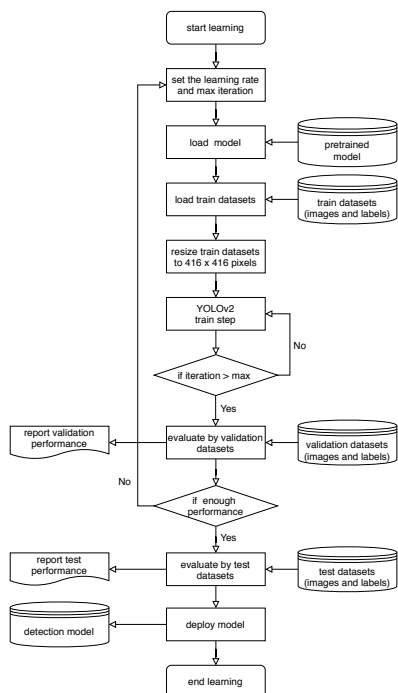
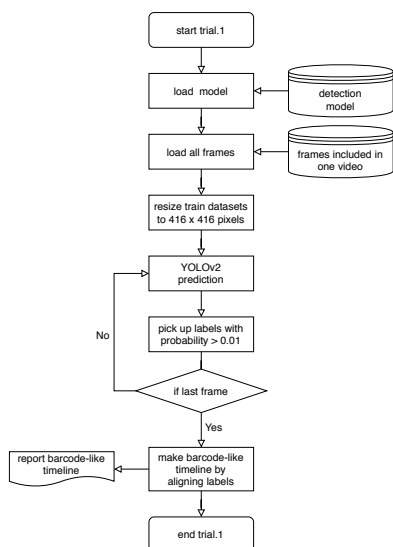


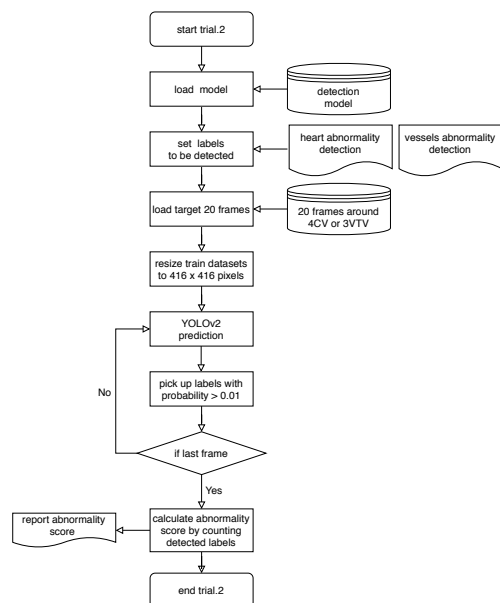
(a)



(b)

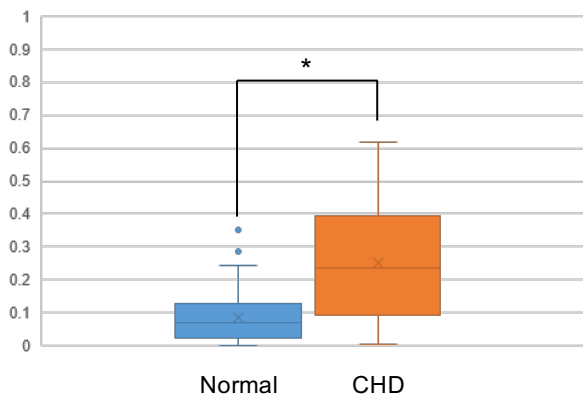


(c)



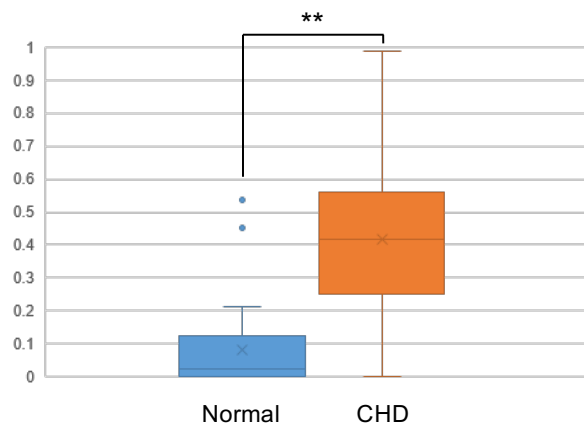
**Supplementary Figure S1.** Experimental flow charts demonstrate our key steps in (a) the training; (b) cardiac substructure detection; (c) detection of cardiac structural abnormalities. YOLO: you only look once.

(a)



$*p < 0.001$

(b)



$**p < 0.001$

**Supplementary Figure S2.** Abnormality scores in Heart and Vessels. The mean value of abnormality scores in 42 videos of CHD cases was significantly higher than 42 videos of normal cases in both (a) Heart and (b) Vessels.

**Supplementary Table S1.** Characteristics of the cases with congenital heart disease (CHD) for detection of cardiac structural abnormalities ( $n = 14$ ).

CHD	Gestational Week
<b>Validation Data</b>	
AVSD	19
TA	23
TOF	29
<b>Test Data</b>	
DORV with TGA and VSD	21
Ebstein	21
HLHS	28
PAIVS	21
PAIVS	23
Persistent right fourth aortic arch	25
TA	20
TA	26
TGA type 1	19
TGA type 1	20
TOF	21

AVSD: atrioventricular septal defect; DORV: double-outlet right ventricle; HLHS: hypoplastic left heart syndrome; PAIVS: pulmonary atresia with intact ventricular septum; TA: tricuspid atresia; TGA: transposition of the great arteries; TOF: tetralogy of Fallot.

(a)

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(b)

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(b)

[illegible][illegible][illegible][illegible][illegible]



**Supplementary Video S1.** Graphical user interface in a normal case. The detection probabilities of cardiac substructures in each frame were measured and real-timely demonstrated in the upper right table. Along with the sweep scanning, the abnormality scores were calculated and its transitive line graph were displayed at the bottom right of the screen. The heart (= chambers) and vessels (= large vessels) areas were colored and emphasized. Furthermore, after the examination was finished and the report button was clicked, another window was opened in the same screen. It displayed a barcode-like timeline of the whole examination and the mean value of abnormality scores in the heart and vessels.

**Supplementary Video S2.** Graphical user interface in a TOF case. In comparison with normal cases, some cardiac substructures were not detected in this TOF case. The line of abnormality score dramatically increased in both the heart and vessels areas in the bottom right graph. The report window displayed a different timeline from normal cases and high abnormality scores.