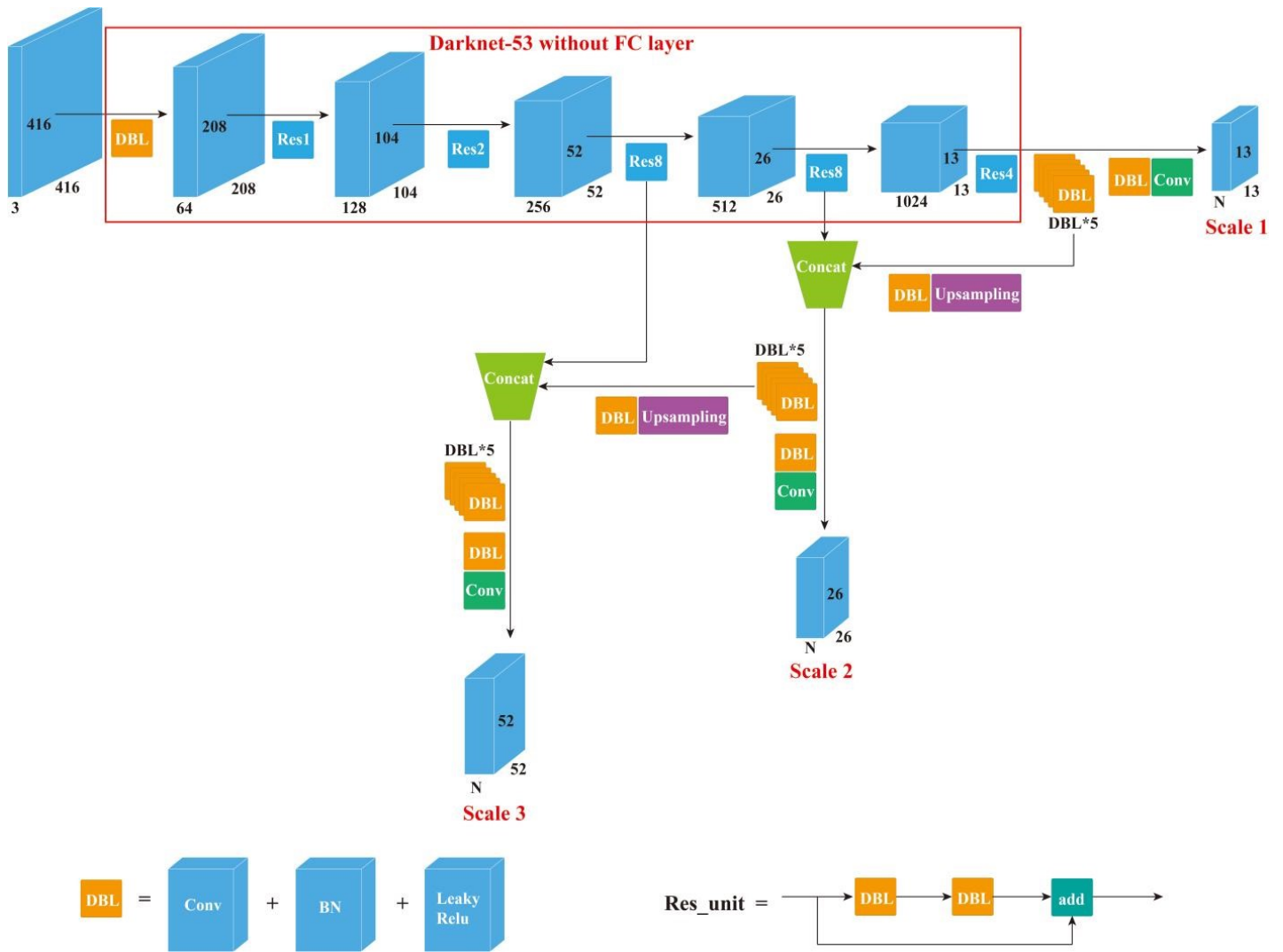


Figure S2. Scheme of the network structure of YOLOv3. The DBL in the figure is the smallest component of YOLOv3 and consists of the convolutional layer, Batch Normalization layer and Leaky Relu activation function. There are 5 Resn (n=1, 2, 4, 8) structures in the network. Each block for residual calculation (Res_block) contains n Res_units. The Concat in the figure stands for tensor concatenation that concatenates the middle layer of the Darknet-53 with the upsampling of a later layer. The add in the Res_unit structure represents the addition of tensors that doesn't extend dimensions.



Figure S3. Image augmentation methods: (a) original image, (b) 90° clockwise rotation, (c) 180° clockwise rotation, and (d) brightness transformation.